YANCOAL
兖煤澳大利亚有限公司
MT THORLEY WARKWORTH

Mount Thorley Warkworth

2023 Annual Review

Name of Operations	Mount Thorley Warkworth
Name of Operator	Coal & Allied (NSW) Pty Ltd (wholly owned subsidiary of Yancoal Australia Ltd)
Development consent /project approval	SSD-6464 & SSD-6465
Name of holder of development consent/project approval	Warkworth Mining Ltd Mt Thorley Operations Pty Ltd
Mining Lease #	Contained within Section 3.1 of this report
Name of holder of mining lease	Warkworth Mining Ltd Mount Thorley Operations Pty Ltd
Water Licence #	Contained within Section 3.1 of this report
Name of holder of water licence	Contained within Section 3.1 of this report
Annual Review Start Date	01/01/2023
Annual Review End Date	31/12/2023

I, Gary Mulhearn, certify that this audit report is a true and accurate record of the compliance status of Mount Thorley Warkworth for the period 1 January 2023 to 31 December 2023 and that I am authorised to make this statement on behalf of Coal & Allied (NSW) Pty Ltd.

Note.

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 the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, $1 million and for an individual, $250,000.

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

Name of Authorised Reporting Officer	Mr Gary Mulhearn
Title of Authorised Reporting Officer	Environment and Community Manager
Signature of Authorised Reporting Officer	
Date	28 March 2024

Executive Summary

Mount Thorley Warkworth (MTW) is an integrated operation of two open cut coal mines, Warkworth Mining Limited (WML) and Mount Thorley Operations (MTO). This Annual Review reports on the environmental performance of MTW for the period 1 January 2023 to 31 December 2023.

This report has been prepared in accordance with conditions of the development consents held by MTW which require a report of the operation's environmental performance to be provided on an annual basis. The structure of the 2023 Annual Review aligns with the NSW Department of Planning and Environment (DPE) *Post-approval requirements for State significant mining developments – Annual Review Guideline* (October 2015).

MTW produced 17.23 million tonnes of run-of-mine (ROM) coal during 2023, and 11.27 million tonnes of saleable coal. ROM coal from WML and MTO was produced at less than the approved ROM coal production rates for WML (18 Mtpa) and MTO (10 Mtpa).

Noise

There were no non-compliances recorded against MTW's consented noise limits. There was an increase (from 106 to 143) in the number of supplementary attended noise measurements which exceeded the internal trigger levels for corrective action compared to 2022. Total of up to 3,201 hours of mine stoppages were recorded due to proactive and reactive measures to minimise noise and ensure compliance with noise criteria.

Blasting

During the reporting period 235 blast events were initiated at MTW and all blasts returned results below the relevant airblast overpressure / ground vibration criteria for all monitoring locations. MTW's Blast Management Plan was reviewed and revised in 2023 to update the status of the Warkworth blast monitoring location.

Air Quality

During 2023, MTW complied with all short term and annual average air quality criteria. A total of 3,539 hours of mine stoppage was recorded following implementation of proactive and reactive measures to minimise dust and ensure compliance with air quality criteria.

Heritage

Aboriginal and Historic heritage matters continued to be managed in accordance with the Aboriginal Heritage Management Plan (AHMP) and Historic Heritage Management Plan (HHMP).

Nine Aboriginal cultural heritage sites were salvaged from the ahead of mining area at Warkworth Mine and two sites were salvage from areas of Mount Thorley Operations in accord with Aboriginal community recommendation. The salvaged artefacts were catalogued and transported to the MTW cultural heritage storage area. Maintenance of key historic heritage sites occurred however planned works were not undertaken because specialist resources could not be secured. The *MTW Historic Heritage Conservation Fund* (administered by Singleton Council) continued to operate in 2023. MTW

completed the fifth (and last) of its annual contributions to the fund in the 2022 reporting period. Annual AHMP and HHMP compliance inspections were conducted by a consultant archaeologist assisted by representatives of the Aboriginal community, and representatives from the site's Community Heritage Advisory Group (CHAG). There were no heritage incidents or unauthorised disturbance to managed sites identified during the reporting period.

Surface Water

2023 was a dryer than average year with a total of 502 mm of rainfall recorded at MTW's Charlton Ridge Meteorological station. The average annual rainfall at Charlton Ridge is 693mm, as calculated from 2007 to 2022 annual totals.

Groundwater

Groundwater monitoring activities were undertaken in 2023 in accordance with the MTW Water Management Plan and groundwater monitoring programme. The monitoring results are used to establish and monitor trends in physical and geochemical parameters of surrounding groundwater potentially influenced by mining.

Groundwater monitoring data is reviewed on a quarterly basis and is included in the March, June, September and December Monthly Environmental Monitoring Reports, available at https://www.mtwcoal.com.au/page/environment/environmental-monitoring/

Visual Amenity

Slashing works were undertaken in 2023 along Putty Road, improving visual amenity. Shade cloth screening that was installed in 2021, remained in place on chainmesh boundary fencing along Putty Road, whilst planted native vegetation is establishing to permanent visual screening between areas of established vegetation adjacent to the Warkworth open cut mining activities.

Rehabilitation and Land Management

A total of 93.6ha of new rehabilitation was completed during 2023 which was slightly more than the Forward Program 2023 target of 90ha. Total disturbance undertaken in 2023 was 106.5ha against a Forward Program target of 90.7ha. The additional disturbance was due to 7.9ha of rehabilitation disturbance to merge the updated final landform in with existing South Pit rehabilitation areas; and the remainder of the additional disturbance was related to installation of water management structures ahead of mining in West Pit.

Biodiversity and Offset Management

Restoration of the Warkworth Sands Woodland vegetation community continued with 10,000 tube stock planted in the Northern Biodiversity Area (BA) and 800 planted in the Southern BA. Planting at the Goulburn River BA, to increase the suitability of habitat for the Regent Honeyeater, was undertaken with 10,000 tube stock planted. Rapid Condition Assessments and property inspections were undertaken across all BA's in 2023.

Weed control, vertebrate pest management activities, seed collection and fence repairs were conducted during 2023 in accordance with the Offset Management Plans.

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1 STATEMENT OF COMPLIANCE

A Statement of Compliance against the relevant approvals is provided in **Table 1.1**. **Table 1.2** provides a brief summary of the non-compliances and a reference to where these are addressed within this Annual Review.

TABLE 1.1 STATEMENT OF COMPLIANCE

Approval	Were all conditions complied with?
DA SSD-6465 (MTO)	Yes
DA SSD-6464 (WML)	No

TABLE 1.2 NON COMPLIANCES

Relevant approval	Condition number	Condition description (summary)	Compliance status	Section in this Annual Review it is addressed.
SSD-6464 (WML)	Schedule 5 Condition 11	Access to information	Non-compliant	10

TABLE 1.3 COMPLIANCE STATUS KEY FOR TABLE 1.2

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

Source: NSW Government Post-approval requirements for State significant mining developments – Annual Review Guideline (October 2015).

2 INTRODUCTION

Mount Thorley Warkworth Coal Mine (MTW), is an integrated operation consisting of Warkworth Mining Limited (WML) and Mount Thorley Operations (MTO) (**Figure 1**) situated 14 km southwest of Singleton, in the Upper Hunter Valley region of NSW. MTW is managed and operated by Coal & Allied (NSW) Pty Ltd, a wholly owned subsidiary of Yancoal Australia Limited (YAL). A summary of MTW tenements is shown in **Figure 2.**

2.1 Scope

This Annual Review (AR) covers the twelve-month reporting period from **1 January 2023 to 31 December 2023.**

This report summarises the environmental performance of MTW in accordance with conditions of the development consents held by site. The structure of this 2023 Annual Review aligns with the *DPE Post-approval requirements for State significant mining developments – Annual Review Guideline* (October 2015).

This AR includes reference to the mining tenement of the Mount Thorley Coal Loader (MTCL), which is included in the Rehabilitation Management Plan. The MTCL operates under a Singleton Council development consent, and annual environmental reporting for the MTCL is not included within the scope of this AR.

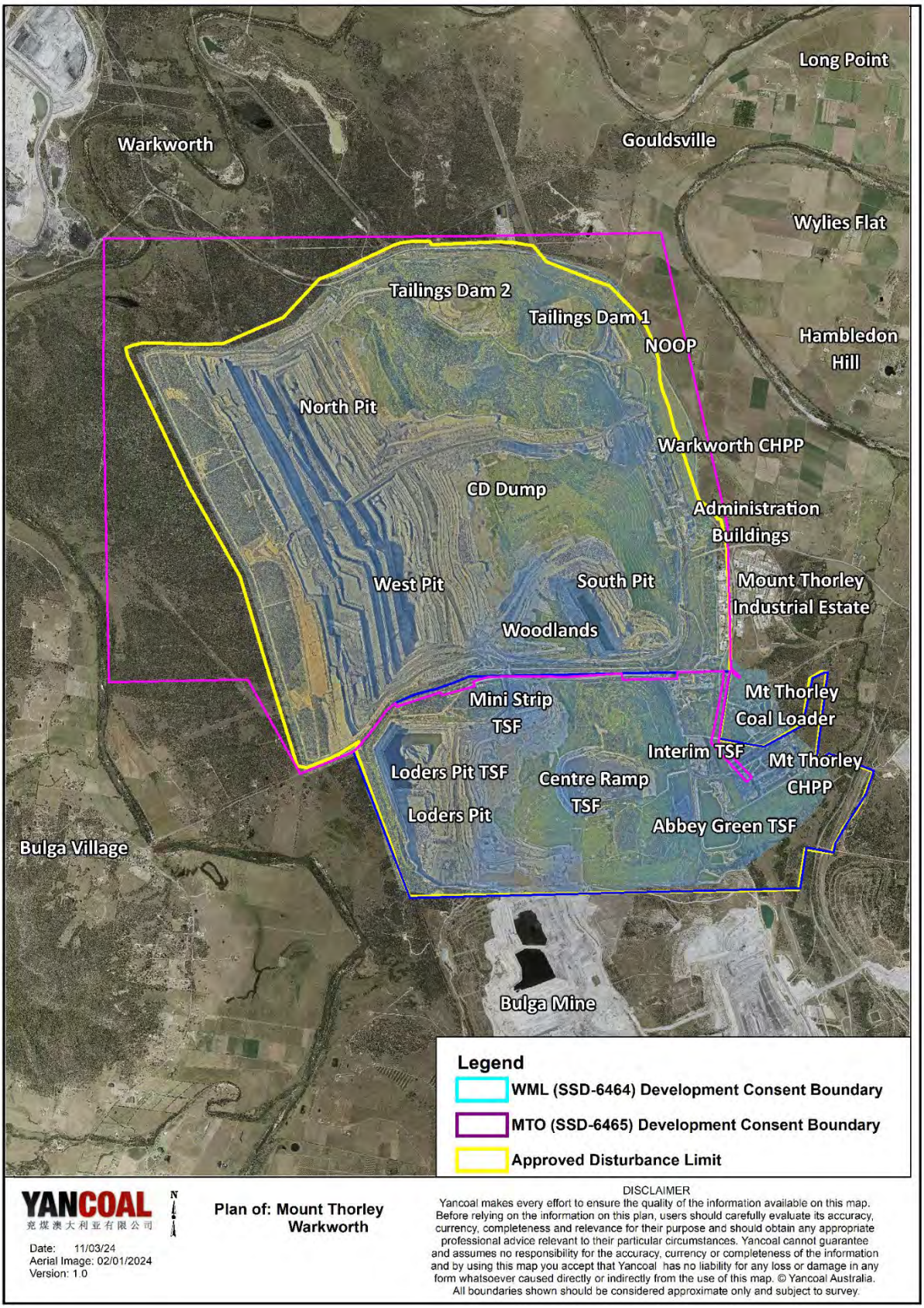


FIGURE 1: MTW SITE LAYOUT AND LOCALITY PLAN

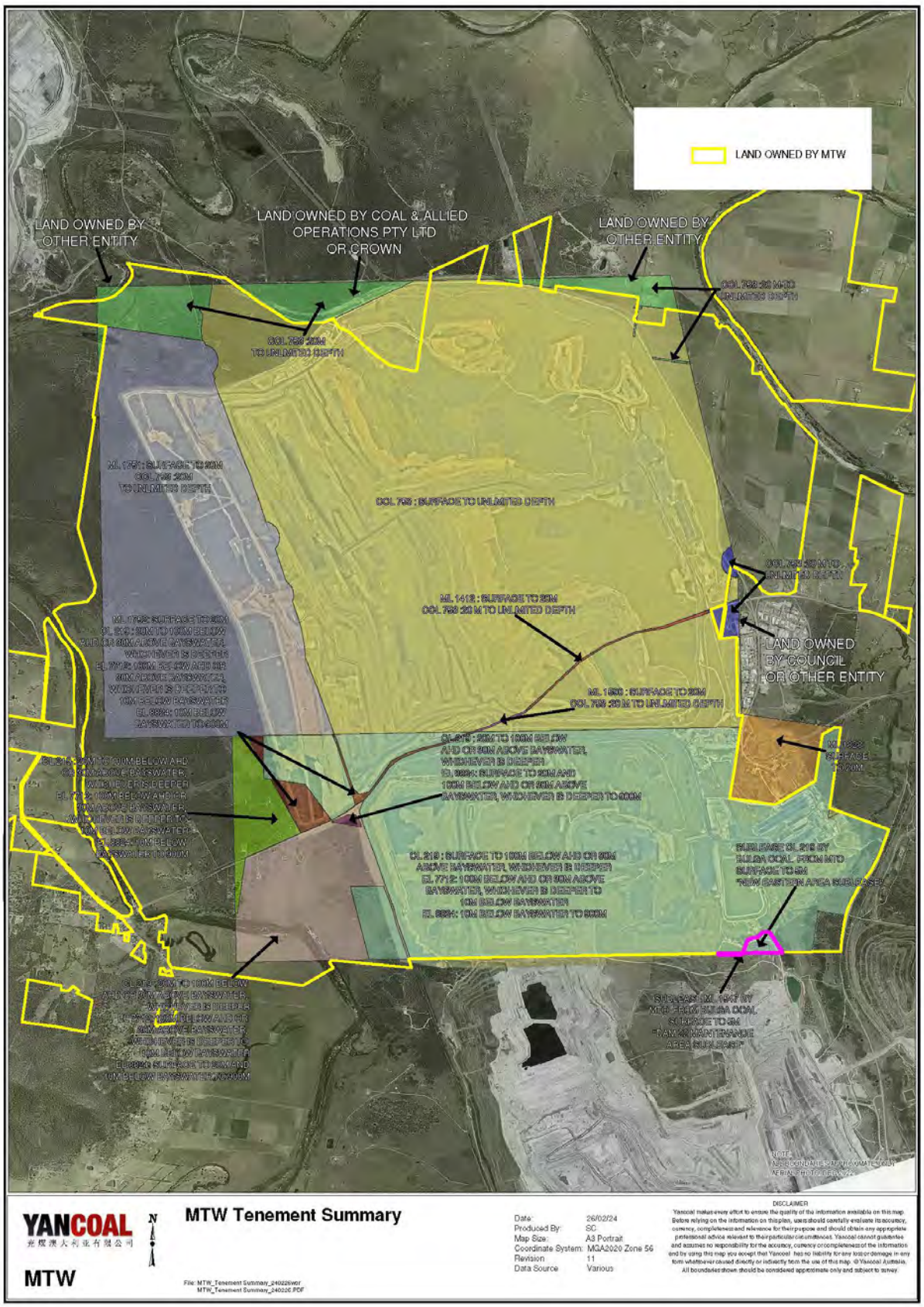


FIGURE 2: MTW TENEMENT SUMMARY

2.2 Mine Contacts

Table 2.1 outlines the contact details for site personnel responsible at Mount Thorley Warkworth.

TABLE 2.1 SITE PERSONNEL

Position	Name	Contact Number
General Manager – MTW	David Bennett	(02) 6570 1500
Environment & Community Manager - MTW	Gary Mulhearn	(02) 6570 1734

3 APPROVALS

3.1 Approvals, Leases and Licences

3.1.1 Current Approvals

The status of MTO and WML development consents, licenses and relevant approvals at 31 December 2023 are summarised in **Table 3.1** to **Table 3.6**.

TABLE 3.1 OPERATIONS APPROVALS- WARKWORTH

Approval Number	Description	Authority	Date of Approval / Variations
SSD-6464	Warkworth Continuation Project development consent.	DPE	26/11/2015
SSD-6464 MOD 2	Modification the Warkworth Continuation Project to use the Lemington Underground as a water storage for Warkworth (and HVO); and authorise construction of the Ultra-Class truck workshop.	DPE	27/05/2022
EPBC 2009/5081	Approval under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) to extend the existing Warkworth Coal Mine over an additional 705 hectares of land at Warkworth NSW including associated modifications to existing mine infrastructure.	Department of Climate Change, Energy, the Environment and Water (DCCEEW)	9/8/2012 – 31/3/2033 (varied on 14/10/2018)
EPBC 2002/629	Approval under the EPBC Act to construct and operate an open cut coal mine extension at the Warkworth Coal Mine.	DCCEEW	18/2/2004 – 25/02/2039 (varied on 6/4/2004, 24/5/2004, 19/11/2004, 13/7/2012, 14/10/2018)

TABLE 3.2 OPERATIONS APPROVALS - MOUNT THORLEY

Approval Number	Description	Authority	Date of Approval / Variations
SSD-6465	Mount Thorley Continuation Project development consent	DPE	26/11/2015

TABLE 3.3 LICENCES AND PERMITS

Licence No	Description	Authority	Date of Approval / Variations
Warkworth			
EPL 1376	Environment Protection Licence	EPA	25/10/2021
5061122	Radiation Licence	EPA	02/05/2023
XSTR100160	Licence to Store – Explosives Act	WorkCover NSW	18/08/2019
Mount Thorley			
EPL 1976	Environment Protection Licence	EPA	02/06/2023
5061110	Radiation Licence	EPA	31/07/2023

Note: Environment Protection Licences remain in force until the licence is surrendered by the licence holder or until it is suspended or revoked by the EPA or the Minister. A licence may only be surrendered with the written approval of the EPA.

TABLE 3.4 MINING TENEMENTS

Mining tenement	Type	Purpose	Status	Grant Date	Expiry Date
Warkworth Mining Ltd					
CCL 753	Consolidated Coal Lease	Mining	Granted	23/05/1990	17/02/2034
ML 1412	Mining Lease	Mining	Renewal Pending	11/01/1997	10/01/2038
ML 1590	Mining Lease	Mining	Granted	27/02/2007	26/02/2028
ML 1751	Mining Lease	Mining	Granted	17/03/2017	17/03/2038
Mount Thorley Operations Pty Ltd					
CL 219	Coal Lease	Mining	Renewal Pending	23/09/1981	23/09/2044
(Part) ML 1547	Sub-Lease	Mining	Registered	The part sublease area known as the "Dam 22 Long Term Mining Sublease" was registered on 10th January 2018 for a term until 3 April 2025.	03/04/2025

Mining tenement	Type	Purpose	Status	Grant Date	Expiry Date
ML 1752	Mining Lease	Mining	Granted	17/03/2017	17/03/2038
EL 7712	Exploration Licence	Prospecting	Granted	23/2/2011	23/02/2026
EL 8824	Exploration Licence	Prospecting	Granted	15/02/2019	15/02/2025
Mount Thorley Coal Loading Ltd					
ML 1828	Mining Lease	Mining Purposes	Granted	25/02/2022	25/02/2043

TABLE 3.5 WATER LICENCES

Licence Number	Type	Purpose	Legislation	Description	Renewal Date
20BL168821	Bore	Monitoring Bore	Part 5 Water Act 1912	Bores: MTAGP1, MTAGP2, ABGOH07, ABGOH43, ABGOH44, ABGOH45	Perpetuity
20BL171729	Bore	Monitoring Bore	Part 5 Water Act 1912	G3	Perpetuity
20BL171841	Bore	Monitoring Bore	Part 5 Water Act 1912	OH1126	Perpetuity
20BL171842	Bore	Monitoring Bore	Part 5 Water Act 1912	OH944	Perpetuity
20BL171843	Bore	Monitoring Bore	Part 5 Water Act 1912	OH1137	Perpetuity
20BL171844	Bore	Monitoring Bore	Part 5 Water Act 1912	Bores: OH1123 (E), OH1123 (W)	Perpetuity
20BL171845	Bore	Monitoring Bore	Part 5 Water Act 1912	OH1124	Perpetuity
20BL171846	Bore	Monitoring Bore	Part 5 Water Act 1912	Bores: OH786, OH942	Perpetuity
20BL171847	Bore	Monitoring Bore	Part 5 Water Act 1912	Bores: OH1127, OH787	Perpetuity
20BL171848	Bore	Monitoring Bore	Part 5 Water Act 1912	OH1125	Perpetuity
20BL171849	Bore	Monitoring Bore	Part 5 Water Act 1912	OH1122	Perpetuity
20BL171850	Bore	Monitoring Bore	Part 5 Water Act 1912	OH1138	Perpetuity
20BL171891	Bore	Monitoring Bore	Part 5 Water Act 1912	Bores: OH1121, OH788, OH943	Perpetuity

Licence Number	Type	Purpose	Legislation	Description	Renewal Date
20BL171892	Bore	Monitoring Bore	Part 5 Water Act 1914	Bores: WOH2153 (PZ2), WOH2154 (PZ1), WOH2155 (PZ4), WOH2156 (PZ3)	Perpetuity
20BL171893	Bore	Monitoring Bore	Part 5 Water Act 1918	Bores: WOH2141 (PZ6), Ground Water Alluvial Modelling	Perpetuity
20BL171894	Bore	Monitoring Bore	Part 5 Water Act 1913	WOH2139 (PZ5)	Perpetuity
20BL172272	Bore	Monitoring Bore	Part 5 Water Act 1912	PZ9S, PZ9D	Perpetuity
20BL172273	Bore	Monitoring Bore	Part 5 Water Act 1912	PZ8S, PZ8D	Perpetuity
20BL172439	Bore	Monitoring Bore	Part 5 Water Act 1912	Windermere	Perpetuity
20BL172518	Bore	Monitoring Bore	Part 5 Water Act 1912	Windermere: MBW01, MBW02, MBW03, MBW04	Perpetuity
20BL173276	Bore	Monitoring Bore	Part 5 Water Act 1912	Windermere	Perpetuity
20BL173065	Bore	Monitoring Bore	Part 5 Water Act 1912	SR012	Perpetuity

TABLE 3.6 WATER ACCESS LICENCES

Licence Number	Description	Water Source	Water Sharing Plan	Water Source – Management Zone	Licence Allocation (ML)*	2023 Take (ML) Total
WAL963	Warkworth Mining Limited Hunter River Pump (General Security)	Hunter River	Hunter Regulated River WSP	Zone 2b (Hunter River from Wollombi Brook Junction to Oakhampton Rail Bridge)	243	0
WAL10543	Mount Thorley Joint Venture (MTJV) water supply scheme, held by Singleton Shire Council	Hunter River	Hunter Regulated River WSP	Zone 2b (Hunter River from Wollombi Brook Junction to Oakhampton Rail Bridge)	1,907 (MTW share is 1,009)	195

Licence Number	Description	Water Source	Water Sharing Plan	Water Source – Management Zone	Licence Allocation (ML)*	2023 Take (ML) Total
WAL43056	Warkworth Mining Limited (High Security)	Hunter River	Hunter Regulated River WSP	Zone 2b (Hunter River from Wollombi Brook Junction to Oakhampton Rail Bridge)	2,000	0
WAL43057	Warkworth Mining Limited (High Security)	Hunter River	Hunter Regulated River WSP	Zone 2b (Hunter River from Wollombi Brook Junction to Oakhampton Rail Bridge)	1,400	0
WAL18233	Old Farm	Hunter River Alluvium	Hunter Unregulated and Alluvial Water Sources WSP	Hunter Regulated River Alluvial Water Source – Downstream Glennies Creek Management Zone	5	0
WAL18558	Hawkes	Wollombi Brook	Hunter Unregulated and Alluvial Water Sources WSP	Lower Wollombi Brook Water Source	50	0
WAL19022	Sandy Hollow Creek	Unregulated River	Hunter Unregulated and Alluvial Water Sources WSP	Singleton Water Source	60	0
WAL40464 / WAL40465	Mt Thorley and Warkworth Pit Excavations	Permian Coal Seams	North Coast Fractured and Porous Rock Groundwater Sources WSP	Sydney Basin – North Coast Groundwater Source	180 / 750	428
WAL39798	Bore Extraction (Lemington underground)	Permian Coal Seams	North Coast Fractured and Porous Rock Groundwater Sources WSP	Sydney Basin – North Coast Groundwater Source	1,800	545

** Licence allocations are for 1 July to 30 June reporting year. Actual usage can exceed licence allocation in the table above if carryover provisions are available and have been applied during the water year.*

3.1.2 Management Plans, Programmes and Strategies

Table 3.7 details the management plans and strategies which are required under the Warkworth (SSD-6464) and Mount Thorley (SSD-6465) Development Consent instruments.

TABLE 3.7 STATUS OF MANAGEMENT PLANS REQUIRED UNDER WARKWORTH CONTINUATION (SSD-6464) AND MOUNT THORLEY OPERATIONS (SSD-6465) DEVELOPMENT CONSENTS

Plan / Program / Strategy	Status at end of 2023 (approval date)
Air Quality Management Plan	8/08/2022
Noise Management Plan	08/08/2022
Blast Management Plan	24/03/2023
Water Management Plan	15/11/2021
WML Biodiversity Management Plan	20/09/2018
Rehabilitation Management Plan (RMP)	Prepared 28/07/2022 Components of RMP approved by Resources Regulator: Final Landform and Rehabilitation Plan (FLRP) and Rehabilitation Objectives (ROBJ) approved 8/12/2023.
Environmental Management Strategy	5/08/2022
MTW Historic Heritage Management Plan	12/08/2022
MTW Aboriginal Heritage Management Plan	12/08/2022
Wollombi Brook Aboriginal Cultural Heritage Conservation Area Plan of Management	16/06/2022
Loder Creek Aboriginal Cultural Heritage Conservation Area Plan of Management	19/03/2019
Management Plan for Goulburn River Biodiversity Area	12/08/2022
Management Plan for Bowditch Biodiversity Area	12/08/2022
Management Plan for Southern Biodiversity Area	12/08/2022
Management Plan for Northern Biodiversity Area	12/08/2022
Management Plan for North Rothbury Biodiversity Area	12/08/2022
Warkworth Sands Woodland Integrated Management Plan	Pending (Submitted to OEH 15/02/2017)
Warkworth Sands Woodland Performance Criteria	Pending (Submitted to OEH 15/02/2017)

4 OPERATIONS DURING THE REPORTING PERIOD

4.1 Summary of Mining Activities

Areas to be mined are geologically modelled, a mine plan is formed and the relevant mining locations are surveyed prior to mining. **Figure 3** illustrates the mining process.

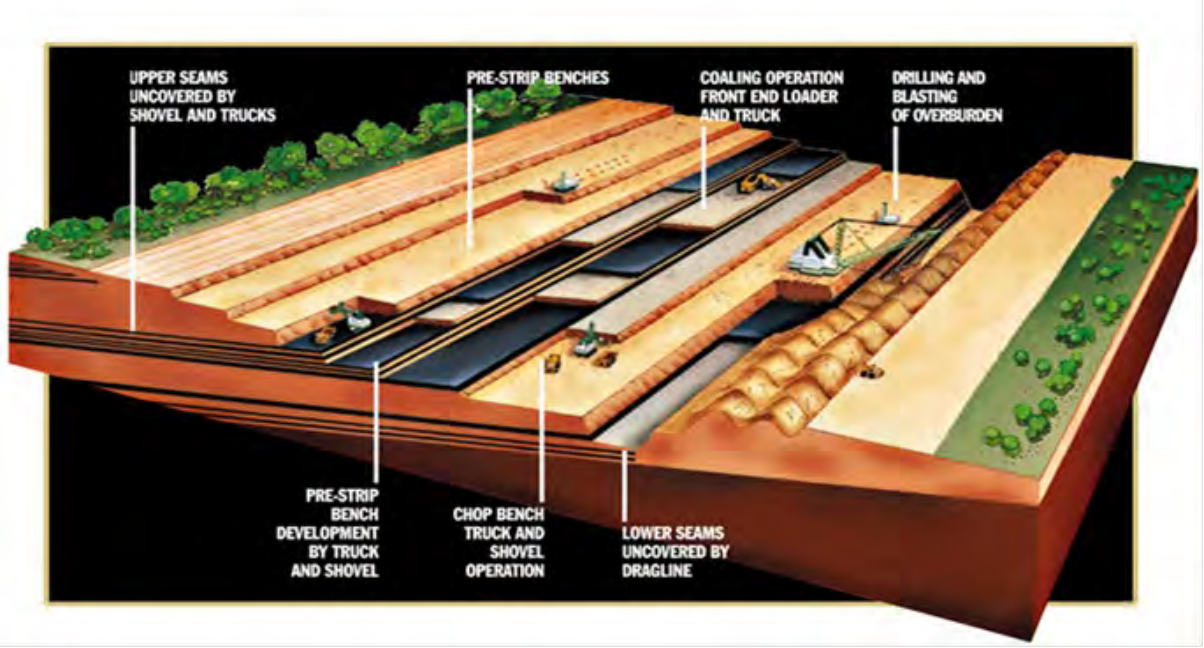


FIGURE 3: MINING PROCESS

Within Warkworth, mining activities continued to advance in a westerly direction in both North and West Pits; and the North Out of Pit (NOOP) Dam excavation by heavy mining equipment commenced in February 2022 and continued during the reporting period. North, West and South Pit voids were used for dumping overburden & coarse rejects from the North & South CHPP. Mount Thorley operations continues to be utilised for fine tailings and overburden emplacement. Exploration drilling was conducted within the relevant mining leases ahead of mining and within the pit to gain further information on the resource. All mining related activity is in line with the current development consent.

4.1 Mineral Processing

All processing and rejects/tailings disposal activities undertaken in 2023 were consistent with the approved development consent and no changes were made to the processing and rejects/tailings disposal methods.

The Loders Pit Tailings Storage Facility commenced operating in 2021 and continued throughout 2023. The Centre Ramp & Abbey Green Tailings Storage Facilities were also used as alternative locations when required. Waste capping of Tailings Dam 2 continued throughout 2023 in limited quantities.

4.2 Production Statistics

MTW is permitted to extract up to 18 million tonnes of ROM coal from the Warkworth Mine and 10 million tonnes from the Mount Thorley Mine. MTW Production Statistics for the previous, current and future reporting period are summarised in **Table 4.1**.

TABLE 4.1 SUMMARY OF PRODUCTION AT MTW IN 2023

Material	Approved Limits	Reporting Period 2022	Reporting Period 2023	Forecast for 2024
Prime Overburden Waste (kbcm)	N/A	76,771	96,954	94,558
MTO ROM Coal (Mtpa)	10 (SSD-6465)	0.13	0.70	0.07
WML ROM Coal (Mtpa)	18 (SSD-6464)	12.28	16.53	16.66
Combined MTW ROM Coal (Mtpa)	28 (Combined)	12.41	17.23	16.73
Coarse Reject (kt)	N/A	3,948	5,179	4,834
Fine Reject – Tailings (kt)	N/A	438.7	575.5	537.1
Product (kt)	N/A	8,077	11,265	11,105

All product coal was transported by rail. MTW transported 11,156 kt of product coal via rail during the 2023 reporting period.

4.3 Summary of Changes (Developments and Equipment Upgrades)

- The Charlton Ridge Communications Tower was erected at MTW in 2022 to provide critical communications to the mining lease areas and has enabled MTW to implement a high speed 4G mobile private network. This has ensured network reliability and continuity for fleet management, safety systems and environmental monitoring.
- Existing in-pit crib hut infrastructure was upgraded at West Pit South and North Pit North with Occupation Certificates obtained on 21 July 2023. The upgraded infrastructure includes in-pit muster areas, supervisor work stations, dispatch, and upgraded amenities and effluent treatment systems (with Singleton Council approval).
- Warkworth's new Ultraclass Workshop, which was granted development consent by modification to SSD-6464 on 27 May 2022, received Construction Certificate on 8 December 2022. Significant progress with effluent management system installation and commissioning (after Singleton Council Approval), and workshop infrastructure construction progressed during 2023.
- The following new heavy mining equipment was commissioned in 2023:
    - Eight dozers
    - Three haul trucks
    - Two graders
    - One excavator
    - One Drill
- The following heavy mining equipment was decommissioned in 2023:
    - Ten dozers
    - Two haul trucks
    - Two graders
    - One Excavator
    - One Wheel Loader
    - One Shovel
    - One Drill

5 ACTION(S) REQUIRED FROM PREVIOUS ENVIRONMENTAL MANAGEMENT REVIEW

DPE requested the following additional information:

- A map showing the location of the Mount Thorley Warkworth Mine in its regional context.
  (Refer to Figure 1 of this AR)
- A map showing the operational disturbance footprint (as of 31 December), active mining areas and rehabilitation areas.
  (Refer to Figure 1 of Appendix 7 of this AR)
- A recent aerial base image. Please include the date of the image in the figures.
  (Refer to Figure 1 of this AR)

6 ENVIRONMENTAL MANAGEMENT AND PERFORMANCE

6.1 Meteorological Data

Meteorological data is collected to assist in day to day operational decisions, planning, and environmental management and to meet development consent requirements. MTW operates a meteorological (weather) station located on Charlton Ridge. The meteorological station measures wind speed, wind direction, temperature, humidity, solar radiation, rainfall, and sigma theta. Instruments are installed, calibrated, and maintained according to the relevant Australian Standard AS 3580.14 (2014). Meteorological data is available to site personnel and provides mining operations with trend assessment details to inform operational decisions aimed at minimising impacts. Daily Meteorological data summaries are presented in the Monthly Environmental Monitoring reports, available via the MTW website: https://www.mtwcoal.com.au/.

6.2 Noise

6.2.1 Noise Management

MTW manages noise to ensure compliance with permissible noise limits at nearby private residences. A combination of both proactive and reactive control mechanisms is employed on a continuous basis to ensure effective management of noise emissions is maintained. Noise management strategies and processes employed at MTW are detailed in the MTW Noise Management Plan available via the MTW website: https://www.mtwcoal.com.au/.

MTW's 2023 noise performance metrics are shown below:

- Community noise complaints received – reduced from 47 in 2022 to 35 in 2023.
- Number of Community Response Officer (CRO) (supplementary) noise measurements which exceed the internal trigger level for action increased from 106 in 2022 to 143 in 2023.
- Number of equipment downtime hours logged in response to noise management triggers – Decrease from 4882 hours in 2022 to 3,201 hours in 2023.

A range of noise management processes were undertaken during 2023. These are described herein.

6.2.2 Sound Power Control

During the reporting period, 89 sound power level assessments were undertaken by an external consultant across 48 trucks, 6 excavators, 6 dozers, 2 draglines, 2 shovels, 8 drills, 1 loader, and 16 ancillary equipment items (rubber tyre dozer, scraper, water truck, fuel/lube truck, grader, small excavator). Of the assessments undertaken, 23 pieces of equipment exceeded MTW In-Service targets and as such are subject to further maintenance inspections/defect management to address sound power and to be retested as required.

6.2.2.1 Real Time Noise Management

MTW's Real-Time noise management framework provides an effective tool for managing instances of elevated noise, ensuring compliance is maintained, and responding to community concerns.

MTW utilise CROs to provide an interface between the mine and community. They are effective in implementing the management framework, validating real-time alerts through supplementary handheld noise measurements and audible observations, driving operational change as required and responding to community complaints. A summary of supplementary handheld noise measurements conducted by the CROs in 2023 is presented in **Table 6.1**.

MTW's Insite website allows members of the general public to access noise, meteorological, air quality data as well as any operational changes made during shift via MTW's interactive website. Insite viewer access: http://insite.yancoal.com.au

TABLE 6.1 SUMMARY OF SUPPLEMENTARY ATTENDED NOISE MONITORING CONDUCTED BY COMMUNITY RESPONSE OFFICERS 2023

Monitoring Location	Number of Assessments	Number of measurements >WML trigger^	Number of measurements > MTO trigger^	Average WML noise level ($L_{Aeq\ 5min}$ dB(A))*	Average MTO noise level ($L_{Aeq\ 5min}$ dB(A))*
Wollemi Peak Road (Bulga RFS)	1468	88	33	33.3	33.7
Bulga Village	510	3	0	32.9	32.3
Inlet Road	391	4	1	32.8	31.6
Inlet Road West	357	1	0	30.6	29.4
Long Point	536	0	-[1]	30.6	-[1]
South Bulga	0	-	-	-	-
Wambo Road	622	13	0	33.4	32.3
Total	3884	109	34	-	-

^Triggers are internally set thresholds for operational response and are specified in the MTW Noise Management Plan. The number of measurements greater than the trigger cannot be used as an assessment or interpretation of compliance. A compliance assessment is provided in Sections 0 and 6.2.3.1.

**Average noise levels do not take account of measurements taken where the noise source of interest was recorded as inaudible.*

[1] noise measurement taken where inaudible for MTO and noise level not assigned.

In response to the events listed in **Table 6.1** which were greater than the trigger, up to 3201 hours of equipment downtime were recorded to manage noise during 2023.

6.2.3 Noise Performance

A total of 96 compliance measurements were undertaken by an independent acoustic specialist in accordance with the MTW Noise Monitoring Programme during the reporting period. Each measurement involves an assessment of mine noise against the various LAeq, 15 minute and LA1, 1min noise criteria. Noise monitoring results are shown in **Appendix 1** and are also presented in the Monthly Environmental Monitoring Reports, available via the MTW website https://www.mtwcoal.com.au/page/environment/environmental-monitoring/

In accordance with the requirements of the EPA's Noise Policy for Industry (NPfI), the applicability of the low frequency modification penalty has been assessed. There were two noise measurements taken during the reporting period which required the modifying factor penalty to be applied. There were no noise measurements taken during the reporting period which exceeded consent conditions following application of NPfI low frequency modifying factor.

TABLE 6.2 ATTENDED NOISE MEASUREMENTS EXCEEDING CONSENT CONDITIONS FOLLOWING APPLICATION OF NPFI LOW FREQUENCY MODIFYING FACTOR

Location	Date/Time	Relevant Criteria	Criterion (dB)*	L_{Aeq}(dB)	Revised L_{Aeq} (dB)	Exceeds by (dB)
N/A	-	-	-	-	-	-

6.2.3.1 Comparison against Last Years' Results

A comparison of non-compliances and exceedances between years is used as a measure of the effectiveness of noise management measures employed on site.

Details of this comparison are provided in **Table 6.3** which demonstrates that MTW's performance in 2023 is similar to most years since 2014, and the exceedances recorded in 2022 (due to low frequency modifying factor) were not consistently repeated in 2023.

TABLE 6.3 COMPARISON OF 2023 NOISE MONITORING RESULTS AGAINST PREVIOUS YEARS'

Year	Number of assessments	Number of exceedances	Number of non-compliances
2023	576	0	0
2022	612	7	6
2021	576	0	0
2020	576	0	0
2019	588	1	0
2018	594	1	0
2017	576	0	0
2016	576	0	0
2015	665	0	0
2014	700	0	0
2013	456	11	7
2012	562	13	3
2011	572	11	4
2010	561	3	3
2009	569	10	4

A comparison of supplementary noise measurements undertaken during the previous and current reporting period is provided in **Table 6.4**. This data shows the considerable effort in undertaking supplementary noise measurements has continued in 2023, and average noise readings have been comparable.

TABLE 6.4 COMPARISON OF CRO (SUPPLEMENTARY) NOISE MEASUREMENT PERFORMANCE

Monitoring Location	Number of Assessments		Number of Measurements >WML Trigger^		Number of Measurements > MTO Trigger^		Average WML Noise Level ($L_{Aeq\ 5min}$ dB(A))*		Average MTO Noise Level ($L_{Aeq\ 5min}$ dB(A))*	
	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023
Wollemi Peak Road (Bulga RFS)	1153	1468	32	88	17	33	33.6	33.3	33.4	33.7
Bulga Village	500	510	4	3	0	0	32.8	32.9	32.0	32.3
Inlet Road	450	390	16	4	2	1	33.3	32.8	32.5	31.6

Inlet Road West	348	357	6	1	0	0	30.9	30.6	29.9	29.4
Long Point	848	536	9	0	0	-[1]	32.1	30.6	29.0	-[1]
South Bulga	0	0	-	-	-	-	-	-	-	-
Wambo Road	478	622	20	13	0	0	34.1	33.4	32.8	32.3
Total	3777	3884	87	109	19	34	-	-	-	-

^Triggers are internally set thresholds for operational response and are specified in the MTW Noise Management Plan. The number of measurements greater than the trigger cannot be used an assessment or interpretation of compliance. Compliance assessment is provided in 6.2.3 and 6.2.4.

**Average noise levels do not take account of measurements taken where the noise source of interest was recorded as inaudible.*

[1] noise measurement taken where inaudible for MTO and noise level not assigned.

6.2.3.2 Validation of Real Time Monitoring Results

A comparison of real time and independent attended noise monitoring results was undertaken for 2023. The comparison identified that the majority of attended noise monitoring results were aligned or lower than the corresponding real time noise monitoring results i.e. real time noise monitor trigger is largely conservative for the most closely located real time noise monitors and for the mostly closely aligned 15-minute monitoring periods. There were exceptions to this, including;

- WML $L_{Aeq\ 15\ minute}$ attended monitoring measured noise levels were higher than the real time monitoring measured noise levels for three of eight monitoring locations in January, April, May, September and November, for one of eight monitoring locations in February and August, for four of eight monitoring locations in July (two of the real time monitoring sites were within 2 and 3 dB of the attended monitoring result) and for two of eight monitoring locations in December.

- MTO $L_{Aeq,\ 15\ minute}$ attended monitoring measured noise levels were higher than the real time monitoring measured noise levels for one of eight attended monitoring locations in January and July, for three of eight monitoring locations in April, August and December, for four of eight monitoring locations in May (one of the real time monitoring sites was within 2 dB of the attended monitoring result).

On the occasions where the WML and MTO attended monitoring measured noise levels were higher, the recorded noise levels were generally well below noise limits specified in MTW's Noise Management Plan.

The real time noise monitors can have difficulty assigning WML and MTO directional noise levels at times, such as where there is more than one noise source and where MTW is not the primary noise source. MTW's noise management process is that routine supplementary noise monitoring is also undertaken by the Community Response Officer each night and provides additional assessment of directional noise levels, allowing for swift targeted operational modifications where noise levels from MTW presents a risk of exceeding the specified noise limit(s).

6.2.3.3 Comparison against EIS Predictions

Table 6.5 provides a comparison of 2023 attended monitoring data and the predicted noise levels modelled in the 2014 Warkworth Continuation EIS. Comparison has been made against the modelled worst-case noise levels for Year 9 of the development (nominally 2023). The comparison data has been sourced from the modelled noise levels at the nearest residential receivers to the current monitoring locations. Reported 2023 data is the calculated quarterly average of WML contribution to measured $L_{Aeq,\ 15\ minute}$ results and the maximum monthly measured noise level obtained through compliance assessment (irrespective of applicability of noise criteria due to meteorological conditions).

Where a monitoring event has been assessed as being "inaudible" or "not measurable", a conservative value of 25dB has been used to calculate the $L_{Aeq,\ 15\ minute}$ average for the quarter. The comparison shows that average measured $L_{Aeq,\ 15\ minute}$ noise is within the predicted EIS noise level range. Maximum measured $L_{Aeq,\ 15\ minute}$ noise was also within the predicted EIS noise level.

TABLE 6.5 PREDICTED NIGHT TIME WML (EIS 2014) LAEQ (15 MINUTE) NOISE LEVELS AND AVERAGED AND MAXIMUM 2023 MONITORING RESULTS

Monitoring Location	Year 9 Modelled Noise	Quarter 1 2023 average & maximum		Quarter 2 2023 average & maximum		Quarter 3 2023 average & maximum		Quarter 4 2023 average & maximum	
	$L_{Aeq\ (15\ minute)}$ (dB)	$L_{Aeq\ (15\ minute)}$ (dB)		$L_{Aeq\ (15\ minute)}$ (dB)		$L_{Aeq\ (15\ minute)}$ (dB)		$L_{Aeq\ (15\ minute)}$ (dB)	
		Avg	Max	Avg	Max	Avg	Max	Avg	Max
Wollemi Peak Road*/Bulga RFS	≤38	30.0	35	29.3	32	29.3	33	28.7	31
Bulga Village	≤38	29.0	32	32.7	35	32.3	36	30.3	36
Gouldsville Road	≤35	25.3	26	26.7	30	28.3	35	28.7	33
Inlet Road	≤37	30.3	35	31.0	33	31.3	35	30.7	35
Inlet Road West*	≤35	25.7	27	28.0	33	30.7	34	30.0	33
Long Point*	≤35	25.0	25	25.0	25	25.0	25	25.0	25
South Bulga	≤38	25.0	25	25.0	25	25.0	25	28.3	30
Wambo Road	≤38	29.3	33	31.7	36	31.0	35	29.7	34

**Denotes – No nearby receiver location modelled*

6.3 Blasting

6.3.1 Blast Management

During the reporting period, the MTW blast monitoring network operated in accordance with AS2187.2-2006 to measure ground vibration and air blast overpressure of each event at a high sampling frequency. Monitors function as regulatory compliance instruments in accordance with the MTW Blast Monitoring Programme (appended to Blast Management Plan) and are located on (or in locations representative of) privately owned land. During 2023 monitors were located at:

- Abbey Green (Abbey Green Station, Putty Road, Glenridding);
- Bulga Village (Wambo Road, Bulga);
- Putty Road, Mount Thorley (known as MTIE)
- Wambo Road (Wambo Road, Bulga);
- Warkworth Village (former Warkworth Public School, Warkworth); and
- Wollemi Peak Road (intersection of Putty & Wollemi Peak Roads, Bulga).

These locations are shown on **Figure 4** below.

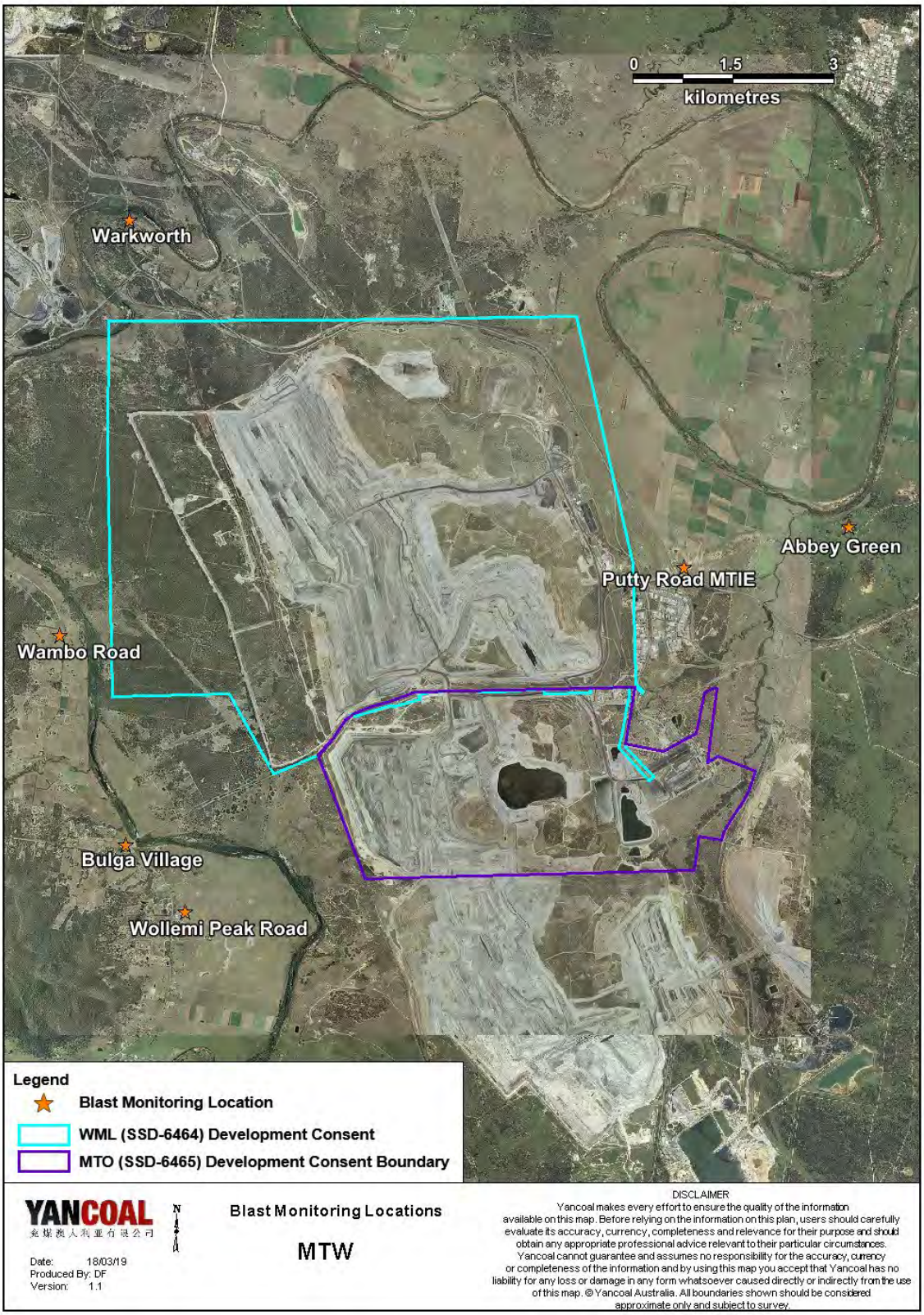


FIGURE 4: BLAST MONITORING LOCATIONS

6.3.2 Blast Performance

During the reporting period 235 blast events were initiated at MTW. Results of ground vibration and airblast overpressure recorded during 2023 are presented in **Figure 5** to **Figure 10**. All blasts returned results below the relevant airblast overpressure / ground vibration criteria for all monitoring locations.

Road closures occurred for all blasts within 500 metres of a public road. Public roads were also closed on occasions to mitigate potential impact upon road users from post blast emissions.

In accordance with Schedule 3, Conditions 9 and 10 of SSD-6464, Warkworth Mining Limited carried out blasting on site between 7am and 5pm Monday to Saturday inclusive. No blasts occurred on Sundays or on public holidays. Warkworth Mining Limited carried out not more than 3 blasts per day and not more than 12 blasts per week (averaged over a calendar year).

No blasts were carried out at Mt Thorley Operations Limited in 2023.

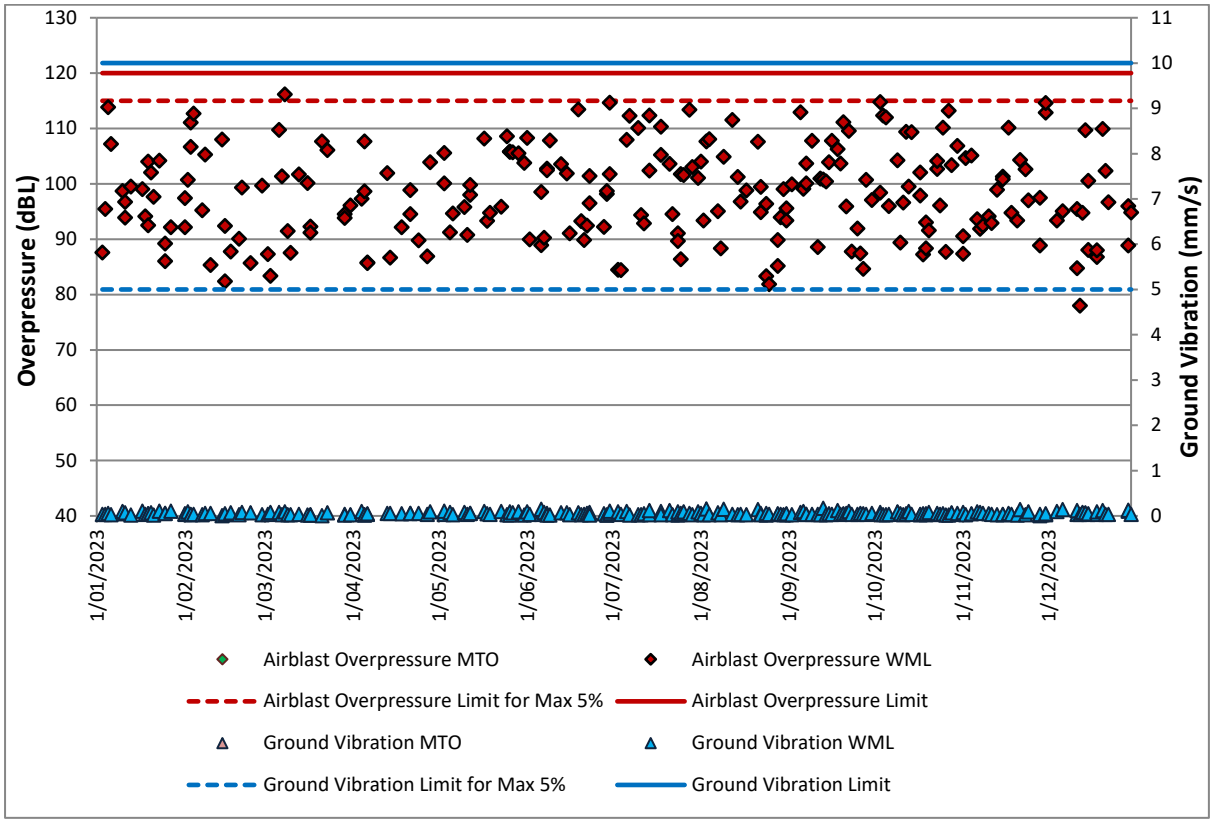


FIGURE 5: ABBEY GREEN BLAST RESULTS

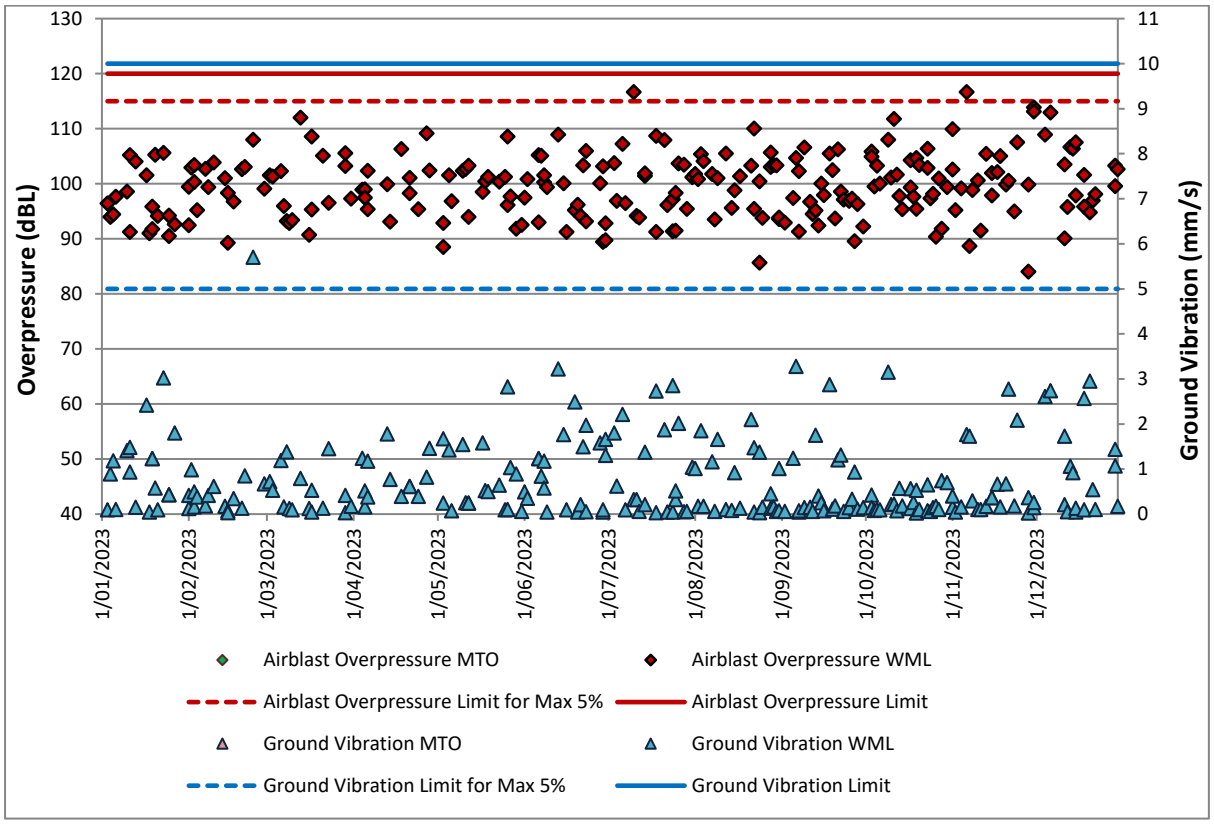


FIGURE 6: BULGA VILLAGE BLAST RESULTS

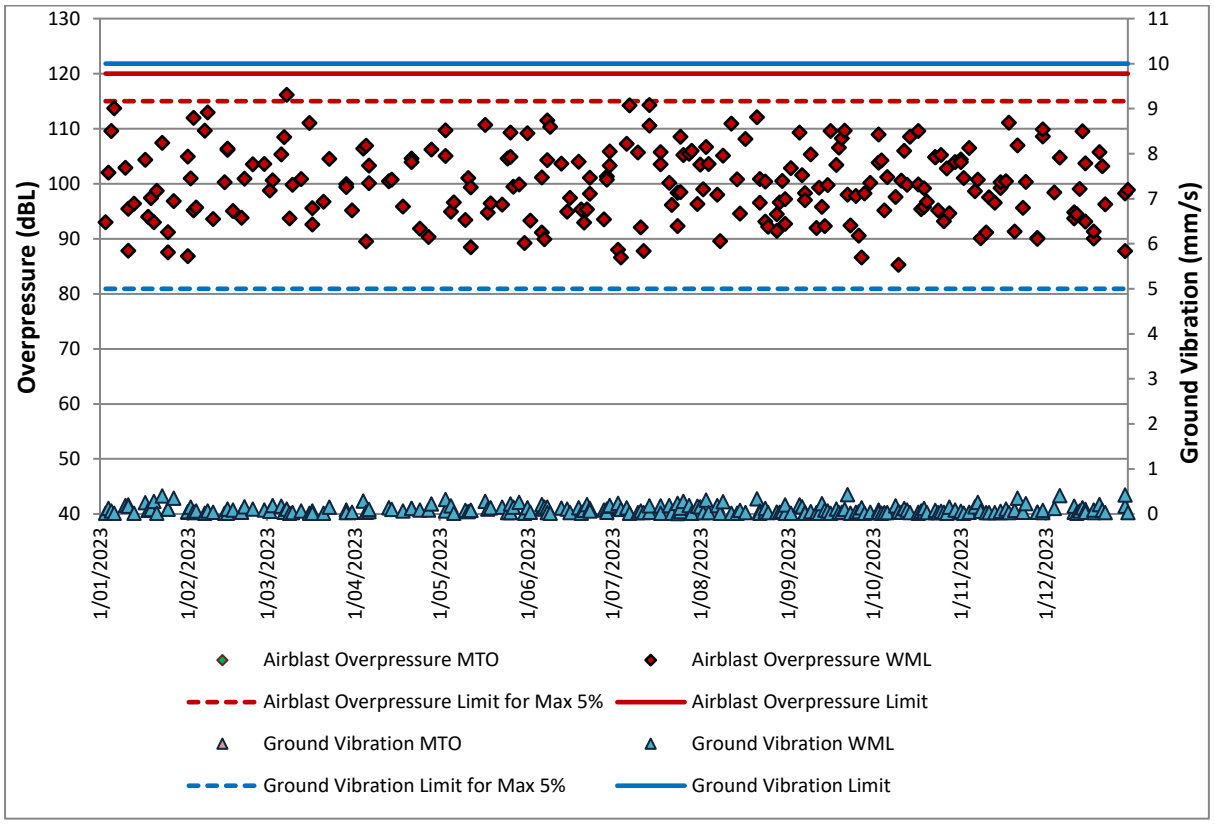


FIGURE 7: MTIE BLAST RESULTS

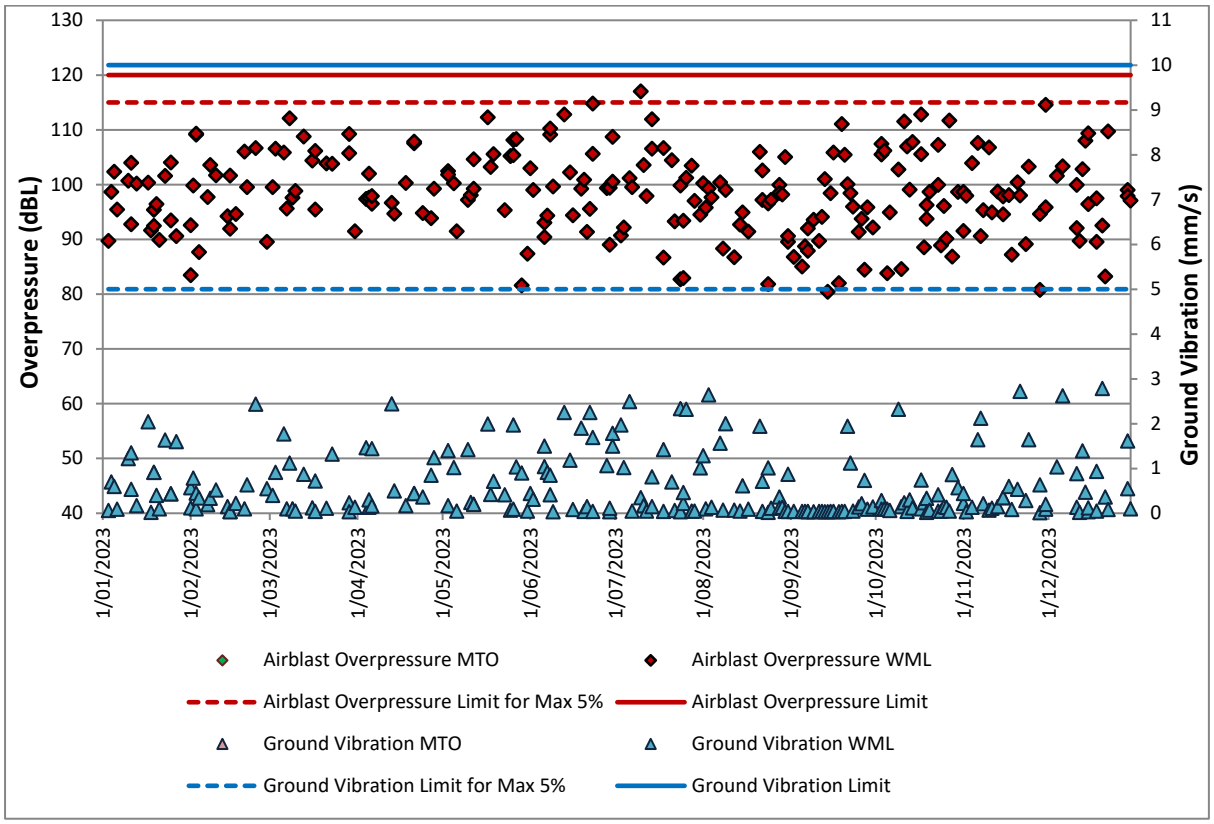


FIGURE 8: WOLLEMI PEAK ROAD BLAST RESULTS

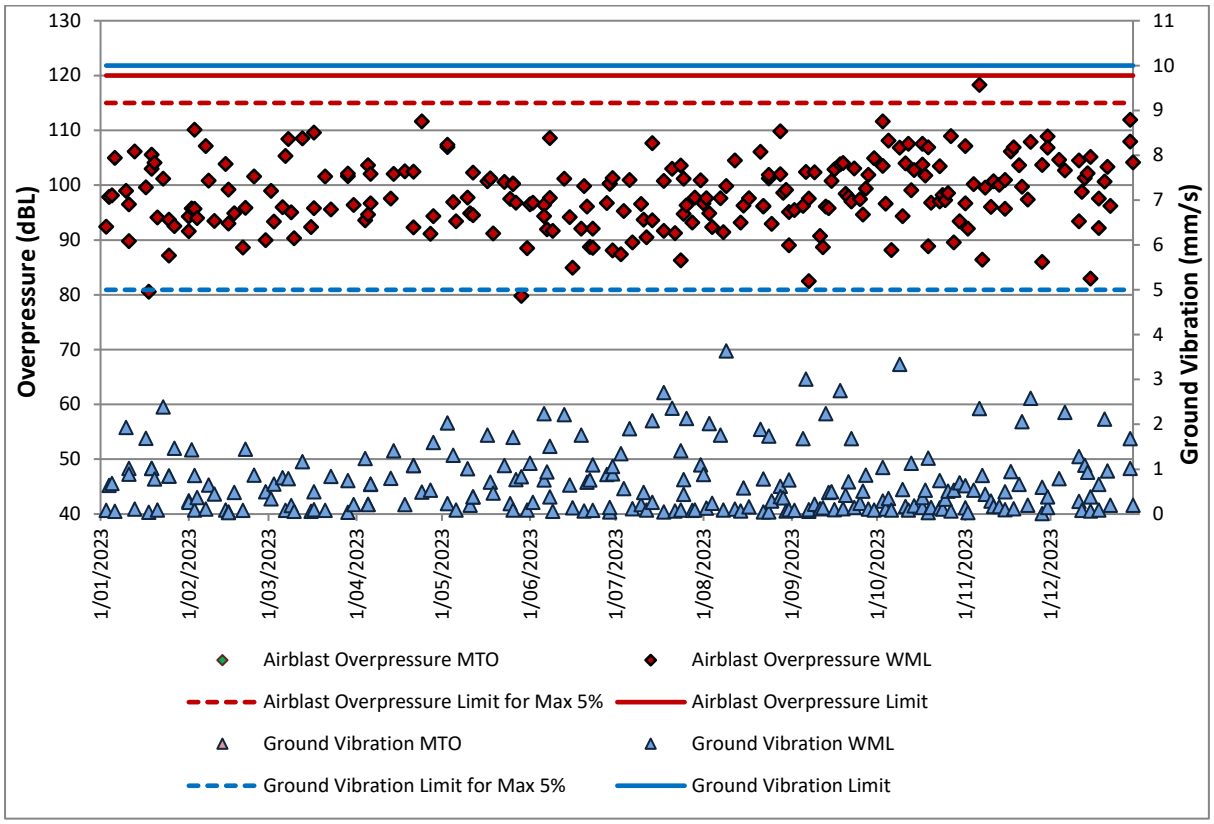


FIGURE 9: WAMBO ROAD BLAST RESULTS

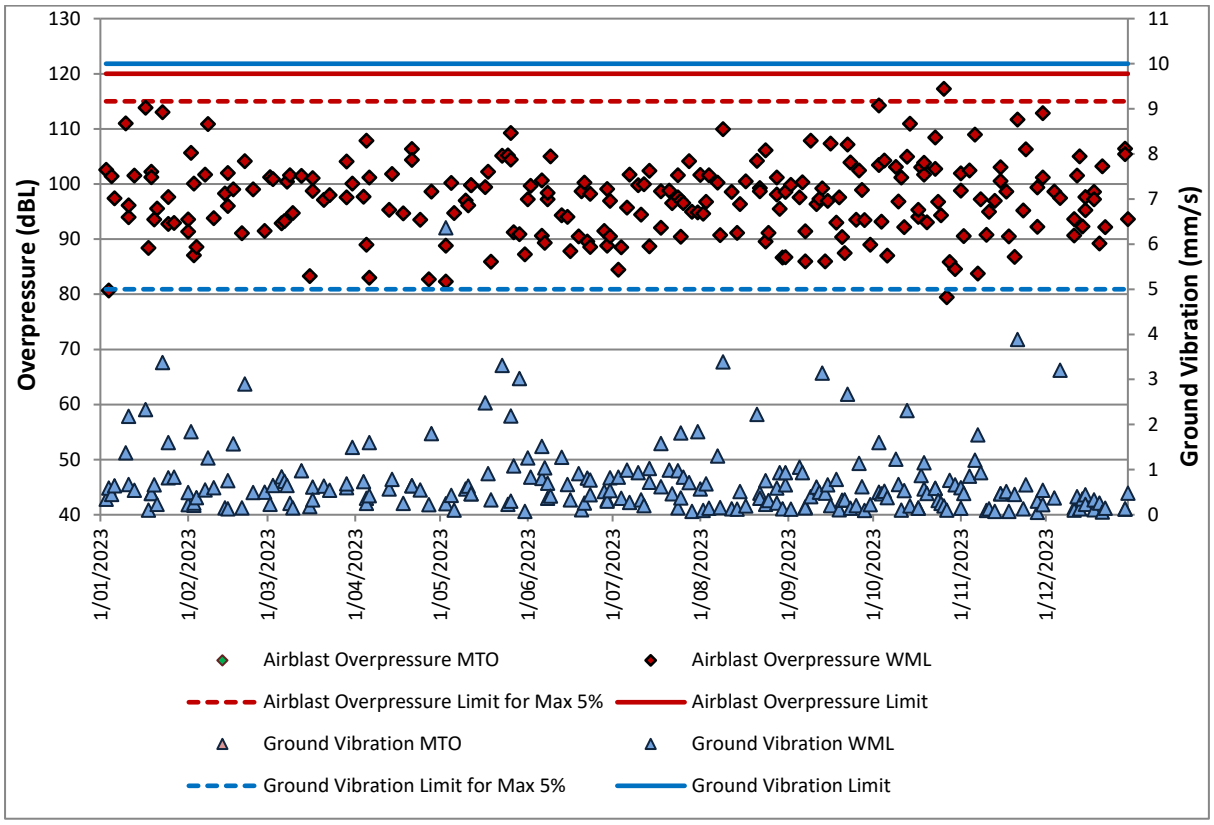


FIGURE 10: WARKWORTH BLAST RESULTS

6.3.2.1 Blast Fume Management

MTW operates a Post Blast Fume Generation Mitigation and Management Plan. This document outlines the practices to be utilised to reduce generation of post blast fume and reduce potential offsite impact from any fume which may be produced. This includes risk assessment of the likelihood of fume production, specialised blasting design, appropriate product selection, on-bench water management, implementation of fume management zones and use of blasting permissions to identify likely path of any fume which may be produced.

All blasts are observed for fume and any fume produced is ranked according to the Australian Explosive Industry & Safety Group (AEISG) Scale. During 2023, no blasts produced visible post-blast fume with a post-blast ranking Level 4 or higher according to the AEISG Scale.

Rankings for visible blast fume according to the AEISG scale for shots fired during 2023 and comparison to rankings distribution during previous years is provided in **Table 6.6.**

TABLE 6.6 VISIBLE BLAST FUME RANKINGS ACCORDING TO THE AEISG COLOUR SCALE

AEISG Ranking	2023	2022	2021
0	272	219	230
1	9	15	13
2	5	11	9
3	7	2	4
4	0	0	0
5	0	0	0
Total*	293	247	256

** Where a number of individual blasts were fired as a blast event, fume was assessed for each individual blast pattern rather than for the event as a whole.*

6.3.2.2 Comparison of Monitoring Results Against Previous Years' Performance and EA Predictions

Blasting results recorded in 2023 are similar to results recorded in previous years and are generally consistent with EA predictions.

6.4 Air Quality

6.4.1 Air Quality Management

Air quality management at MTW is prescribed by the Air Quality Management Plan (available at https://www.mtwcoal.com.au/page/environment/environmental-management-plans/), the management plan:

- Describes procedures required to ensure compliance with the approval conditions relating to air quality including the measures that MTW will use to manage air quality;
- Details the management framework and mitigation actions to be taken while operating; and
- Provides a mechanism for assessing air quality monitoring results against the relevant impact assessment criteria.

6.4.1.1 Real-Time Air Quality Management

MTW's real-time air quality monitoring stations continuously log information and transmit data to a central database, generating alarms when particulate matter levels exceed internal trigger limits. Following an alarm, an inspection is undertaken, and operations and equipment usage are modified as required to manage air quality in accordance with MTW's Air Quality Management Plan.

1,683 real-time alarms for air quality and wind conditions were received and acknowledged during 2023. In response, up to 3,539 hours of equipment downtime was recorded due to air quality management. A detailed breakdown of air quality related equipment stoppages (per month, per equipment type) is presented in **Figure 11**.

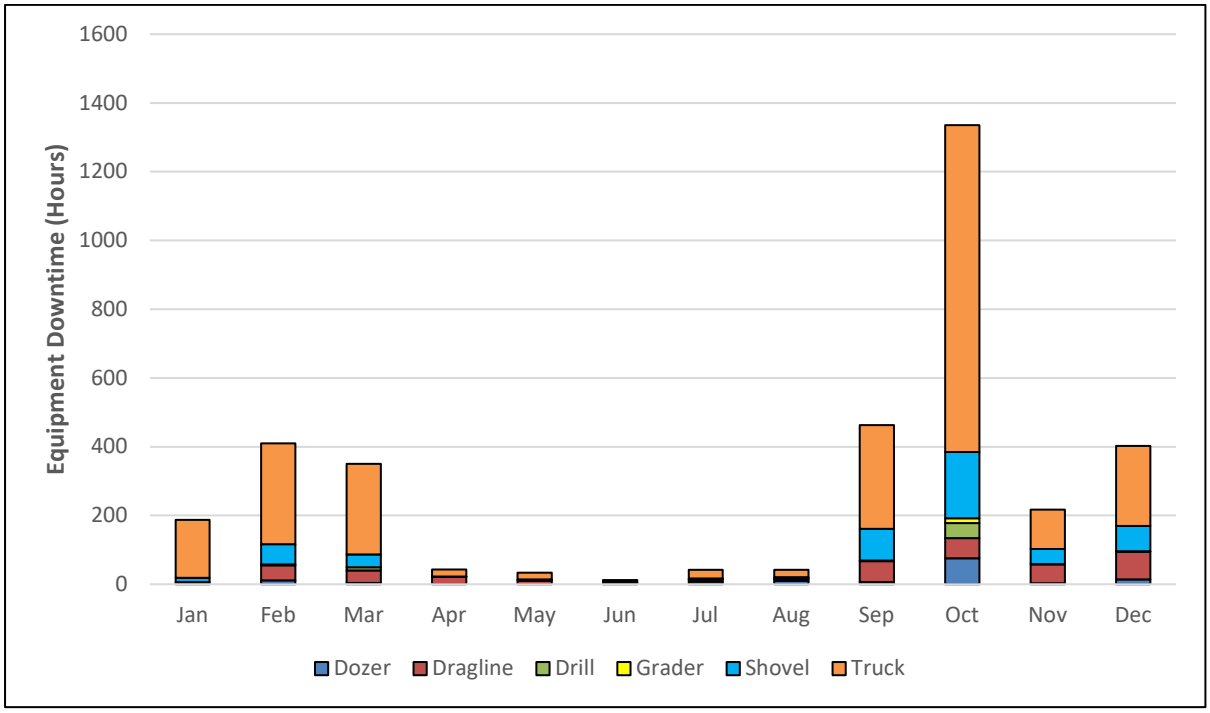


FIGURE 11: EQUIPMENT DOWNTIME FOR DUST MANAGEMENT BY MONTH (2023)

6.4.1.2 Temporary Stabilisation

An aerial seeding programme was undertaken in 2023, which aimed to reduce airborne dust from inactive waste dumps and ahead of mining areas. 71 hectares of area was seeded (see **Figure 12**) using an exotic pasture grass and legume mix suitable for summer sowing. Fertiliser was mixed with the seed prior to loading to provide sufficient nutrients for plant growth.

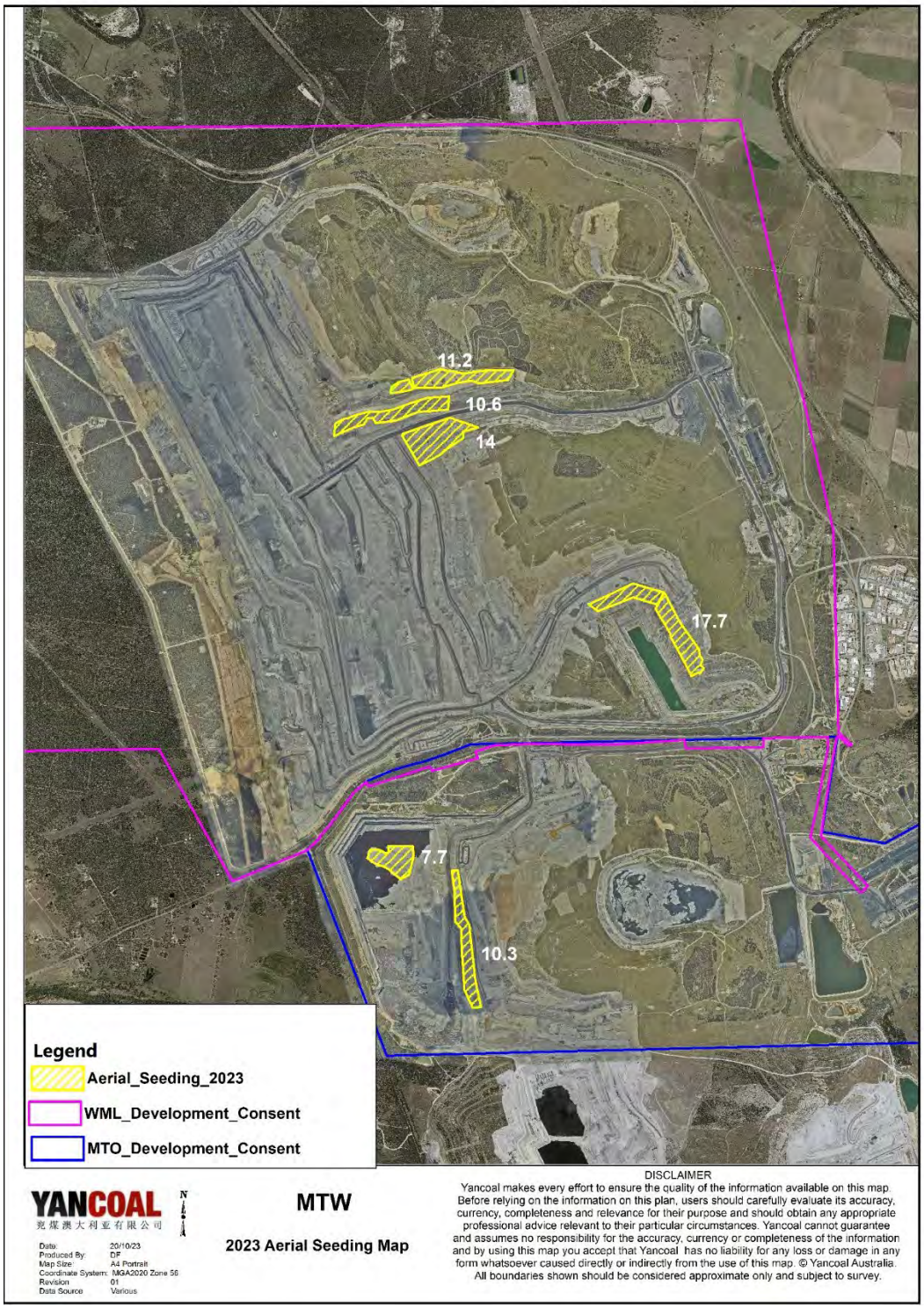


FIGURE 12: AERIAL SEEDING AREAS

6.4.2 Air Quality Performance

6.4.2.1 Air Quality Monitoring

Air quality monitoring at MTW is undertaken in accordance with the MTW Air Quality Monitoring Programme and protocol for evaluating non-compliances. The monitoring network comprises an extensive array of monitoring equipment which is utilised to assess performance against the relevant conditions of MTW's approvals and EPL's. Air quality monitoring locations are shown in **Figure 13**. During 2023, MTW complied with all short term and annual average air quality criteria.

Air quality compliance criteria are shown in **Table 6.7**, along with a summary of MTW's performance against the criteria. Whilst MTW operates under two separate planning approvals the following compliance assessment has been undertaken on a 'whole of MTW site' basis, rather than individually assessing the contribution of each approval area to the measured results.

Air quality monitoring data is made publicly available through the MTW Monthly Environmental Monitoring Report available on the MTW website https://www.mtwcoal.com.au/page/environment/environmental-monitoring/, and daily data can be accessed on the MTW Insite website: https://insite.yancoal.com.au/mount-thorley-warkworth/data

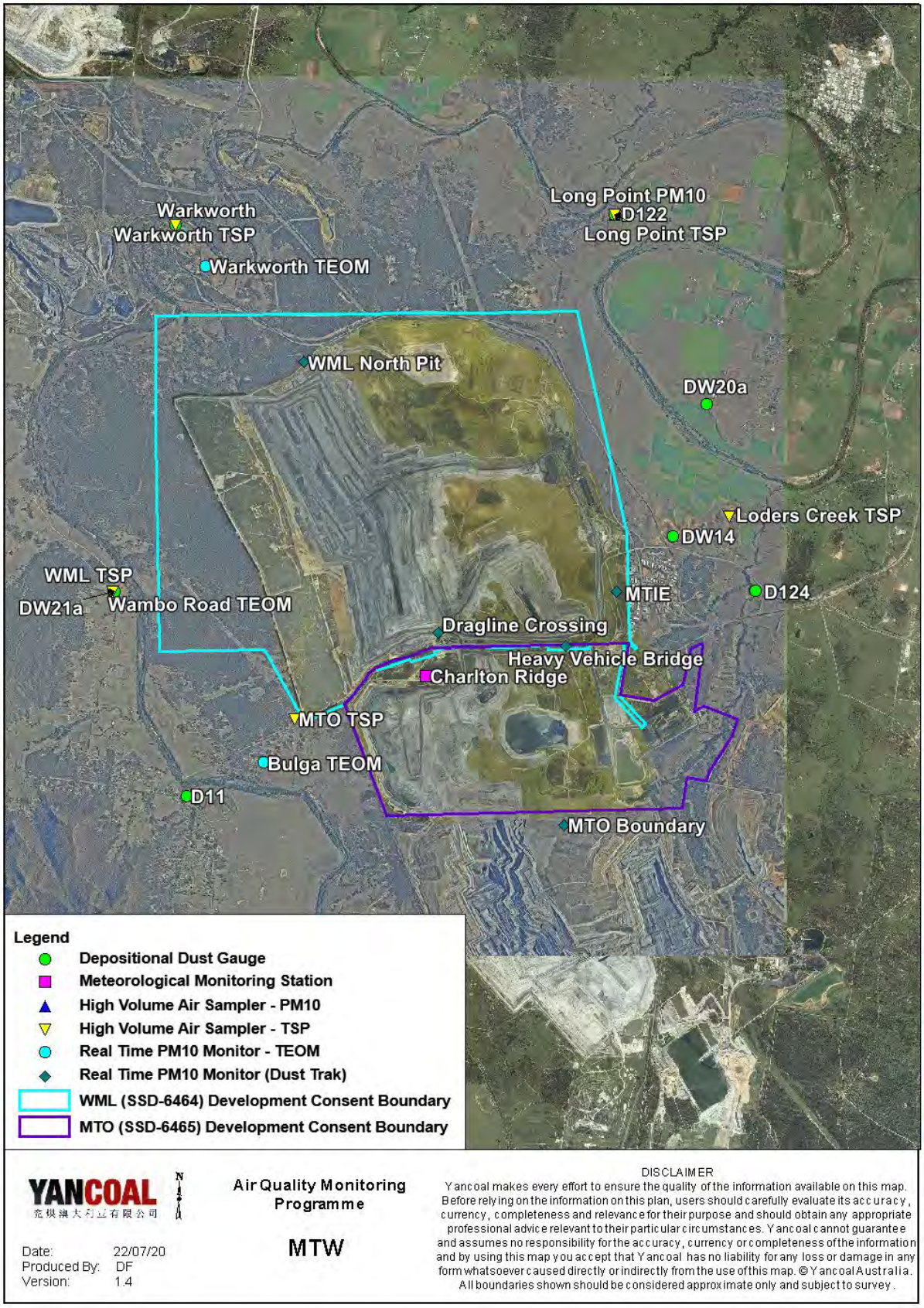


FIGURE 13: AIR AND METEOROLOGICAL MONITORING LOCATIONS MTW 2023

TABLE 6.7 AIR QUALITY IMPACT ASSESSMENT CRITERIA AND 2023 COMPLIANCE ASSESSMENT

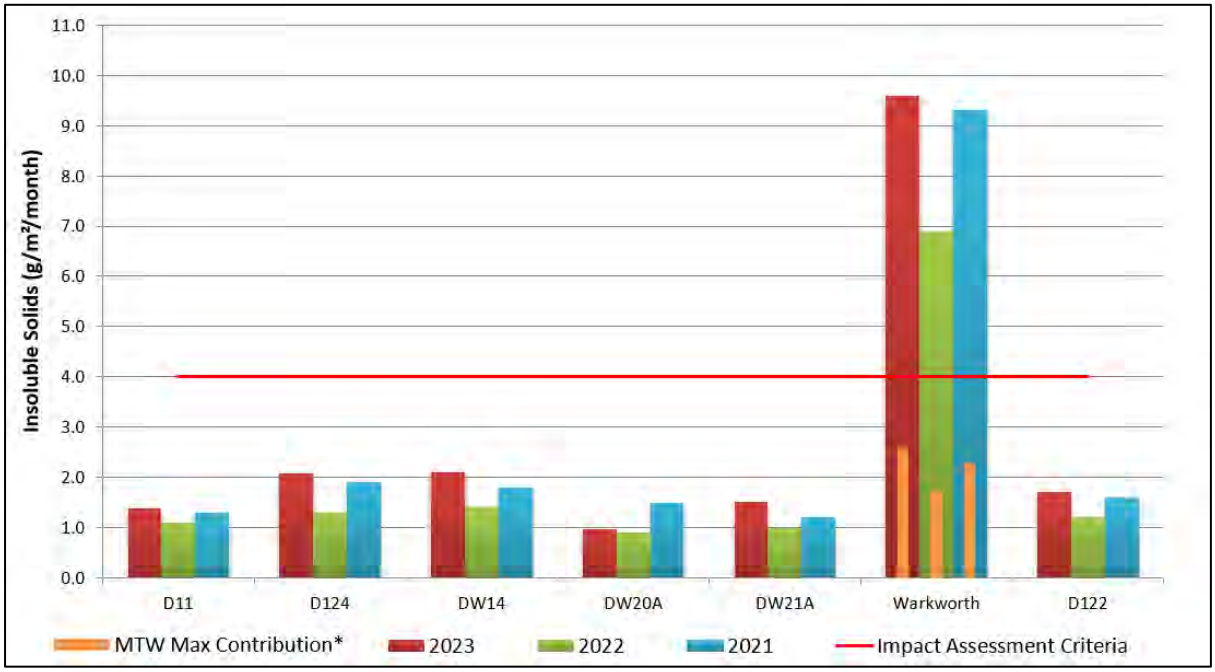
Pollutant	Criterion	Averaging Period	Compliance
Deposited Dust	4 g/m^2/month	Maximum total deposited dust level	100%
	2 g/m^2/month	Maximum increase in deposited dust level	100%
Total Suspended Particulate matter (TSP)	90 µg/m^3	Long Term (Annual)	100%
Particulate matter <10µm (PM_{10})	30 µg/m^3	Long Term (Annual)	100%
	50 µg/m^3	Short Term (24 hour)	100%

6.4.2.2 Deposited Dust

Deposited dust is monitored generally in accordance with AS3580.10.1(2016) at six (6) locations situated on, or representative of residences on privately-owned land and also at a 7th location (Warkworth). The Warkworth deposited dust gauge location differs from the other six dust gauge locations as there are no longer any residences on privately owned properties in Warkworth. The annual average insoluble matter deposition rates in 2023 compared with the impact assessment criterion and previous year's data is shown in **Figure 14**.

There was one exceedance of the 4 g/m^2/month long-term impact assessment criteria, for maximum total deposited dust level, recorded at the Warkworth monitoring location. An external consultant was engaged to conduct an investigation which determined maximum MTW contribution to be less than or equal to 2.6g/m2/month, or ~27% of the total level of 9.6g/m2/month at Warkworth. Whilst the result exceeds the 2 g/m^2/month maximum allowable increase in deposited dust criterion, there are no residences on privately-owned land in Warkworth and as such, this does not constitute non-compliance, as per Schedule 3, Condition 17 of Warkworth Mining Limited Development Consent (SSD-6464) and Schedule 3, Condition 15 of Mount Thorley Operations Development Consent (SSD-6465).

After analysis of the single exceedance, all annual average insoluble matter deposition rates recorded on or representing privately owned land were compliant with the long-term impact assessment criteria of 4g/m2/month. MTW propose to amend its Air Quality Monitoring Programme to remove the Warkworth depositional dust gauge from its monitoring network, considering that there are no longer any residences on privately-owned land in Warkworth.



** MTW's estimated maximum contribution to annual average deposited dust level (determined by external air quality consultant).*

FIGURE 14: 2023 DEPOSITIONAL DUST RESULTS COMPARED AGAINST THE IMPACT ASSESSMENT CRITERIA AND PREVIOUS YEARS' RESULTS

6.4.2.3 Total Suspended Particulates (TSP)

Total Suspended Particulates (TSP) are measured at four (4) locations situated on or representative of privately-owned land in accordance with AS3580.9.3 (2003) and also at a 5th location (Warkworth HVAS). The Warkworth HVAS is not representative of privately-owned land as there are no longer privately owned properties in Warkworth.

Annual average TSP concentrations recorded in 2023 compared against the long-term impact assessment criterion and previous years' data, are shown **Figure 15**.

One high volume air sampler exceeded the annual TSP impact assessment criteria during the 2023 reporting period. This was investigated to determine the level of contribution from MTW activities in accordance with the compliance protocol outlined in the approved MTW Air Quality Management Plan. The recorded exceedance was determined to be compliant with the relevant criteria, as the measured result was not primarily attributable to MTW.

After analysis of the single exceedance, all annual average results were compliant with the impact assessment and land acquisition criteria.

A summary of the investigation undertaken for the annual TSP exceedance is provided in Table **6.8**

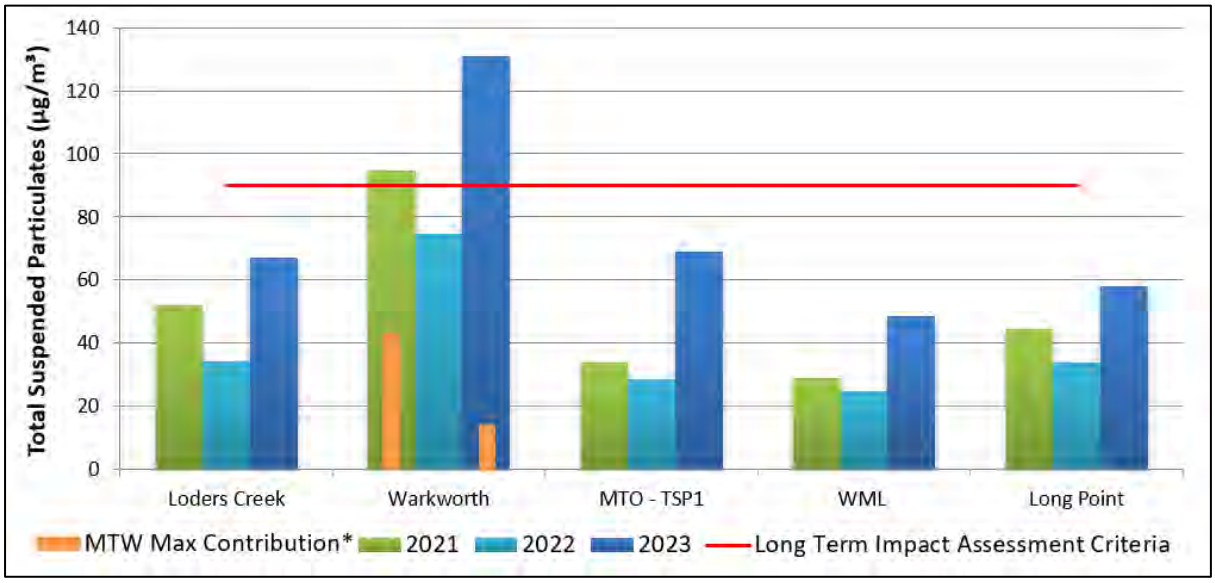
TABLE 6.8 ANNUAL TSP INVESTIGATION - 2023

Date	Site	Annual Average PM_{10} result ($\mu g/m^3$)	Calculated Annual TSP ($\mu g/m3$)	Discussion
2023	Warkworth HVAS TSP	130.9	≤14.2*	An external consultant was engaged to investigate the exceedance. The investigation determined that the maximum potential contribution from MTW at the Warkworth monitor during the review period was 14.2 µg/m3. This was based on an analysis of meteorological data, estimated background particulate levels and position of the site in relation to MTW. As the measured result is not primarily attributable to MTW, it does not constitute non-compliance, as per MTW's approved Air Quality Management Plan. No further action is required.

* *MTW's estimated contribution to annual average TSP level ($\mu g/m^3$).*

During the reporting period, 7 out of the 305 TSP measurements were not able to be fully collected on the scheduled sampling date (based on a sampling frequency of every six days) likely due to power failures and equipment issues.

The annual average TSP concentrations recorded in 2023 are higher than those recorded in previous years, which is likely related to below average rainfall in 2023 compared to above average rainfall in 2021 and 2022.



** MTW's estimated maximum contribution to annual average TSP level (determined by external air quality consultant).*

FIGURE 15: 2023 TSP ANNUAL AVERAGE COMPARED AGAINST THE IMPACT ASSESSMENT CRITERIA AND PREVIOUS YEARS' RESULTS

6.4.2.4 Particulate Matter <10µm (PM10)

Compliance assessment for Particulate Matter <10µm (PM_{10}) is measured at four (4) locations on privately owned land in accordance with AS3580.9.6 (2003). During 2023, all short term and annual average results were compliant with the impact assessment criteria, as per MTW's approved Air Quality Management Plan.

6.4.2.5 Short term PM10 impact assessment criteria

Monitoring results for PM_{10} (24 hour) collected through High-Volume Air Sampler monitoring are compared against the short-term impact assessment criteria (**Figure 16**). All 24hr average results recorded by MTW's surrounding network of TEOM monitors are presented on a quarterly basis in **Figure 17** to **Figure 20.**

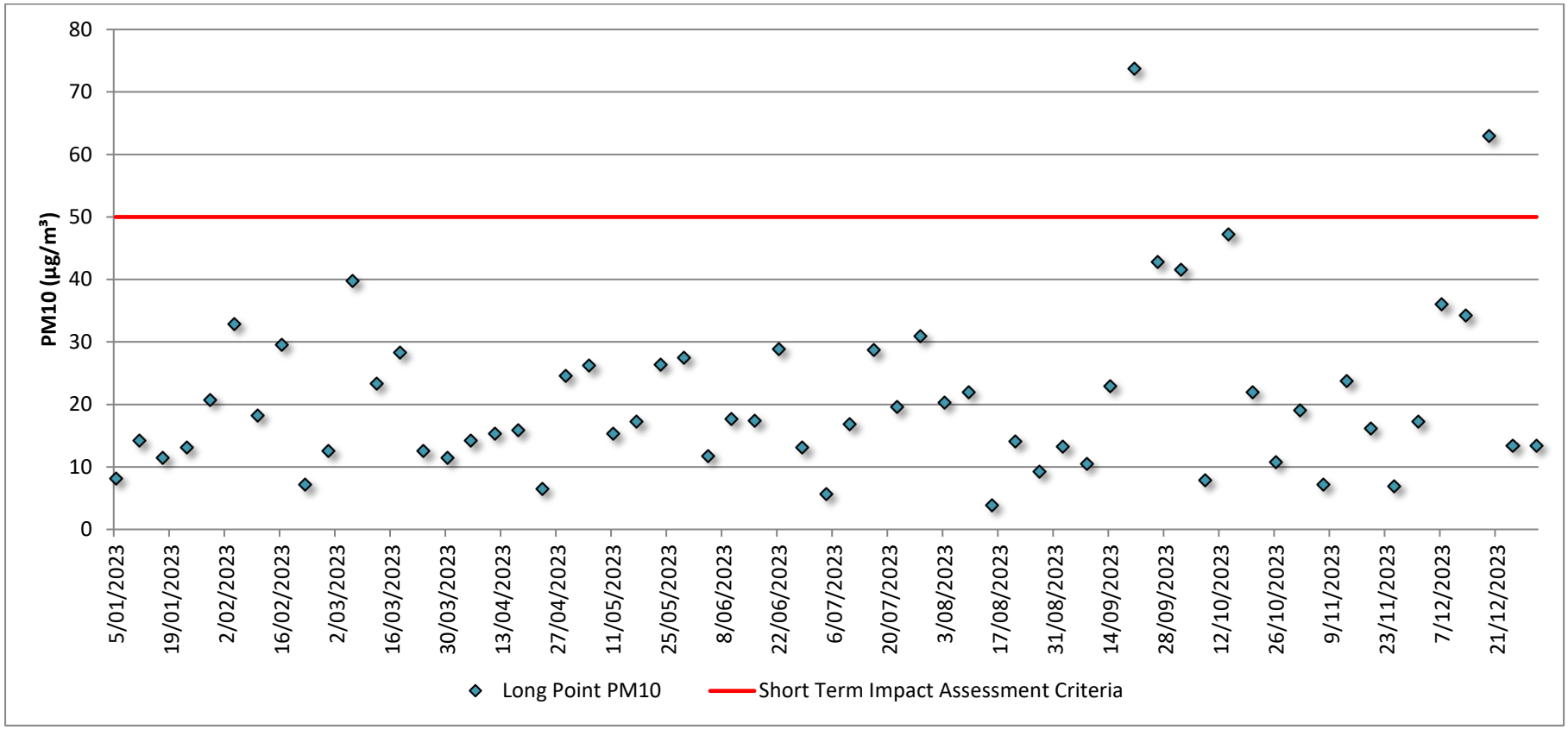


FIGURE 16: PM10 24HR MONITORING RESULTS (MEASURED BY MTW PM10 HVAS MONITOR)

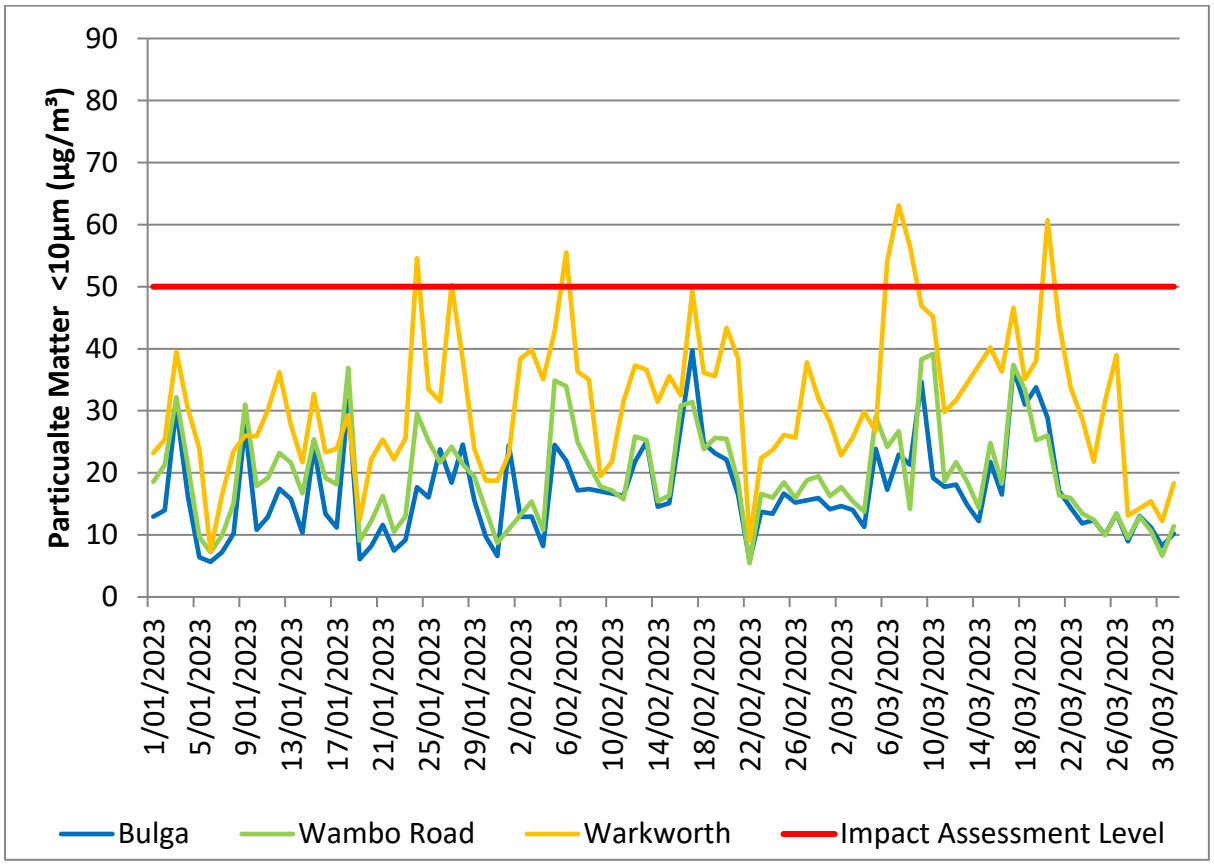


FIGURE 17: 24HR AVERAGE PM10 MEASURED AT TEOM MONITORS SURROUNDING MTW - QUARTER ONE 2023

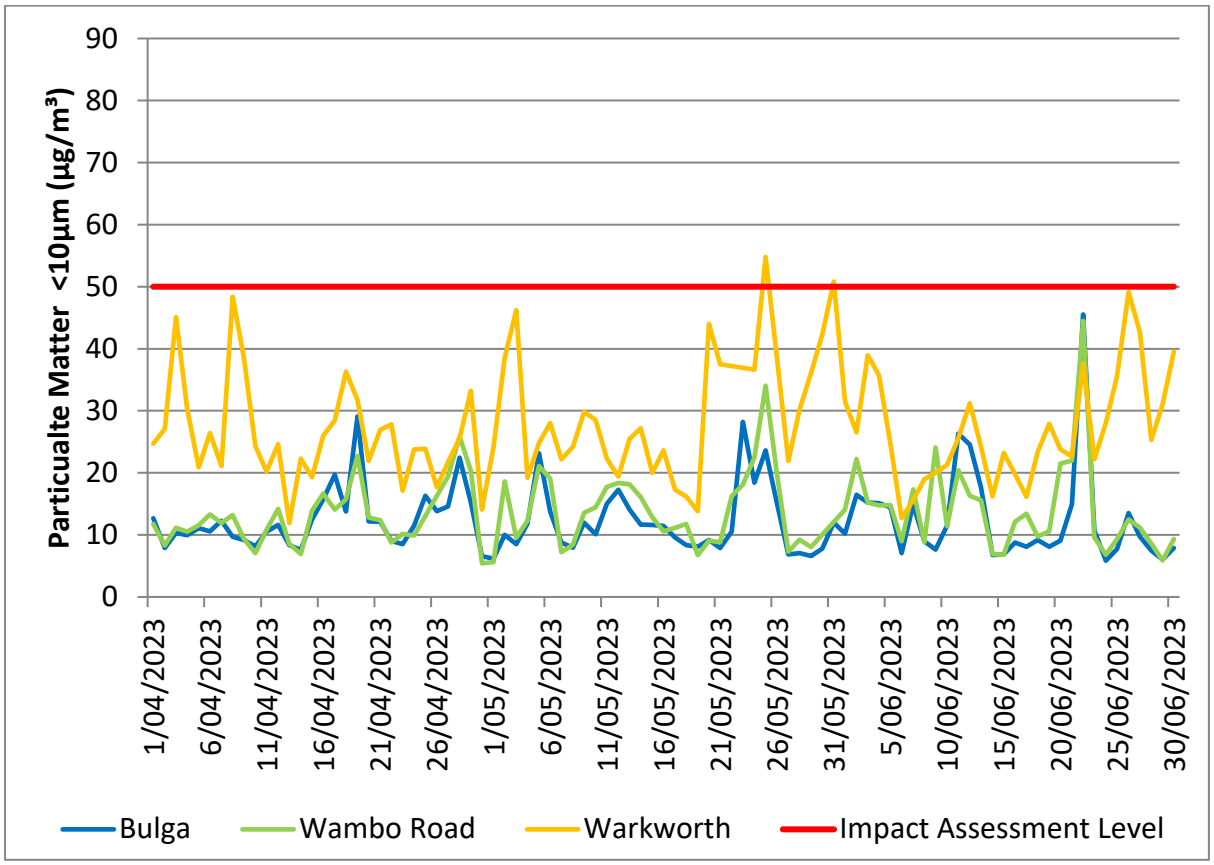


FIGURE 18: 24HR AVERAGE PM10 MEASURED AT TEOM MONITORS SURROUNDING MTW - QUARTER TWO 2023

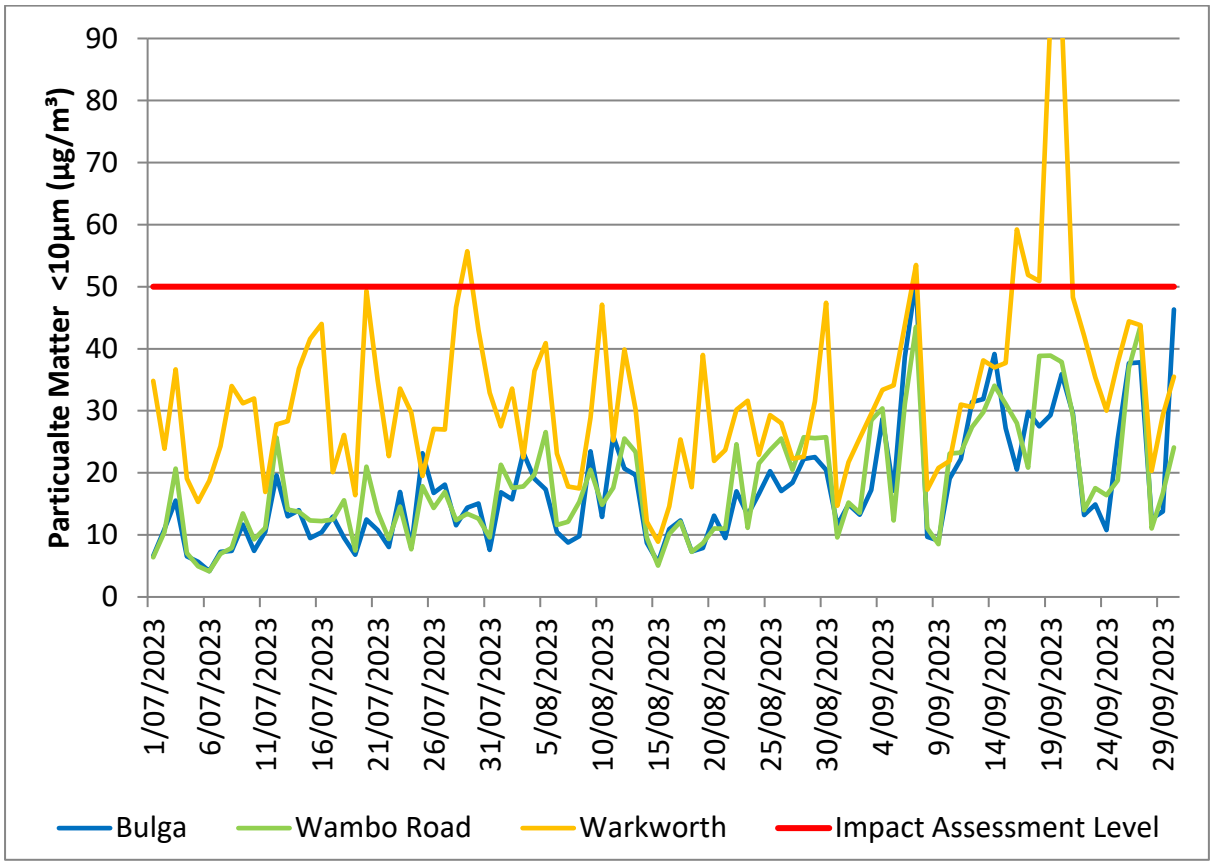


FIGURE 19: 24HR AVERAGE PM10 MEASURED AT TEOM MONITORS SURROUNDING MTW - QUARTER THREE 2023

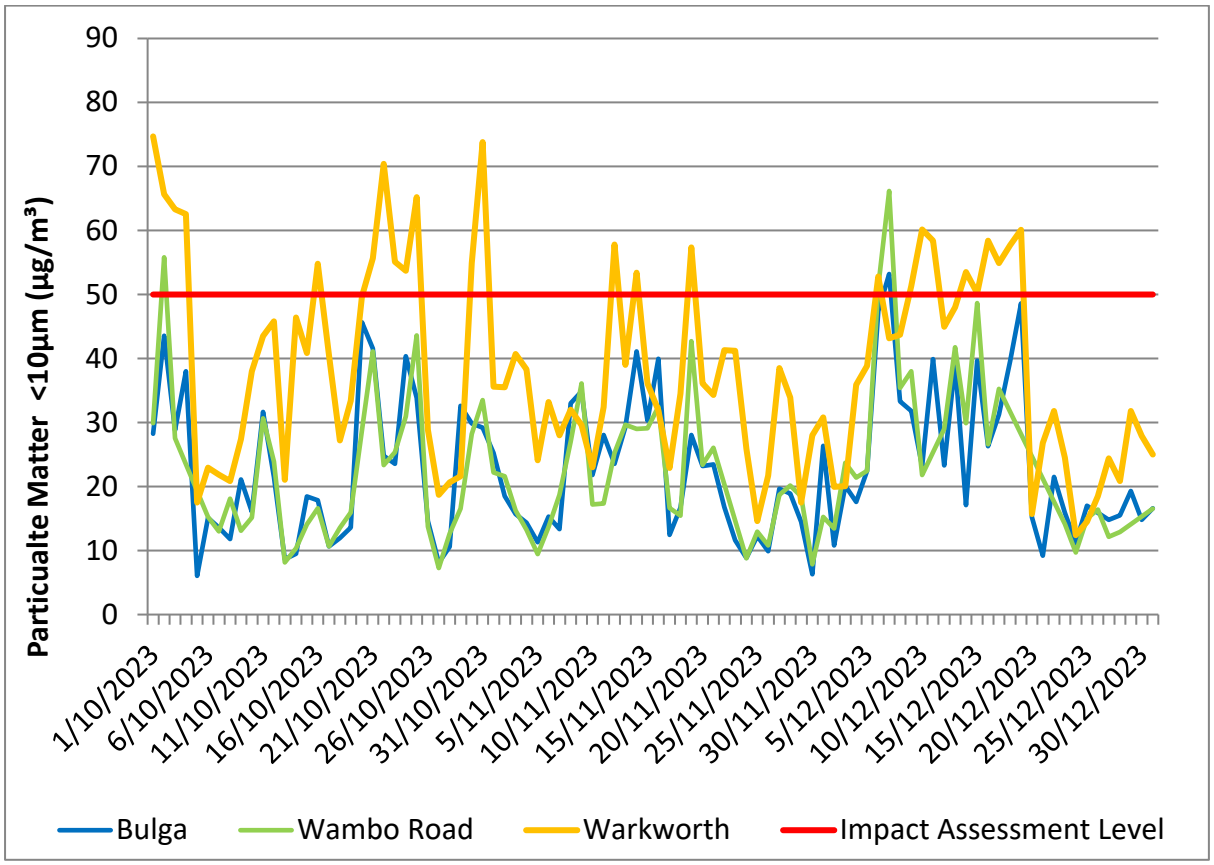


FIGURE 20: 24HR AVERAGE PM_{10} MEASURED AT TEOM MONITORS SURROUNDING MTW - QUARTER FOUR 2023

Forty-five (45) TEOM PM_{10} raw measurement results (all sources) exceeded the 24 hour short term impact assessment criteria during the reporting period. The exceedances were investigated to determine the level of contribution from MTW activities in accordance with the compliance protocol outlined in the MTW Air Quality Management Plan. This protocol considers wind direction to infer the source of particulate matter. A summary of the investigations undertaken for the short term PM10 exceedances is provided in **Appendix 2**. The investigations found that MTW was not a significant contributor to the exceedances for all 45 of the raw TEOM PM_{10} results, and therefore no non-compliances were recorded.

6.4.2.6 Long term PM_{10} impact assessment criteria

Annual average PM_{10} concentrations have been compared with the long term PM_{10} impact assessment criterion and previous years' data. All annual average PM_{10} concentrations recorded on privately owned land (or representative of the nearest privately-owned property) were compliant with the assessment criterion.

The Bulga, Wambo Road, Warkworth and Long Point monitoring locations recorded increases in annual average PM_{10} concentrations compared to 2022 and 2021. This increase is considered largely attributable to below average rainfall.

One TEOM recorded a result above the annual PM_{10} impact assessment criteria during the reporting period. The result was investigated by an external consultant following identification of the exceedance to determine the level of contribution from MTW activities in accordance with the compliance protocol outlined in the MTW Air Quality Management Plan. The result was determined to be compliant with the relevant criteria. A summary of the investigation undertaken is provided in **Table 6.9**.

TABLE 6.9 ANNUAL PM_{10} INVESTIGATION – 2023

Date	Site	Annual Average PM_{10} result ($\mu g/m^3$)	Calculated Annual PM_{10} ($\mu g/m^3$)	Discussion
2023	Warkworth TEOM	32.5	3.9	An external consultant was engaged to investigate the exceedance. The investigation determined that the contribution from MTW at the Warkworth monitor during the review period was relatively low. This was based on an analysis of meteorological data, estimated background PM_{10} levels and position of the site in relation to MTW. As the measured result is not primarily attributable to MTW, it does not constitute non-compliance, as per MTW's approved Air Quality Management Plan and so no further action was required.

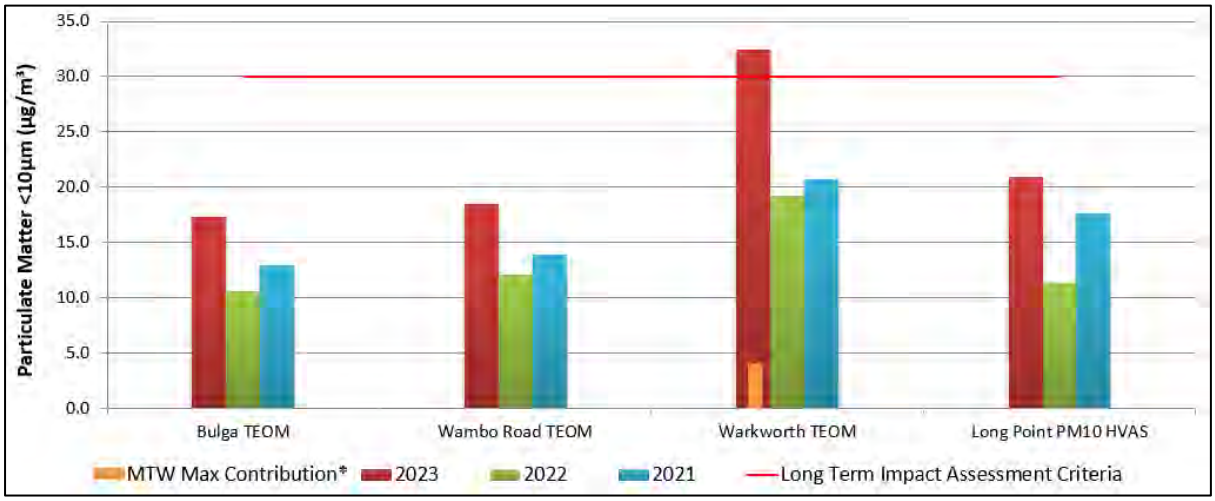


FIGURE 21: ANNUAL AVERAGE PM10 RESULTS 2021 TO 2023

6.4.2.7 Comparison of 2023 Air Quality data against EA predictions

Annual average PM_{10} results at three of four monitoring locations were above the modelled range for Year 9 of the development (nominally 2023). Refer to **Table 6.10**

TSP annual averages at all monitoring locations were higher than modelled predictions for the Year 9 scenario. Refer to **Table 6.11** and **Figure 15.**

The difference between modelled predictions and the measured results can be explained as a function of model inputs which do not account for PM_{10} or TSP contribution from regional particulate events such as bushfires, stock movement, dust from local roads and driveways and agricultural activity. The annual average TSP and PM_{10} concentrations recorded in 2023 are higher than those recorded in the previous years, shown in **Figure 15** and **Figure 21**, which is likely related to below average rainfall in 2023 compared to above average rainfall in 2021 and 2022.

TABLE 6.10 2023 PM10 ANNUAL AVERAGE RESULTS COMPARED AGAINST CUMULATIVE PREDICTIONS FOR YEAR 9 - WARKWORTH CONTINUATION EIS (2014).

Monitoring Location	Long Term (annual average) PM_{10} criteria	
	Year 9 EIS Prediction (µg/m³)	2023 Annual Average (µg/m³)
Bulga OEH TEOM	22	17.3
Wambo Road TEOM	14	18.5
Warkworth OEH TEOM	32	32.5
Long Point PM_{10}	16	20.9

TABLE 6.11 2023 TSP ANNUAL AVERAGE RESULTS COMPARED AGAINST CUMULATIVE PREDICTIONS FOR YEAR 9 – WARKWORTH CONTINUATION EIS (2014).

Monitoring Location	Long Term (annual average) TSP criteria	
	Year 9 EIS Prediction (µg/m^3)	2023 Annual Average (µg/m^3)
MTO TSP	50	68.9
Loders Creek TSP	41	67.2
WML TSP	35	48.6
Warkworth TSP	68	130.9
Long Point TSP	38	58.0

6.4.2.8 Greenhouse Gas

Yancoal's operations report under the National Greenhouse and Energy Reporting (NGER) Scheme for the 2022-2023 financial year. Whilst Mount Thorley and Warkworth are separate facilities for the purpose of NGER reporting, the combined MTW Scope 1 and Scope 2 emissions calculated for the 2022-2023 financial year was 949,843t CO2-e. MTW Scope 1 and Scope 2 emissions calculated for the 2021-2022 financial year was 931,874t CO2-e. The approximate 1.9% increase in emissions can be attributable to an increase in total overburden removed. Scope 1 and Scope 2 emissions attributable to MTW are generally consistent with Environmental Assessment predictions * [See note in this Section].

MTW implemented the following in 2023 to improve efficiency and reduce emissions:

- Deployed automatic shutdown protocols for equipment during idle periods at both North and South CHPP, with a focus on optimizing raw coal stacking and clean coal reclaiming processes.
- Enhanced utilization of the power factor correction module at the South CHPP.
- Initiated the deployment of power monitoring equipment to identify areas for improvement.
- Commissioned 106 wagon trains at the coal loader to minimize the number of trains required to transport the same volume of coal.
- Continued replacement of old dozers with new more efficient dozers.
- Reduced cycle/idle/queue times of trucks by using software to optimise high traffic & congestion areas.
- Continued to place mobile crib huts in strategic areas to reduce travel times of trucks.
- Used mobile fuel farms in strategic areas to reduce travel time of trucks for fuelling.
- Construction of a new water fill point that will provide more efficient watering of roads by better utilisation of water carts.

Note: * - The most recent environmental impact statement (EIS) for the facility was prepared in 2014 to support the NSW development application for SSD-6464. This EIS included an assessment of greenhouse gas impacts, Appendix G – Air Quality and Greenhouse Gas Assessment, Warkworth Continuation Project prepared by Todoroski Air Sciences in June 2014. The greenhouse gas assessment

included a relevant earlier estimate of scope 1 emissions. It estimated that based on producing a maximum of 18 Mt of ROM coal per calendar year, Warkworth would emit an average of 882,056 t CO2e scope 1 emissions.

Regarding the fugitive emissions estimates which form part of our total scope 1 emissions, these are not directly comparable due to a change in reporting methodology. The relevant earlier estimate used the default fugitive emissions factor of 0.045 t CO2e/t ROM coal for open cut mines in NSW as set out in the 2013 Australian National Greenhouse Gas Accounts – National Greenhouse Accounts Factors. Since this time under the Commonwealth NGER Act, the method 1 default factor for open cut coal mines in NSW has increased. Further, Warkworth has refined its gas understanding and changed to method 2 reporting under the NGER Act. As such, a direct comparison of current emissions reported under the NGER Act to those presented in the EIS is not considered practicable or informative. The NGER data is subject to the rigour required under the NGER Act which includes third party assurance.

6.5 Heritage Summary

6.5.1 Heritage Management

During the reporting period, Aboriginal Cultural Heritage and Historic Heritage was managed in accordance with the site's approved Aboriginal Heritage and Historic Heritage Management Plans. A summary of the performance in each of these areas is outlined below.

6.5.2 Heritage Performance

6.5.2.1 Aboriginal Heritage

6.5.2.1.1 Aboriginal Heritage Activities

Aboriginal cultural heritage was managed in accordance with the MTW Aboriginal Heritage Management Plan (AHMP) and the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (the Due Diligence Code).

The Upper Hunter Valley Aboriginal Cultural Heritage Working Group (CHWG) is the primary forum for Aboriginal community consultation on matters pertaining to cultural heritage. The CHWG is comprised of representatives from MTW and Registered Aboriginal Parties (RAPs) from Upper Hunter Valley Aboriginal community groups, corporations and individuals. The CHWG met once during the reporting period on 29 November 2023. Further consultation with the CHWG is planned for the next reporting period to discuss upcoming salvage programs, management of the Conservation Areas, and general cultural heritage management processes.

MTW was issued Care Agreement C0003708 on 26 April 2019 by the Office of Environment and Heritage (now Heritage NSW), which approved the transfer and safekeeping of Aboriginal objects and was a replacement of Care Agreement C0001841. On 19 October 2020, the Aboriginal objects specified in Care Agreement C003708 were transferred to the updated location for safekeeping. Heritage NSW was advised of the transfer on 29 October 2020.

On 23 May 2023 a salvage program was undertaken to salvage eleven isolated artefact sites, with nine of the sites located in the area ahead of mining planned to be disturbed over coming years and two of the sites recommended for salvage during previous AHMP audits. Representatives of the CHWG participated in the salvage program which was undertaken in association with a consultant archaeologist. A total of 46 artefacts which were salvaged and catalogued, prior to storage at MTW's cultural heritage keeping place. Examples of salvaged artefacts are shown in **Figure 22** and **Figure 23.** No new Aboriginal cultural heritage assessments were required during the reporting period and there were no further Aboriginal cultural heritage artefacts ("chance finds") identified during the reporting period.

FIGURE 22: ARTEFACTS SALVAGED FROM SITE MTO-89

Conservation Agreements for the Wollombi Brook Aboriginal Cultural Heritage Conservation Area (WBACHCA) and Loders Creek Aboriginal Cultural Heritage Conservation Area (LCACHCA) were signed on 3 November 2022 under delegation of the Minister administering the *National Parks and Wildlife Act 1974*. During the reporting period work continued to register the Agreements on title for the lands of the Conservation Areas with work to finalise the registrations remaining ongoing at the end of the reporting period.

FIGURE 23: SINGLE PLATFORM CORE SALVAGED FROM SITE MTW-222

Work to reconcile the MTW Cultural Heritage Management Database with the NSW Heritage AHIMS database occurred during the period. Implementation of a Licence Agreement between Heritage NSW and MTW delayed commencement of this project and completion of the reconciliation by a consulting archaeologist remained ongoing at the end of the reporting period. The reconciliation is anticipated to be completed during 2024 with database update and review and implementation of other recommendations to follow across the period.

Consultation with the CHWG ahead of formation of the Plan of Management Implementation Group (PMIG) occurred as part of the CHWG meeting held in November. Consultation was required as the CHWG had not met over the COVID period and re-communication of the PMIG formation process was required. Formation of the PMIG and review and progression of the implementation plans for the Conservation Areas is planned to occur during the next reporting period. Planned works to prepare for relocation of the Site M grinding grooves from the storage area were not undertaken and have been deferred to be considered by the PMIG.

6.5.2.1.2 Audits and Incidents

During the reporting period there were 45 Ground Disturbance Permits (GDPs) assessed for cultural heritage management considerations at MTW. Ground disturbance works were conducted based on an Aboriginal cultural heritage sites avoidance policy so that no un-salvaged sites were impacted by these activities. There were no known incidents, nor any unauthorised disturbance caused to Aboriginal cultural heritage sites at MTW during 2023.

An AHMP compliance inspection covering the 2023 reporting period was undertaken on 5-6 December 2023. This inspection was conducted by representatives of the Aboriginal community, internal MTW personnel, and a consultant archaeologist with 85 Aboriginal cultural heritage sites reviewed during this program. No unauthorised site disturbances or AHMP non-compliances were identified during the inspection and no issues were raised by the CHWG representatives present. The Aboriginal Heritage Management Plan Inspection report is shown in **Appendix 3**.

6.5.2.2 Historic Heritage

6.5.2.2.1 Historic Heritage Activities

Historic heritage was managed in accordance with the MTW Historic Heritage Management Plan (HHMP). In 2012 the MTW Cultural Heritage Advisory Group (CHAG) was established as a community consultation forum for matters pertaining to management of historic (non-Indigenous) heritage located on MTW lands. The CHAG is comprised of community representatives with knowledge and interests in the historic heritage of the region such as historical groups, individuals and local government.

The MTW Historic Heritage Conservation Fund (HHCF) was launched by Singleton Council in December 2018, in accordance with Schedule 17 of the HHMP. MTW has made all of the agreed contributions to the fund (a total of $516,177.12), with the final contribution made in the 2022 reporting period. The availability of the fund is advertised on the Singleton Council and MTW websites, and directly to landowners with registered heritage items, and continued to be available during the 2023 reporting period. Applications for funding under the HHCF are considered by Singleton Council's Singleton Heritage Advisory Committee (SHAC) and recommendations made to Council.

During the reporting period routine grounds maintenance works were undertaken at the Springwood Homestead and the Red Brick (Jarvis) House in addition to ongoing targeted treatment of Cat's Claw Creeper vine at Springwood Homestead. Minor repairs were undertaken at the Red Brick House to stabilise the rear verandah roofing and to re-attach weather hoarding boards following removal by unknown persons. Planned works at the heritage buildings were not undertaken during the period as the availability of appropriate resources was limited. Work to re-establish access to the RAAF Cook House, make safe by removing asbestos and suspended tree fall, and undertake structural inspections and stabilisation will now occur during 2024. Stabilisation works will also be progressed during the next period at Springwood Homestead and the Red Brick House in association with work to mitigate unauthorised access.

An Historic Heritage Management Plan (HHMP) compliance inspection covering the 2023 reporting period was conducted on 7 December 2023. This inspection was conducted by a consultant archaeologist, assisted by a representative of the Community Heritage Advisory Group (CHAG), and MTW personnel. Three historic heritage sites were inspected during this program. No incidents or any unauthorised disturbance was identified at historic heritage sites at MTW during 2023. The Historic Heritage Management Plan Inspection Report is shown in **Appendix 4**. Actions arising from the audit will inform works to be undertaken during the upcoming reporting period.

6.6 Visual Amenity and Lighting

6.6.1 Visual Amenity and Lighting Management

MTW aims to minimise visual amenity impacts from its operations. Two of the main controls used are lighting management and visual screening.

6.6.2 Visual Amenity and Lighting Performance

6.6.2.1 Lighting

MTW aims to provide sufficient lighting for work to be undertaken safely, whilst minimising disturbance to neighbouring residents and public road users, particularly nearby residents in Bulga Village, Mount Thorley, Warkworth Village, Long Point, Milbrodale and motorists on the Putty Road and Golden Highway.

Actions undertaken in 2023 to manage lighting impacts at MTW included:

- Routine night shift inspections conducted by Community Response Officers to observe operating practices and to ensure lights are not shining towards nearby residential areas or affecting public roads;
- Yellow lights are used in preference to white lights in areas based on risk and external exposure;
- Alternate sheltered dumps are operated, or work areas are shut down if lighting or visual amenity issues arise and cannot be sufficiently managed.

6.6.2.2 Visual Screening

Visual screening of MTW's operations incorporates various methods to best suit the terrain and infrastructure constraints around the boundary of the mine.

Visual bunding has an immediate screening effect, providing complete screening in areas where vegetation would be inadequate to filter views or where additional height is required. Bunds may be vegetated where practicable and feasible for visual amenity and to mitigate erosion.

Built screens (i.e. solid fences or walls), may be used as an alternative when bunds and tree screens are not practicable. Temporary screens (i.e. fencing and shade mesh) may also be used as required for interim screening.

Shade cloth was attached to the existing fence along Putty Road in July 2021 and remains in place. This visual screen fencing is an interim measure prior to the establishment of vegetation. Vegetation plantings were undertaken in 2020 to infill between existing trees/shrubs. Slashing works were also undertaken in 2023 along Putty Road, improving visual amenity.

6.7 Water

6.7.1 Water Management

An adaptive management approach is implemented at MTW to achieve the following objectives for water management:

- Fresh water usage is minimised;
- Impacts on the environment and MTW neighbours are minimised; and
- Interference to mining production is minimal.

This is achieved by:

- Preferentially using mine water for coal preparation and dust suppression where feasible;
- An emphasis on control of water quality and quantity at the source;
- Segregating waters of different quality where practical;
- Recycling on-site water;
- Ongoing maintenance and review of the water management system; and
- Releasing water to the environment in accordance with statutory requirements.

Plans showing the layout of key water management structures and key pipelines are shown in **Figure 24**. The MTW Water Management Plan contains further detail on management practices and is available on the MTW website https://www.mtwcoal.com.au/.
Improvements to water management in 2023 included:

- Continue construction of North Out of Pit (NOOP) water management structure that will provide improved water security and balance position at MTW. The NOOP dam is approved by the Warkworth Continuation Project development consent SSD-6464.
- Construction of sediment water management structures Dam 56N and 57N for the western advancing pre-strip at Warkworth completed. These structures were designed in accordance with the NSW Blue Book, Managing Urban Stormwater: Soils and Construction, Volume 2E Mines and Quarries.
- Approval, installation and operation of the Bulga water share project sending mine water to Bulga Coal for use in Bulga Coal operations.
- Desilting of Dams 1S, 2S, 3S, 46N, 53N and 55N. Development of a dam desilting program and budget allocation for 2024.

- Installation of additional internal water transfer pipeline.
- Remote boundary monitoring system installed on Dam 56N and 57N.
- Designed increased discharge rate infrastructure for the MTO discharge point under the Hunter River Salinity Trade Scheme.

There were no water related incidents during the reporting period.

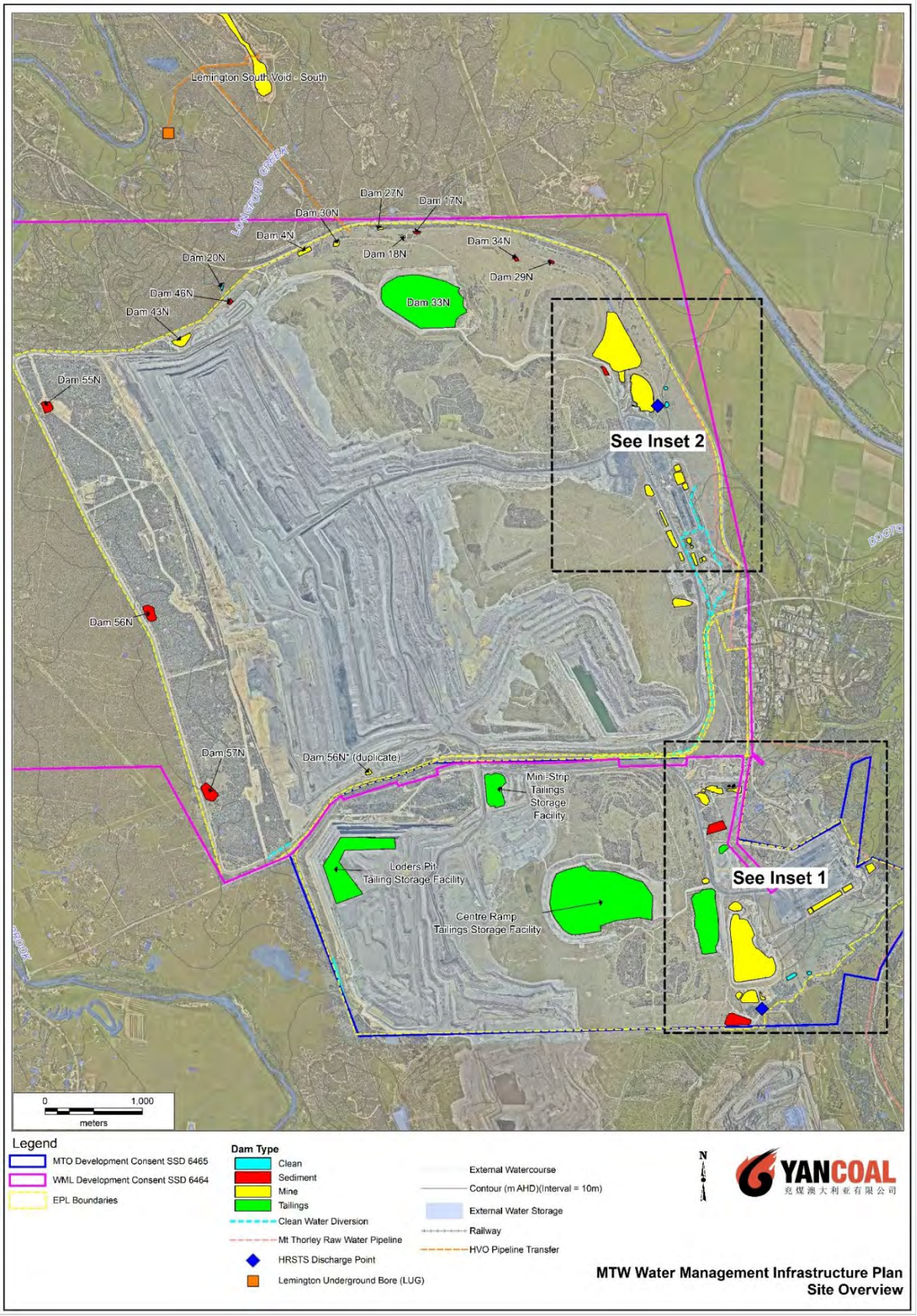


FIGURE 24: WATER MANAGEMENT INFRASTRUCTURE PLAN – SITE OVERVIEW

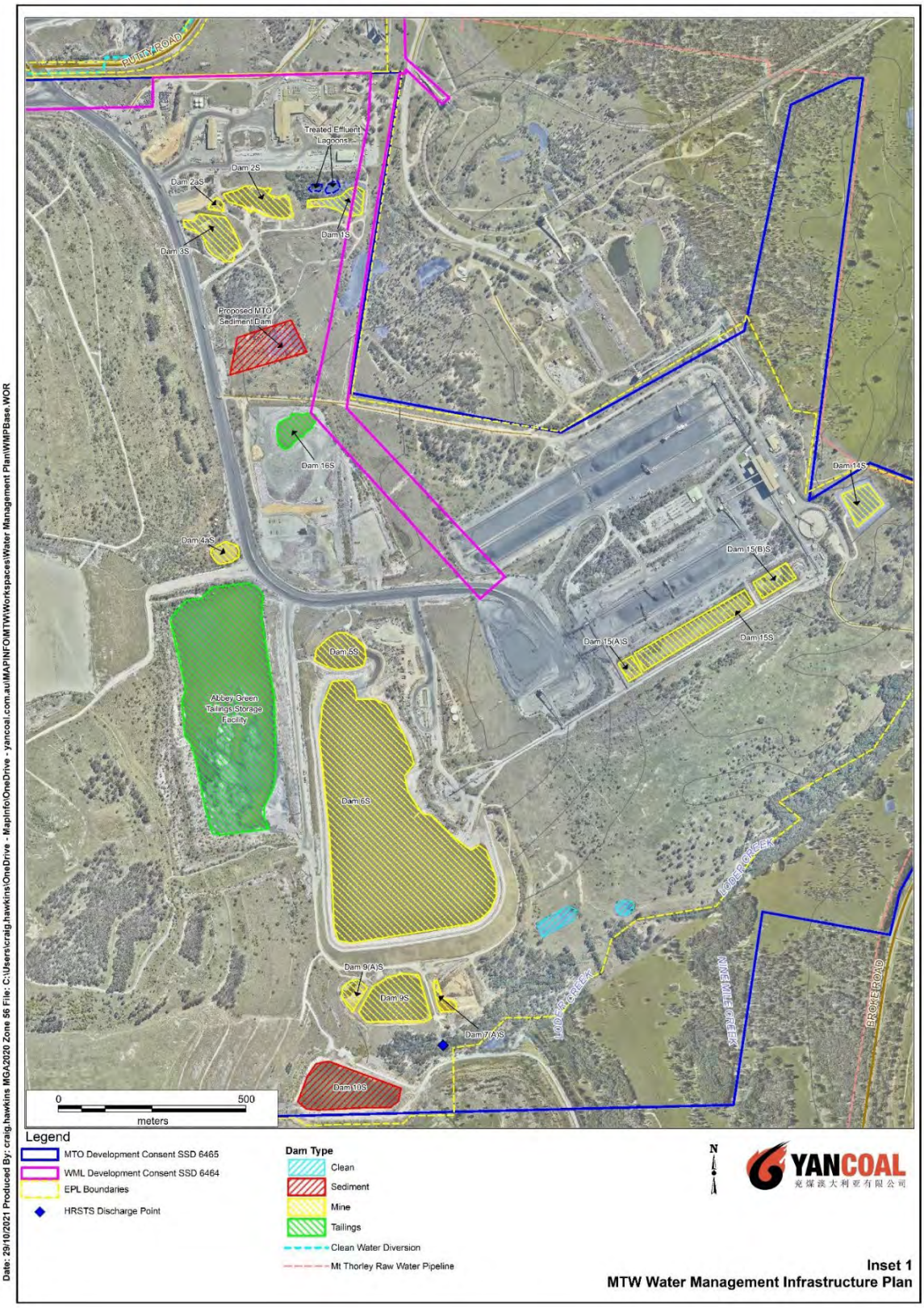


FIGURE 24A – MTW WATER MANAGEMENT INFRASTRUCTURE PLAN – INSET 1 (MTO DETAIL)

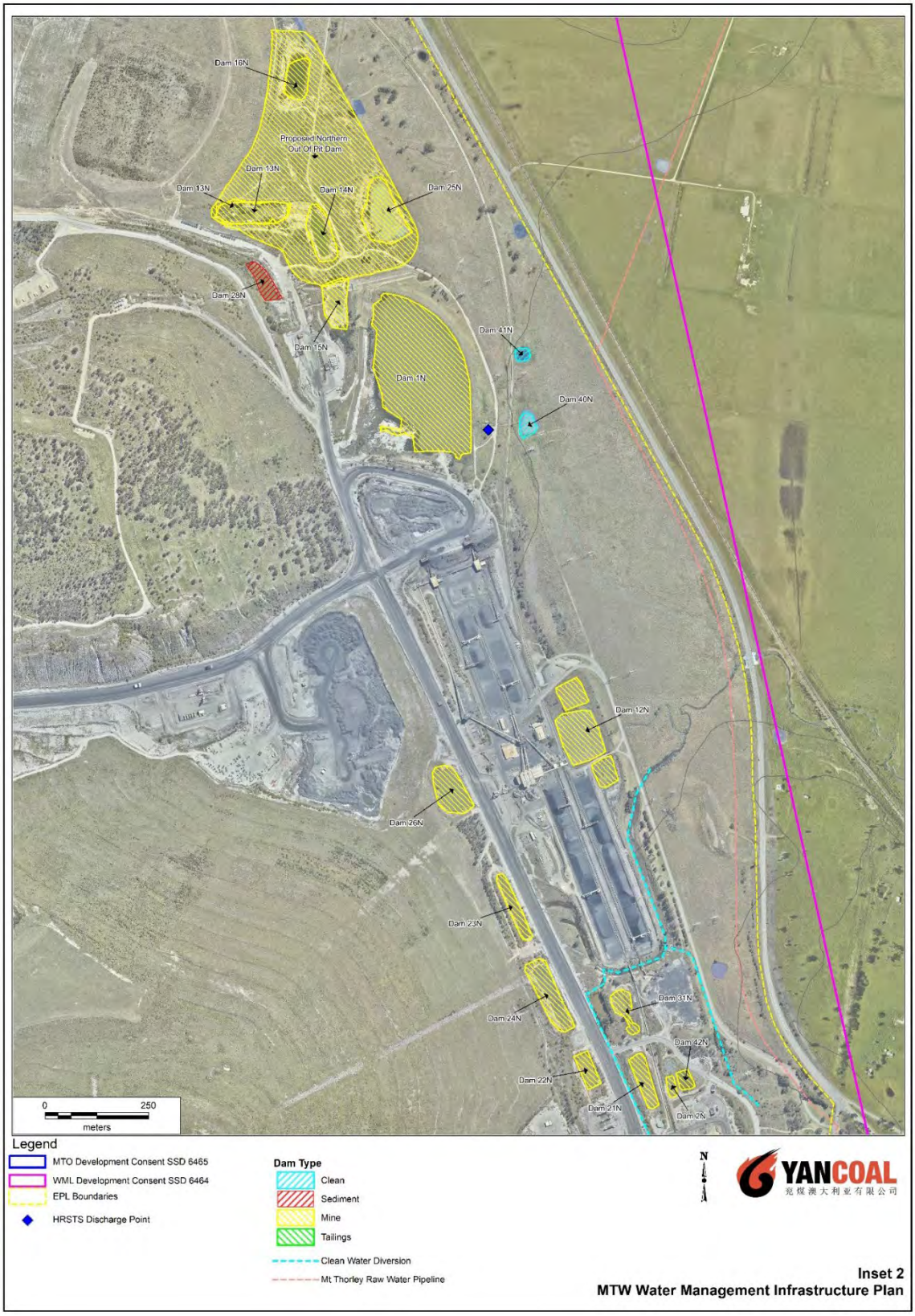


FIGURE 24B – MTW WATER MANAGEMENT INFRASTRUCTURE PLAN - INSET 2 (WML DETAIL)

6.7.2 Water Balance Performance

MTW uses a water balance to record and assess water flux, but also to forecast and plan water management needs. These annual site water balances are then compared to previous results. A 2023 static water balance for MTW is presented in **Table 6.12** and a simplified schematic of this balance is included in **Figure 25**. A salt flux schematic is shown in **Figure 26**.

TABLE 6.12 STATIC MODEL RESULTS, ANNUAL WATER BALANCE

Water Stream	Volume (ML) (% Total)
Inputs	
Rainfall Runoff	5,361 (70%)
Hunter River (MTJV supply scheme)	195 (2%)
Potable (Singleton Shire Council / trucked)	68 (<1%)
Groundwater	428 (6%)
Recycled to CHPP from tailings (not included in total)	4,513
Imported (LUG bore)	545 (7%)
Imported (Hunter Valley Operations)	0 (0%)
Water from ROM Coal	1,085 (14%)
Total Inputs	**7,682**
Outputs	
Dust Suppression	970 (10%)
Evaporation – mine water dams	1,029 (11%)
Entrained in process waste	2,768 (30%)
Sharing with other mines	2,642 (29%)
Discharged (HRSTS)	0 (0%)
Water in coarse reject	711 (8%)
Water in product coal	1,033 (11%)
Miscellaneous use (wash-down etc.)	83 (<1%)
Total Outputs	**9,236**
Change in storage	**-1,554**

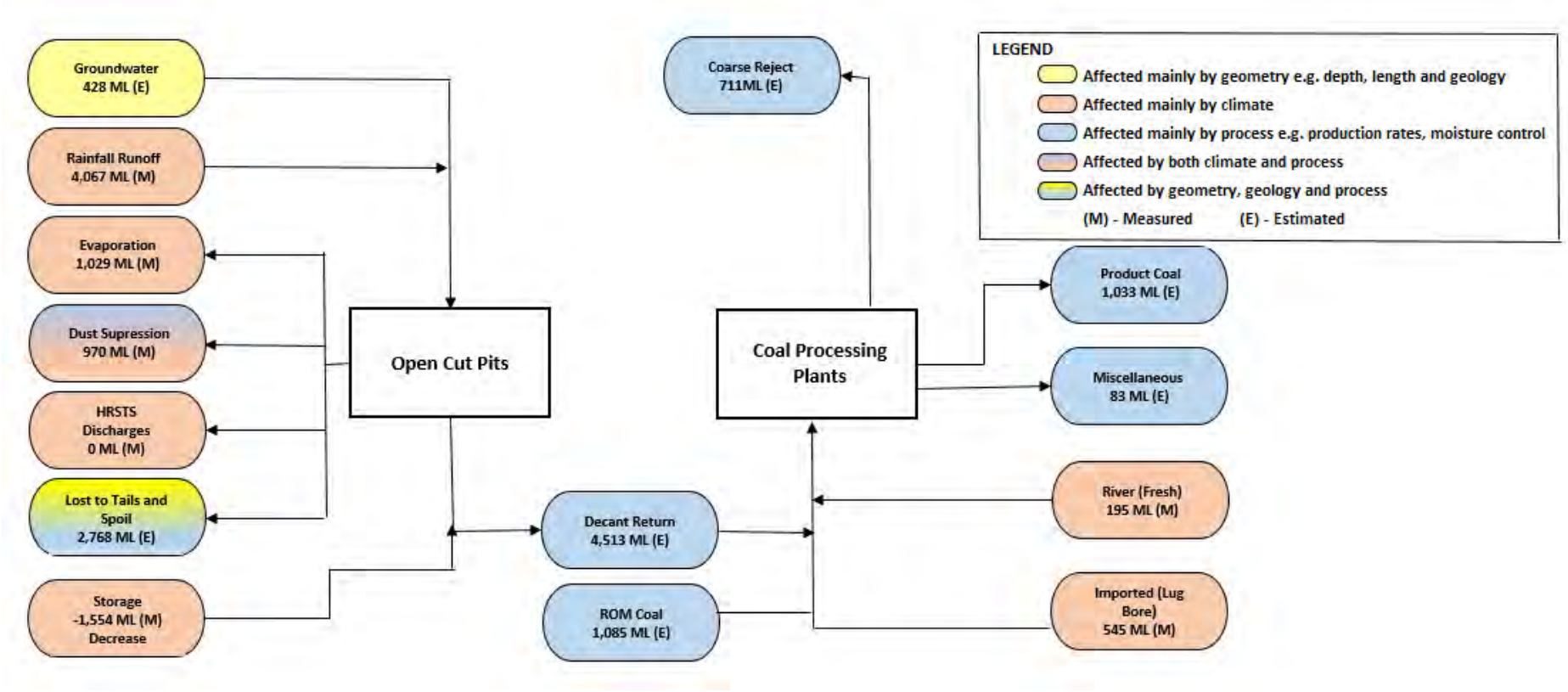


FIGURE 25: SCHEMATIC DIAGRAM MTW WATER FLUX

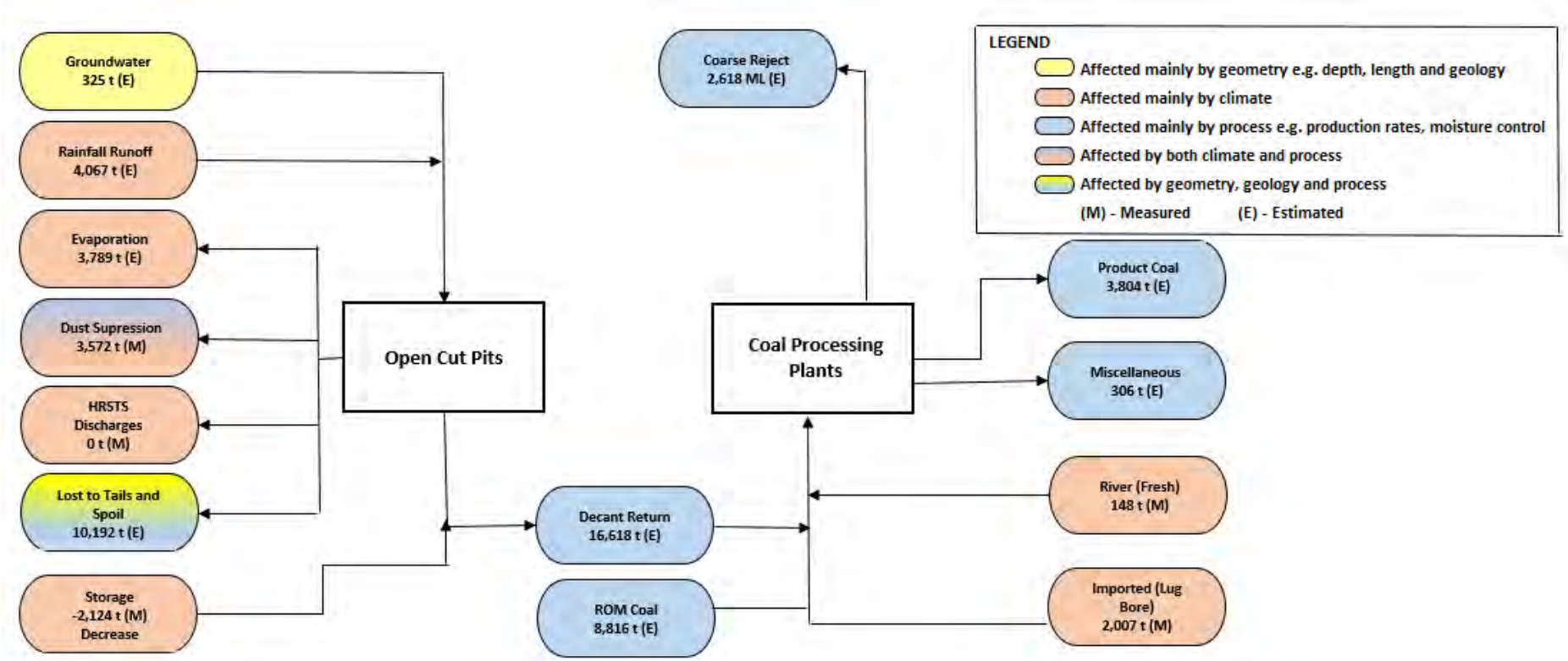


FIGURE 26: SCHEMATIC DIAGRAM MTW SALT FLUX

6.7.2.1 Water Inputs

A total of 502mm of rainfall was recorded at MTW in 2023 producing a calculated 5,361ML of runoff from developed, disturbed and mining catchments. Water falling on clean water catchments is diverted off site into natural systems where possible. Rainfall runoff was the largest input to the site mine water balance in 2023.

Water was required to be imported to meet site demand during 2023. During the reporting period 545 ML was imported from the LUG bore by MTW, compared to the previous reporting period (41ML extracted in 2022).

MTW also sources water from the Hunter River via the Mount Thorley Joint Venture (MTJV) water supply scheme. Singleton Shire Council holds the high security water licence on behalf of the scheme members. Singleton Shire Council maintains and operates the scheme to supply raw water to MTW, Glencore's Bulga Coal complex, and to meet Council's own needs. MTW's share of the MTJV allocation is 1,009 ML per water reporting year.

A total of 195 ML of water was abstracted from the Hunter River during the reporting period for MTW operations which was slightly more than the volume of water extracted in the previous reporting period. (54 ML extracted in 2022).

Groundwater Licences under Part 5 of the Water Act 1912 are held for each mining excavation area, to account for passive take via seepage inflows. Water Licences held by MTW are detailed in **Table 3.5** and **Table 3.6.**

Licence conditions require the volume and quality of water taken by the works to be measured and reported on an annual water calendar year basis (i.e. financial year). Groundwater inflows via pit wall seepage are at low rates, with a significant proportion evaporating at the coal face. The remainder reports to the pit floor, where it may accumulate along with direct rainfall, rainfall runoff and leakage from spoils. As a result, it is not possible to physically measure the volume of water taken by these groundwater licences, nor the quality of waters extracted via seepage to the pits. Ground water inflows volumes are estimated based on modelling from Australasian Groundwater and Environmental Consultants Pty Ltd (2015), *Mount Thorley and Warkworth Mines Long Term Approvals Model Update* (Project No G1468G, February 2015).

6.7.2.1 Water Outputs

Significant water uses at MTW in 2023 were for evaporation from Dams (1,029 ML), water entrained in process waste (2,768 ML) and dust suppression on haul roads, mining areas and coal stockpiles (970 ML). Water sharing to Bulga Coal from MTO was utilised in 2023 (2,642ML).

MTW participates in the Hunter River Salinity Trading Scheme (HRSTS), allowing discharge from licensed discharge points during declared discharge events associated with increased flow in the Hunter River. During high flows, each HRSTS participant is entitled to discharge a share of the total

allowable discharge into a block of water passing down the Hunter River according to the number of HRSTS salt credits that they hold. Credits may be traded between participants to ensure that saline water is being managed in the most cost-effective way.

There are 1000 credits, each entitling the holder to discharge 1/1000 of each high flow day's total allowable discharge. The credits may be traded between participants so that those holders who do not need to discharge can trade their entitlement to others with the greatest need HRSTS discharge opportunity. HRSTS discharges are undertaken in accordance with HRSTS regulations (including the need to hold HRSTS credits for the discharges undertaken), and the licence conditions of EPL 1376 and EPL 1976.

MTW maintains two licensed HRSTS discharge monitoring locations:

- Dam 1N, located at WML North, which discharges to Doctor's Creek; and
- Dam 9S, located at MTO South, which discharges to Loders Creek.

During the reporting period, no discharge occurred from Dam 1N (WML) or Dam 9S (MTO) under the HRSTS.

6.8 Surface Water Management

Surface water monitoring activities continued in 2023 in accordance with the MTW Water Management Plan and MTW Surface Water Monitoring Programme. MTW maintains a network of surface water monitoring sites located at selected site dams and surrounding natural watercourses as shown in **Figure 27**. Water quality monitoring is undertaken to verify the effectiveness of the water management system onsite, and to identify the emergence of potentially adverse effects on surrounding watercourses. Primary water storage dams are monitored routinely to verify the quality of mine water, used in coal processing, dust suppression, and other day to day activities around the mine.

Surface water monitoring data review involves a comparison of measured pH, Electrical Conductivity (EC) and Total Suspended Solids (TSS) results against internal trigger values which have been derived from the historical data set. The response to measured samples outside the trigger limits is detailed in the MTW Water Management Plan.

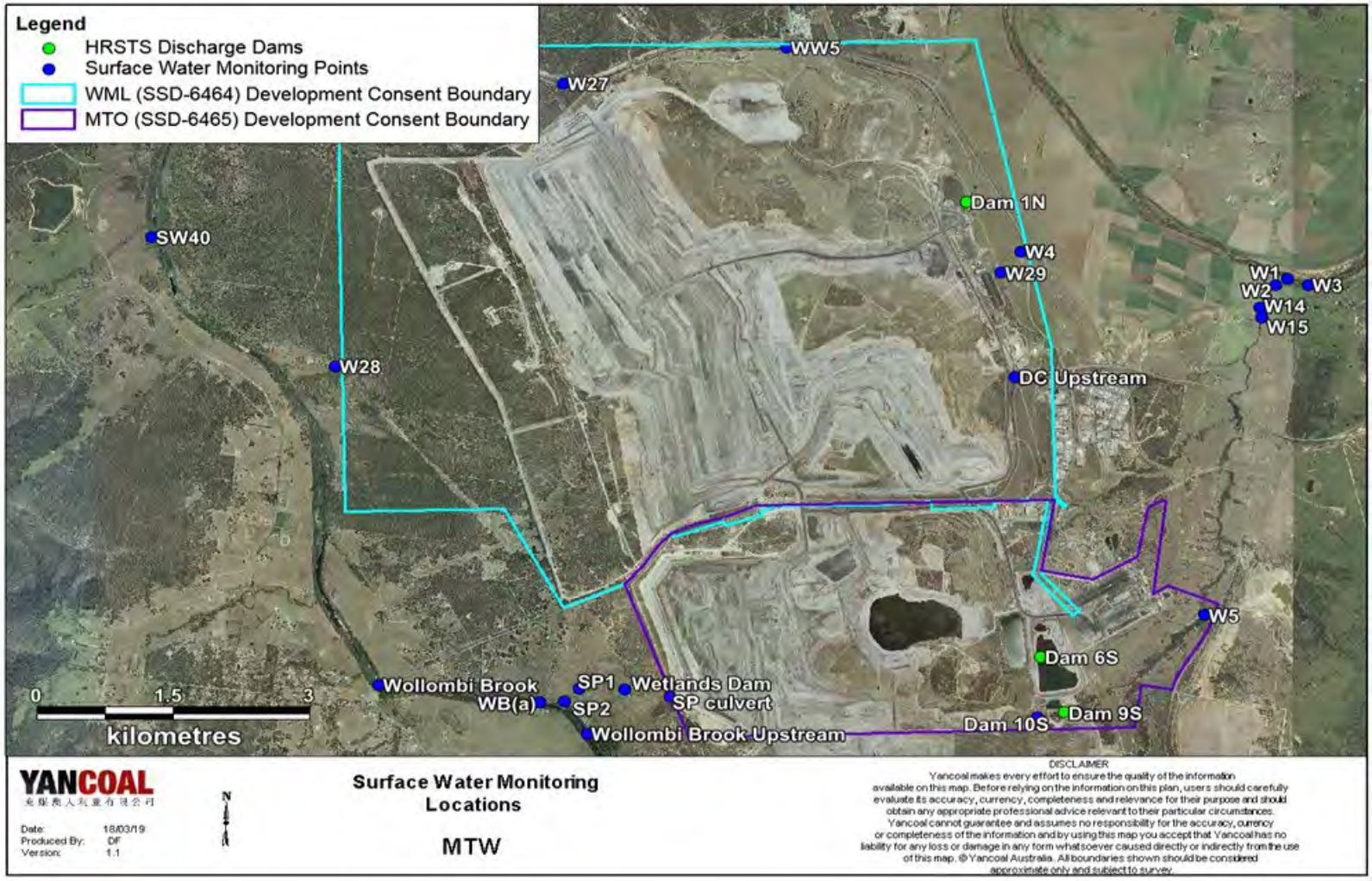


FIGURE 27: SURFACE WATER MONITORING POINTS

6.8.1 Surface Water Performance

Routine surface water monitoring was undertaken from twelve (12) sites and rain event sampling was undertaken from thirteen (13) sites. Sampling of surface waters was carried out in accordance with AS/NZS 5667.6 (1998). Analysis of surface water was carried out in accordance with approved methods by a NATA accredited laboratory.

Water quality is evaluated through the assessment of pH, EC and TSS. All surface water sites were also sampled for comprehensive analysis annually. The sampling frequency for ephemeral water sites was modified in 2016, from quarterly to a rain-event trigger system in an effort to ensure samples taken were more representative of typical water quality for those streams (up to eight sampling events per annum can now be taken under the revised sampling protocol). During the reporting period, there were two rain event sampling runs completed. All required sampling and analysis was undertaken, except as detailed in **Table 6.13**. Trigger tracking results are described in **Table 6.14**.

TABLE 6.13 MTW WATER MONITORING DATA RECOVERY FOR 2023 (BY EXCEPTION)

Location	Data Recovery (%)	Comment
W1	75%	No safe access to site in December.
W2	75%	No safe access to site in December.
W3	50%	No safe access to site in March and December.
WW5	0%	Insufficient water to take a sample in February.
WB(a)	50%	No safe access to site in February.
Wetlands Dam	0%	Insufficient water to take a sample in February and December.

Note: Missing data indicates that there was insufficient water to take a sample, or that there was no safe access.

A summary of all surface water monitoring results is provided in the MTW Monthly Environmental Monitoring Reports and can be viewed via MTW's website (https://www.mtwcoal.com.au/).

Figure 28 to **Figure 33** show long term water quality trends for the Hunter River, Wollombi Brook, other surrounding tributaries and site dams.

Measurements of EC were generally stable during the reporting period across the majority of sites and consistent with historical seasonal trends. Elevated EC level was recorded during the reporting period at the W1, W2 and W3 monitoring site located on the Hunter River, W27 (Longford Creek) and W28 (Wallaby Scrub) monitoring sites. The sites with elevated levels will continue to be monitored for future elevated levels and investigated as required.

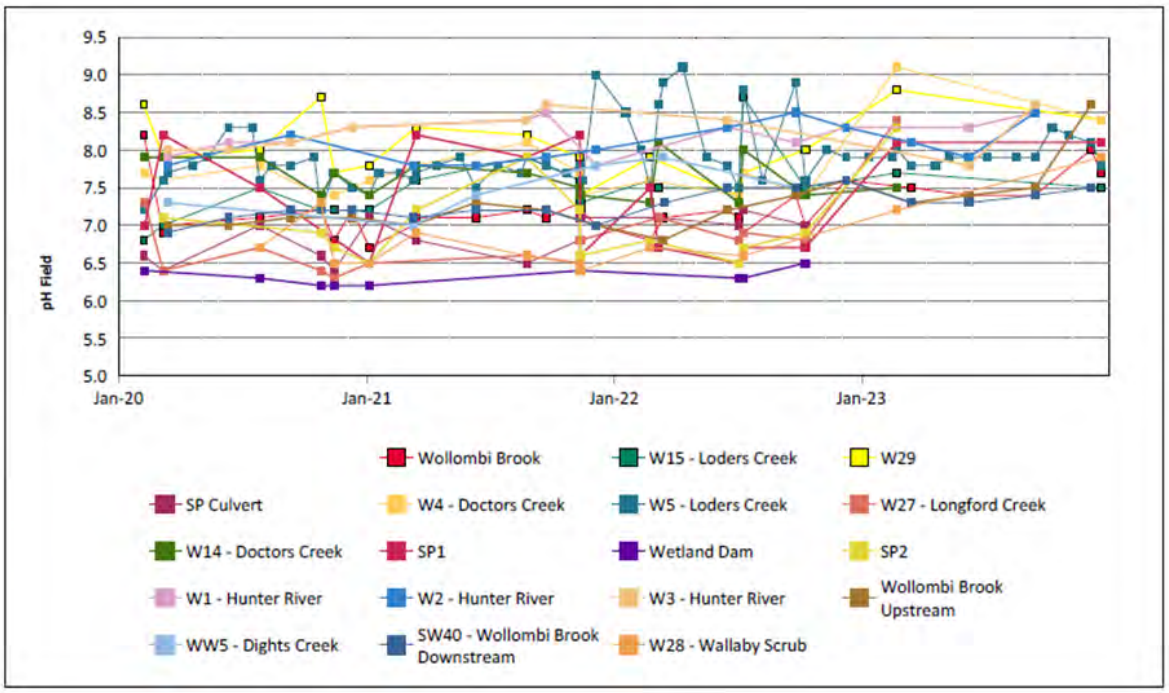
Measurements of pH were generally stable during the reporting period across the majority of sites and consistent with historical seasonal trends. Four sites triggered the 95th percentile/upper limit during the reporting period and will continue to be monitored for future elevated levels and investigated as required.

A number of TSS limits were triggered in the reporting period, which were generally associated with rainfall events or sampling from pooled section of watercourses; these are outlined below in **Table 6.16**. Monitoring results will continue to be monitored for future elevated levels and investigated as required. These results are also provided in the Monthly reports provided on the MTW Insite website (https://www.mtwcoal.com.au/).

TABLE 6.14 SURFACE WATER MONITORING - TRIGGER TRACKING RESULTS

Site	Date	Trigger Limit Breached	Action Taken in Response
W1	08/06/2023	EC – 95th Percentile	Watching Brief*
W1	14/09/2023	EC – 95th Percentile	Watching Brief*
W2	15/03/2023	EC – 95th Percentile	Monitoring results back within trigger limits for June and September 2023 sample rounds. No follow up required.
W3	08/06/2023	EC – 95th Percentile	Watching Brief*
W3	14/09/2023	EC – 95th Percentile	Watching Brief*
W27	22/02/2023	EC – 95th Percentile	Watching Brief*
W28	21/12/2023	EC – 95th Percentile	Watching Brief*
W4	22/02/2023	pH – 95th Percentile	Monitoring results back within trigger limits for September and December 20213 sample rounds. No follow up required.
W27	22/02/2023	pH – 95th Percentile	Watching Brief*
W3	14/09/2023	pH – 95th Percentile	Watching Brief*
Wollombi Brook Upstream	5/12/2023	pH – 95th Percentile	Watching Brief*
W2	08/06/2023	TSS – 50mg/L (ANZECC criteria)	Watching Brief*. Unlikely to be associated with MTW mining related impacts. Elevated TSS results most likely attributable to sampling from water with no flow (pool of water). Note: Result is not considered to be a valid representation given that there was no flow at the time of sampling.
W4	22/02/2023	TSS – 50mg/L (ANZECC criteria)	Elevated TSS associated with high runoff due to rainfall event (53.2mm on 22/02/2023), resulting in mobilisation of sediment. No MTW site sources of sediment identified. No follow up required.
W14	22/02/2023	TSS – 50mg/L (ANZECC criteria)	Elevated TSS associated with high runoff due to rainfall event (53.2mm on 22/02/2023), resulting in mobilisation of sediment. No MTW site sources of sediment identified. No follow up required.
W15	22/02/2023	TSS – 50mg/L (ANZECC criteria)	Elevated TSS associated with high runoff due to rainfall event (53.2mm on 22/02/2023), resulting in mobilisation of sediment. No MTW site sources of sediment identified. No follow up required.
W27	22/02/2023	TSS – 50mg/L (ANZECC criteria)	Elevated TSS associated with high runoff due to rainfall event (53.2mm on 22/02/2023), resulting in mobilisation of sediment. No MTW site sources of sediment identified. No follow up required.
W29	22/02/2023	TSS – 50mg/L (ANZECC criteria)	Elevated TSS associated with high runoff due to rainfall event (53.2mm on 22/02/2023), resulting in mobilisation of sediment. No MTW site sources of sediment identified. No follow up required.
SP1	22/02/2023	TSS – 50mg/L (ANZECC criteria)	Elevated TSS associated with high runoff due to rainfall event (53.2mm on 22/02/2023), resulting in mobilisation of sediment. No MTW site sources of sediment identified. No follow up required.
W5	5/12/2023	TSS – 50mg/L (ANZECC criteria)	Watching Brief*. Unlikely to be associated with MTW mining related impacts. Elevated TSS results most likely attributable to sampling from water with no flow (pool of water). Note: Result is not considered to be a valid representation given that there was no flow at the time of sampling.

* = Watching brief established pending outcomes of subsequent monitoring events.



Note: Missing data indicates that there was insufficient water to take a sample, or that there was no safe access.

FIGURE 28: WATERCOURSE PH TRENDS 2020 TO 2023

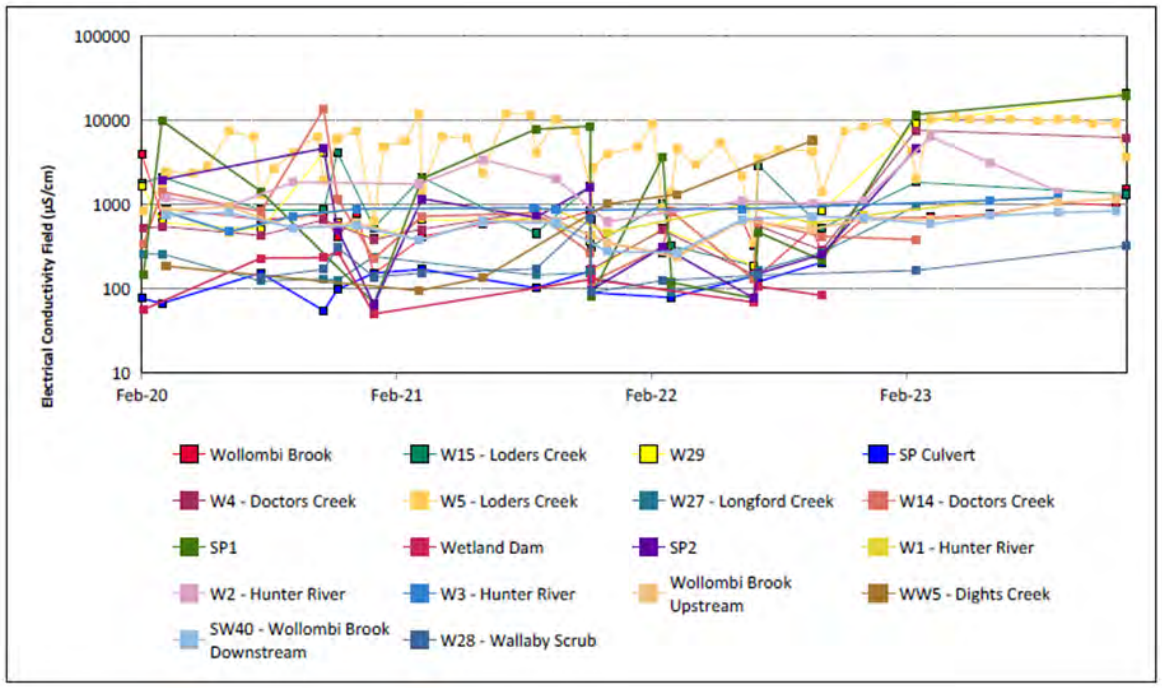


FIGURE 29: WATERCOURSE EC TRENDS 2020 TO 2023

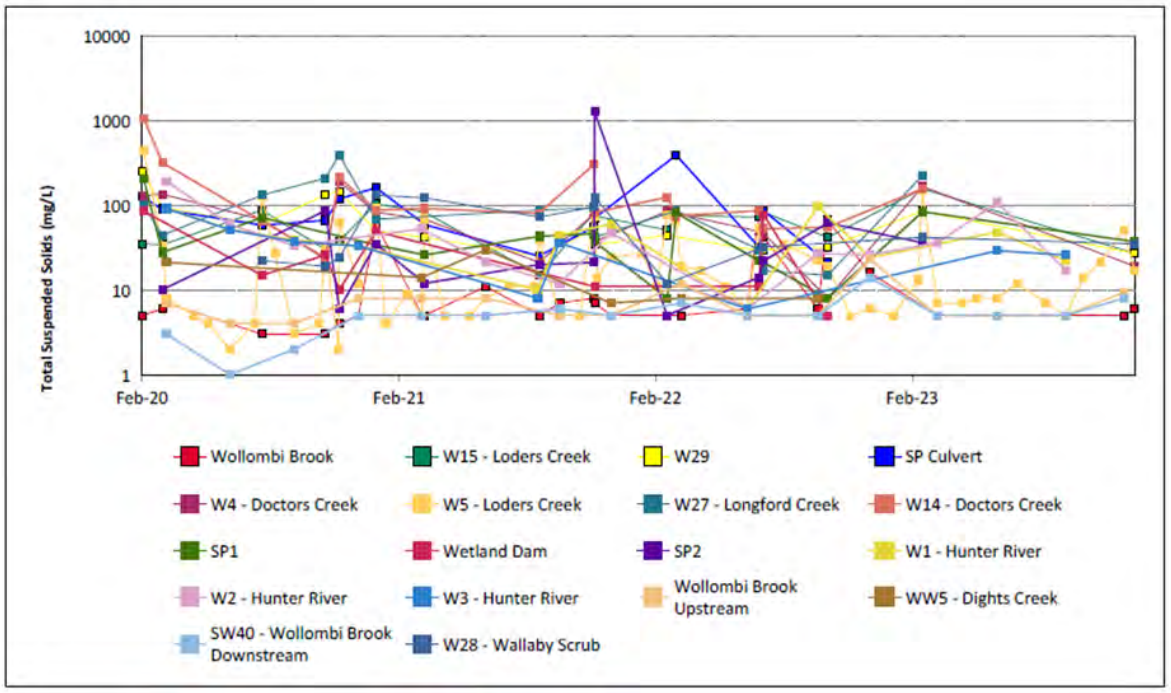


FIGURE 30: WATERCOURSE TSS TRENDS 2020 TO 2023

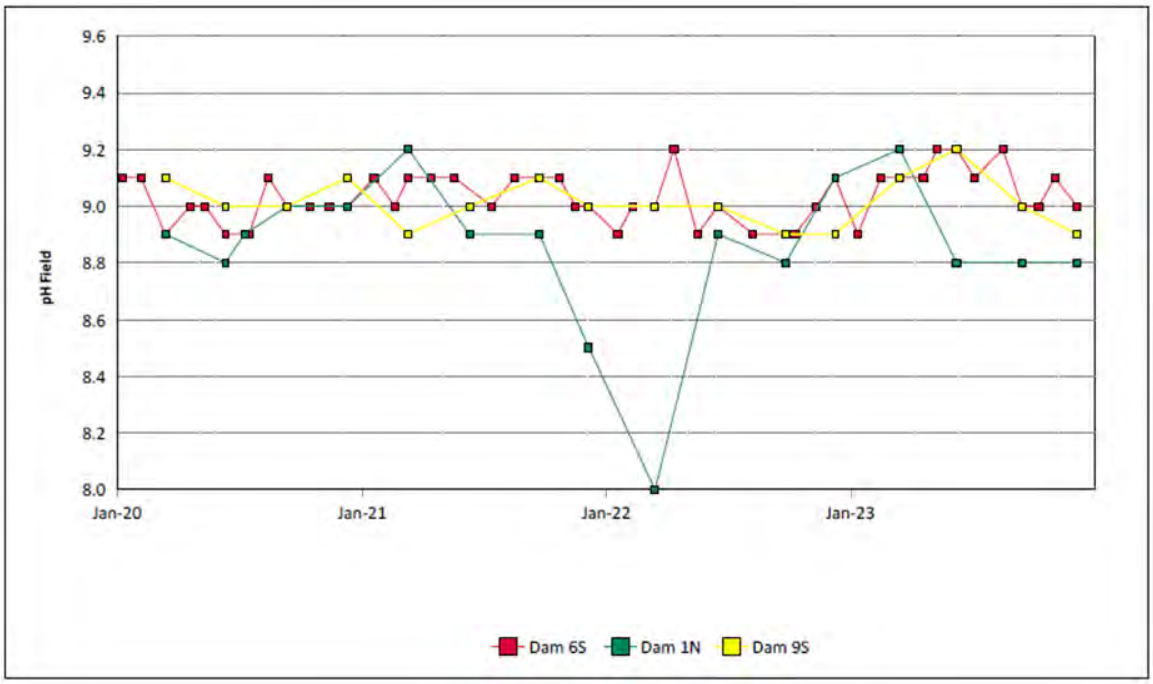


FIGURE 31: SITE DAMS PH TRENDS 2019 TO 2023

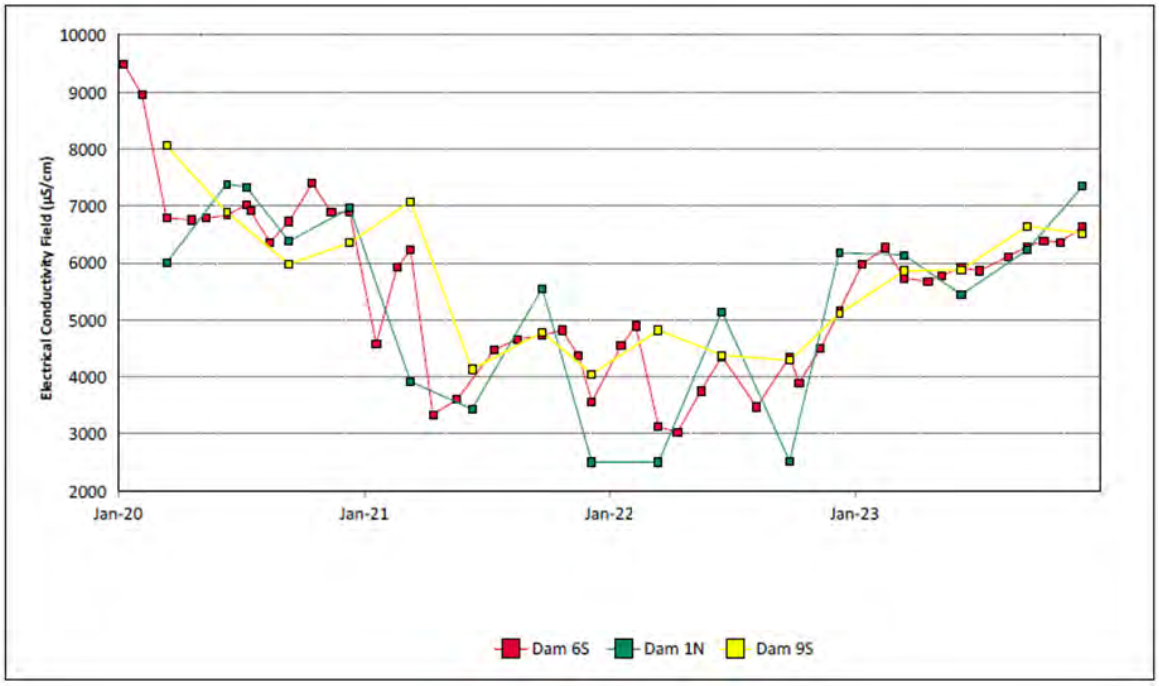


FIGURE 32: SITE DAMS EC TRENDS 2020 TO 2023

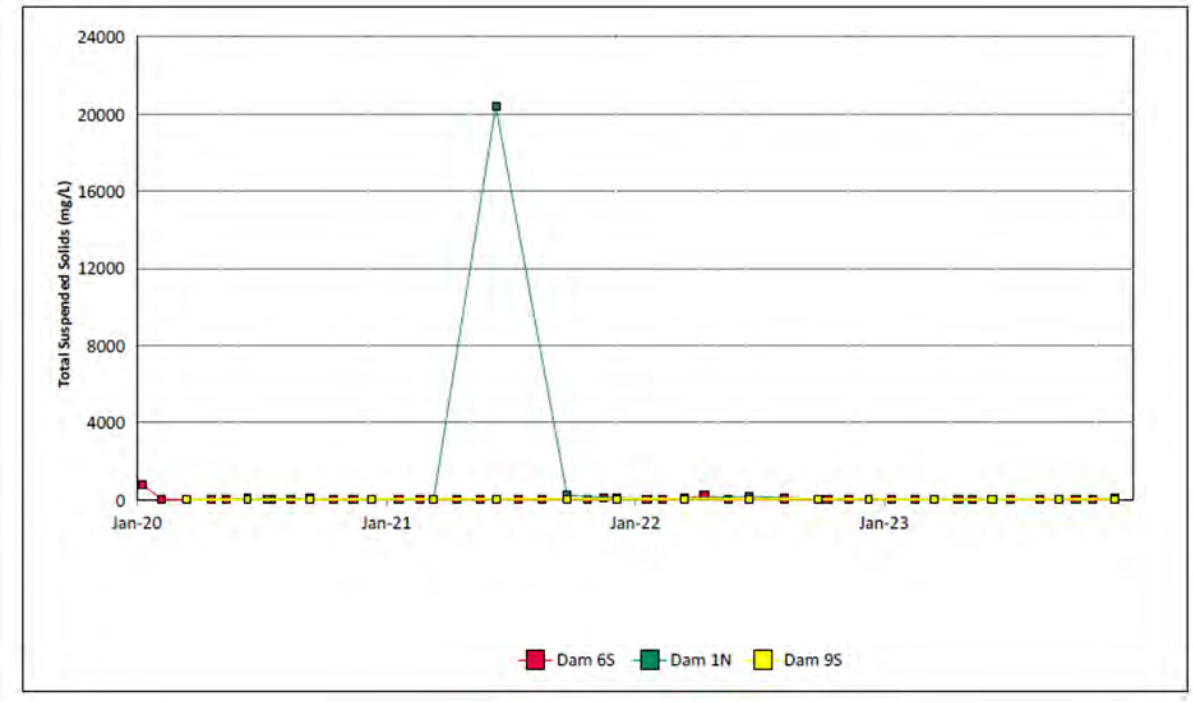


FIGURE 33: SITE DAMS TSS TRENDS 2020 TO 2023

6.8.1.1 Stream Health and Channel Stability

A programme to monitor and report on the stream and riparian vegetation health in Loders Creek and Wollombi Brook which may be potentially affected by the development commenced in 2016. The monitoring programme at times been conducted in conjunction with a similar programme managed by Bulga Surface Operations.

The annual monitoring program includes the following:

- Documenting locations and dimensions of significant erosive or depositional features;
- Photographs upstream, downstream, at both the left and right banks;
- Rating the site with the Ephemeral Stream Assessment protocol developed by the CSIRO to assess the erosional state of the creek at the monitoring location (a measure of channel stability);
- Rating the site with the Rapid Appraisal of Riparian Condition (RARC) protocol developed by Land & Water Australia. This assesses the ecological condition of riparian habitats using indicators that reflect functional aspects of the physical, community and landscape features of the riparian zone (a measure of stream health); and
- Taking measurements of the channel cross-sections (transects) for comparison purposes for any future monitoring.

A copy of the annual stream health and stability monitoring report is provided as **Appendix 5**. Following on from the previous years' record rainfall, 2023 saw a shift in weather patterns with an intensification of dry weather conditions, particularly during the winter months which historically are the driest. The consultant analysed the Bureau of Meteorology's Bulga Down Town rain gauge (61143), which indicated the annual total in 2023 (560mm) was less than half the total in 2022 (1204mm), almost half of which fell in the first quarter (267mm). There were no major flood events in 2023 and stream flows logged by the WaterNSW Wollombi Brook gauging station (210028) indicate moderate and fluctuating flows on a monthly basis between January and March followed by a gradual decline from April to December.

Despite the dry conditions throughout much of the year, there was consistent, almost daily rainfall totalling 53mm over the nine-day period leading into the 2023 Stream Health Channel Stability Monitoring survey in early December, that replenished creekline aquifers in Loder Creek and stimulated riparian and channel vegetation growth.

The results of the 2023 monitoring survey indicate that both stream health and channel stability fluctuate over different sections of Loders Creek. The survey identified that some sections of Loders Creek are currently eroding and are vulnerable to further erosion with areas of significant erosion observed. These areas are generally associated with exposed dispersive sub-soils, which hamper vegetation establishment by the development of a hard surface crust when the soil is dry, and the 'melting' nature of the soil when wet.

Whilst some of the changes to category ratings were owing to re-evaluation of the category scores recorded for the previous survey (and subsequent shifting of band ratings), the majority of individual

category scores were unchanged. Loder Creek site ratings ranged between Active and Stable, and the most influential sources of poor condition assessment relate to existing exposed soil profiles and erosion scars, lack of vegetation and associated ongoing impacts from rainfall events. The 2023 survey indicates that sources of fine silt to the creekline occur from exposed and active erosion scars along the upper bank Loder Creek bank edges, from slumped trees or from tracks formed by ongoing animal use (kangaroos, livestock or wild pigs), and with mobilisation of sediments occurring via lateral inflows to the creek or from longitudinally scouring flow events within the main creek channel.

At several locations in upper Loder Creek, fine colluvial sediments accumulated at the bases of the bank slopes have become colonised by vegetation (mostly couch grasses and spiny rushes), which had showed renewed growth in 2023, presumably from recent rainfall events.

The 2023 Stream Health Monitoring results have showed consistency over the consecutive post-drought surveys since 2021. The MTW site results ranged between Average and Good.

It has been recommended that the MTW Licenced Discharge Point stream health channel stability monitoring site be relocated for future monitoring events. To date, channel transect measurements have been undertaken across the width of the channel at the discharge pipe outlet, and the results have been highly variable owing to the inter-survey variation in placements of the measurement staff on boulders, which is limited in its ability to inform whether or not there has been any potential erosion or deposition occurring as a result of the LDP. It has therefore been recommended that the transect profile site be moved to the channel area just downstream of the boulder embankment for a more effective monitoring point that is capable of detecting potential depositional or erosive events.

6.8.2 Groundwater Management

Groundwater monitoring activities were undertaken in 2023 in accordance with the MTW Water Management Plan and groundwater monitoring program. The monitoring results are used to establish and monitor trends in physical and geochemical parameters of surrounding groundwater potentially influenced by mining.

The groundwater monitoring program at MTW measures the quality of groundwater against background data, EIS predictions and historical trends. Groundwater quality is evaluated through the parameters of pH, EC, and standing water level. A comprehensive suite of analytes are measured on an annual basis, including major anions, cations and metals.

Groundwater monitoring data is reviewed on a quarterly basis. The review involves a comparison of measured pH and EC results against internal trigger values (5th and 95th percentile) which have been derived from the historical data set. The response to results outside the trigger limits is detailed in the MTW Water Management Plan.

The monitoring locations are shown in **Figure 34** and the annual Ground Water Review report can be found in **Appendix 6.**

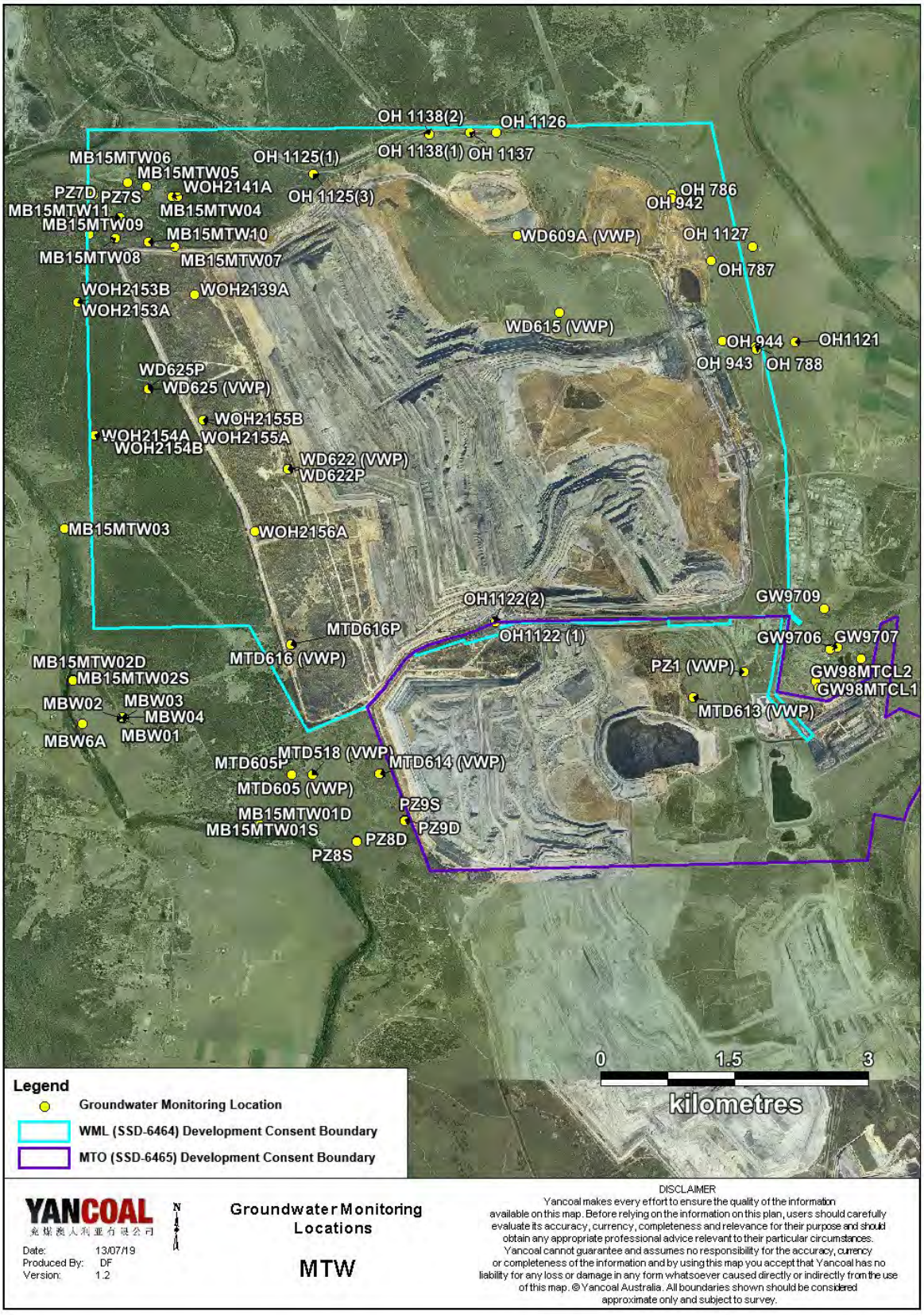


FIGURE 34: GROUNDWATER MONITORING NETWORK AT MTW IN 2023

6.8.3 Groundwater Performance

Sampling of ground waters was carried out on 406 occasions from 63 bores across MTW in accordance with AS/NZS 5667.6 (1998). Where laboratory analysis was undertaken, this was performed by a NATA accredited laboratory. Groundwater sampling and analysis was undertaken as required with the following exceptions detailed in **Table 6.15**.

TABLE 6.15 MTW WATER MONITORING DATA RECOVERY FOR 2023 (BY EXCEPTION)

Location	Data Recovery (%)	Comment
OH786	75%	Insufficient water for sampling in March.
OH787	50%	No safe access in March and June.
OH944	25%	Insufficient water for sampling in March. June and September.
OH1121	75%	No safe access in March.
OH1122 (1)	0%	Insufficient water for sampling in 2023.
OH1125 (3)	0%	Insufficient water for sampling in 2023.
OH1126	0%	Obstruction in bore unable to sample in 2023.
OH1127	0%	Obstruction in bore unable to sample in 2023.
OH1137	75%	Obstruction in bore unable sample in June.
WOH2139A	0%	Decommissioned due to mine progression.
PZ7S	50%	No safe access in February and May.
PZ7D	50%	No safe access in February and May.
PZ9S	75%	Insufficient water for sampling in March.
WD616P	25%	Decommissioned in May due to mine progression.
WD622P	25%	Decommissioned in May due to mine progression.
GW98MTCL2	75%	Insufficient water for sampling in March.

6.8.4 Annual Ground Water Review

Groundwater monitoring results are reviewed against the trigger limits within MTW's approved Water Management Plan on a quarterly basis by MTW. A comparison of the water quality information across MTW's monitoring bore network is provided graphically in **Appendix 6.** The approved trigger limits are based on the historical water quality data as shown in the relevant site Environmental Impact Assessments. These trigger limits are updated annually based on collected site data as described in the MTW Water Management Plan. A summary of the management actions taken in response to any exceedances of the trigger limits during the period is provided in the Monthly Environmental Monitoring Reports, available via MTW's website (https://www.mtwcoal.com.au/).

An annual groundwater review was undertaken by an independent groundwater consultant. The scope of the review included an assessment of the water quality and groundwater levels recorded during the 2023 reporting period as well as a review of the historical results against the predictions in the site groundwater model. A copy of the full report is included in **Appendix 6.**

Key findings from the independent groundwater consultant's report were:

- Groundwater level in coal seams in the Western down-dip depressurised zone generally declined or remained stable during the 2023 monitoring period;
- Bores WOH2139A, MTD616P and WD622P were decommissioned during the reporting period due to mine progression;
- Groundwater levels in shallow overburden monitoring bores underlying the Wollombi Brook alluvium and Warkworth Sands typically declined or remained stable during the 2023 monitoring period. Minimal interaction between the Wollombi Brook alluvium and the shallow overburden is evident;
- Groundwater level in coal seams eastward and up-dip of mining recorded variable results during 2023. Bayswater monitoring bores were typically stable, whilst groundwater levels in Vaux and Warkworth coal seam bores decreased during the monitoring period;
- Groundwater level in Hunter River alluvial bores were stable or decreased slightly during 2023. The exceptions being OH786, which recorded fluctuating groundwater levels and OH787, which recorded increasing water levels during the last two quarters of 2023;
- Groundwater level in Wollombi Brook alluvium monitoring bores declined during the year. Groundwater levels in all Wollombi Brook alluvium monitoring bores correlate strongly with the CRD, indicating no mining related impacts;
- Groundwater level in Warkworth Sands monitoring bore PZ7S declined between Q3 (August) and Q4 (November). However, no data was available for Q1 (February) and Q2 (May) after February due to wet conditions impeding access;
- One pH trigger exceedance was recorded in Redbank Creek coal seam monitoring bore WOH2155A for Q2 (May) of 2023;
- Multiple pH exceedances were recorded in the shallow overburden monitoring bore MB15MTW01D in 2023. The four consecutive trigger exceedances in MB15MTW01D (in February, May, August and November) relate to the lower pH trigger level (6.9). Previous exceedances for pH in MB15MTW01D were investigated (AGE, 2022) and concluded that inappropriate trigger values were the likely causes of the exceedances;
- A single monitoring bore, eastward and up-dip of mining at MTW, recorded two consecutive pH trigger exceedances during the 2023 monitoring period. This was the Bayswater coal seam bore GW98MTCL2 (in June and September). Historical records from this bore indicate previous instances where pH was below the lower pH trigger level, indicating the fluctuations observed in 2023 were within expected natural variation for this bore;
- Exceedances for pH were recorded in Hunter River Alluvium bores OH786 (in June and November) and OH787 (in September) during the 2023 monitoring period;
- A single EC exceedance was recorded in Whynot coal seam monitoring bore WOH2141A during Q3 (August) of 2023;
- Shallow overburden monitoring bore, underlying Wollombi Brook alluvium and Warkworth Sands, MTD605P recorded a single EC exceedance in Q3 (August). Historical records from this bore indicate previous instances where EC exceeded the trigger level, indicating the fluctuations observed in 2023 were within expected natural variation for this bore;

- VWP sensors installed into the Bayswater coal seam recorded varied results during the 2023 monitoring period. Sensors in WD625 and MTD605 recorded decreasing pressure heads throughout the year and pressure heads in MTD613 increased. Pressure head data recorded in the Bayswater seam at WD622 is erroneous and wire connections should be inspected where possible. No data were available for VWPs MTD616 (decommissioned in 2023) and WD615 for the 2023 period;
- VWP pressure head in sensors installed into the Mt Arthur coal seam declined during the 2023 monitoring period. The exception being sensors in MTD616 (decommissioned in 2023) and MTD615, for which there are no data for the monitoring period;
- Sensors installed into Woodlands Hill coal seam recorded decreasing or stable pressure heads during the 2023 monitoring period;
- There was no data available from sensors in the Wambo coal seam for 2023. Data from the sensor installed into the Wambo coal seam at VWP MTD518 indicates the sensor has failed;
- Data was only available for one VWP sensor in the Vaux coal seam for the 2023 period. Pressure head recorded at WD625 declined in 2023;
- Whybrow coal seam VWP sensor pressure heads either declined or remained stable during the 2023 monitoring period;
- VWP pressure heads in the Glen Munro seam (at MTD614) and Blakefield seam (at MTD605) were stable during the 2023 monitoring period. No data was recorded for the Piercefield seam (at WD615);
- Z calibration factors weren't available. Calibration factors should be located so that Z can be reviewed in future reports; and
- Observed groundwater level trends generally correlate with modelled predictions. The exceptions being Blakefield seam bore OH1122(1) in which observed groundwater levels are >35 m higher than model predictions, a weak correlation between modelled and observed level data in Bowfield seam monitoring bores, and GW98MTCL2 with a difference between observed data and modelled data of >10 m. Typically, observed pressure heads in VWP's don't align strongly with modelled predictions. There is no modelled data for bores constructed after 2015.

Key recommendations from the independent groundwater consultant's report include:

- Calibration factors for VWP PZ1 should be determined so that pressure head trends can be discussed in future annual reviews;
- Mount Arthur, Bowfield and Vaux seam VWP sensor cables should be inspected in MTD614 for damage to determine if erroneous data is due to a poor connection to the logger;
- Vaux seam sensor in MTD605 and Wambo seam sensor in MTD518 should be inspected for damage to determine if missing (MTD605) and erroneous (MTD518) data is due to a poor connection to the logger;
- Undertake remediation actions at OH1127 (blocked by pump), OH1126 (lid can't be removed), and MB15MTW11 (confirm bore is collapsed);
- pH trigger exceedance investigation should be undertaken at GW98MTCL2 if additional exceedances occur throughout the year;
- survey data (coordinates and top of PVC mAHD) should be obtained for bores MB15MTW01 through MB15MTW11, and MBW06A; and
- consider updating the groundwater model to incorporate newly constructed monitoring installations and the removal of decommissioned bores.

MTW will assess and progress the recommendations of the groundwater consultant for the 2023 reporting period including completion of investigation into instances of trigger exceedances, as per MTW's Water Management Plan.

6.8.5 Compensatory Water Supply

Under the *Water Management Act 2000*, there are three types of basic landholder rights in NSW:

- **Domestic and stock rights** - Owners or occupiers of land overlaying an aquifer or with river, estuary or lake frontage can take water without a licence for domestic (household) purposes or for stock watering.
- **Harvestable rights** - Harvestable rights allows landholders to capture and store a proportion of the rainfall runoff from their landholding in one or more harvestable rights dams without requiring a water access licence, water supply work approval, or water use approval.
- **Native title** - Anyone who holds native title with respect to water, as determined under the Commonwealth Native Title Act 1993, can take and use water for a range of personal, domestic and non-commercial purposes.

MTW is required by development consent conditions to provide compensatory water supply to the owner of any privately owned land whose basic landholder water rights (as defined in the *Water Management Act 2000*) are adversely and directly impacted as a result of the development.

During the 2023 reporting period there was no need for compensatory water supply to be provided to others as a result of the development.

6.9 Waste

6.9.1 Management

The management of waste generated on the MTW site is undertaken in accordance with the site MTW non-mineral waste management strategy which is designed to;

- track and record all wastes leaving the site to meet all regulatory requirements; and
- implement appropriate segregation, collection, handling, transport and disposal of waste in a way which minimises the impacts on the environment.

All waste not suitable for reuse on site is removed by a licensed waste contractor and disposed of or recycled accordingly at licensed waste management facilities within the local Hunter region. Appropriate segregation is implemented across various waste streams at MTW to maximise diversion from landfill and minimise the impact to the environment by recycling or reuse. Some waste categories are processed and disposed of on the MTW site, as per NSW EPA exemption approvals, set out in the MTW Environment Protection Licenses. The effluent treatment and disposal facilities at MTW consist of sewage treatment plants which treat, disinfect and dispose, or re-use the treated effluent on site. All waste management contractors engaged for waste collection, handling and transportation at MTW are licensed by the NSW EPA.

6.9.2 Performance

During the reporting period MTW continued to undertake regular inspections of areas where wastes are generated and stored, to reinforce the principles of a considerate waste management approach including waste stream segregation to increase material recycling and promote diversion from landfill. In 2023, 80% of all non-mineral waste generated and removed from MTW was diverted from landfill and processed at licensed recycling and secondary use facilities. The remaining 20% was disposed of as end-of-life waste at a local licensed landfill facility. There were no community complaints or regulatory non-compliance notices receiving in 2023, in relation to waste management during the reporting period.

7 LAND MANAGEMENT

7.1 Summary of Rehabilitation

A total of 93.6ha of new rehabilitation was completed during 2023 which was slightly more than the Forward Program 2023 target of 90ha. Total disturbance undertaken in 2023 was 106.5ha against a Forward Program target of 90.7ha. The additional disturbance was due to 7.9ha of rehabilitation disturbance to merge the updated final landform in with existing South Pit rehabilitation areas; and the remainder of the additional disturbance was related to installation of water management structures ahead of mining in West Pit.

The rehabilitation and disturbance forecasts submitted to Resources Regulator in the current Forward Program (submitted in June 2023) are now based on calendar year periods which therefore align with the calendar year Annual Review reporting period.

Progressive rehabilitation commitments are outlined in the Warkworth Continuation 2014 and Mt Thorley Operations 2014 Environmental Impact Statements. These documents modelled a total of 1,607.8 ha of rehabilitation to be completed by the end of 2023. At the end of the reporting period there had been 1,383.1 hectares of rehabilitation completed across Warkworth and Mount Thorley, 224.7ha behind the EIS forecast for the end of 2023.

An Annual Rehabilitation Report has been prepared to meet the requirements of the new Standard Conditions for Mining Leases. The Annual Rehabilitation report has been provided in **Appendix 6** of this report.

7.2 Weed Control

7.2.1 Weed Treatment

The weeds identified at MTW occur primarily in areas that have been disturbed such as post mining rehabilitation areas, previous civil works areas, soil stockpiles, water management structure surrounds, and general areas of minor ground disturbance. The weed control associated with rehabilitation maintenance is detailed in the Annual Rehabilitation Report (**Appendix 6**). In addition to the rehabilitation maintenance, a total of 50 days of weed management work was undertaken on site at MTW during 2023, with 235 ha of land treated, including maintenance of access tracks and environmental monitoring points. The weeds targeted during the 2023 weed management programme were based on the results of the 2022 weed survey. **Figure 35** illustrates the target species and weed treatment areas across MTW. Weed treatment areas are assessed following the completion of periods of work to determine the effectiveness of control works.

The species focussed on during treatment included:

- African olive *(Olea europaea)*
- African boxthorn *(Lycium ferocissimum)*
- Bitou bush *(Chrysanthemoides monilifera subsp rotundata)*
- Blackberry *(Rubus fruticosus)*
- Green Cestrum *(Cestrum parqui)*
- Galenia *(Galenia pubescens)*
- Lantana *(Lantana camara)*
- Mother of millions *(Bryophyllum delagoense)*
- Noogoora burr *(Xanthium occidentale)*
- Tiger pear *(Opuntia aurantiaca)*
- Saligna/Golden wreath wattle *(Acacia saligna)*
- Farmers friends *(Bidens pilosa)*
- Fleabane *(Tangetes minuta)*
- Paddy's lucerne *(Sida rhombifolia)*
- Purpletop *(Verbena bonariensis)*
- Narrow-leaf cotton bush (*Gomphocarpus fruticosus*)
- Saligna *(Acacia saligna)*
- St John's Wort *(Hypericum perforatum)*
- Various grasses *(Various spp)*

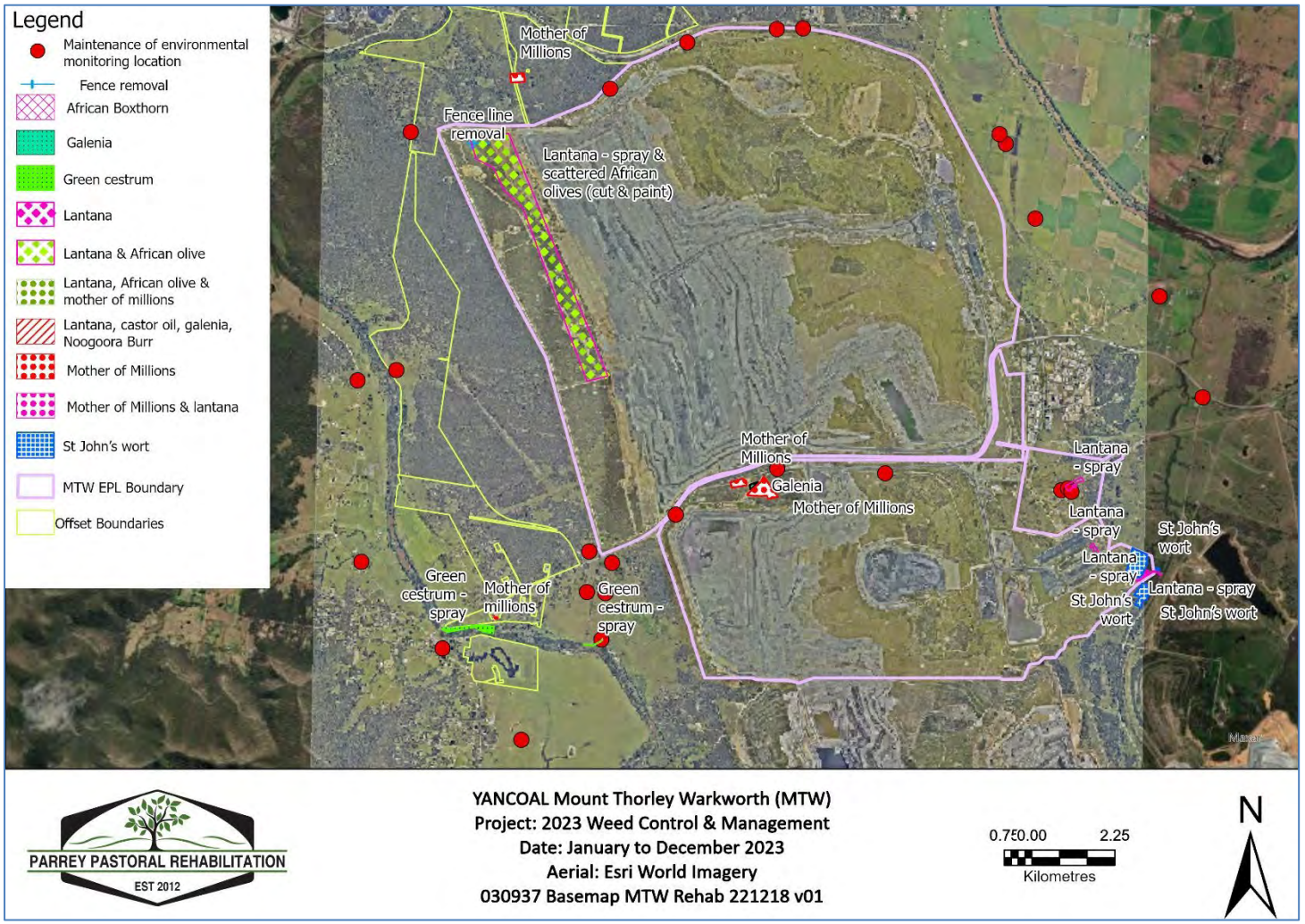


FIGURE 35: ANNUAL WEED CONTROL OVERVIEW FOR 2023

7.2.2 Annual Weed Survey

The management and control of weeds at MTW is governed by the Annual Weed Survey (AWS). The AWS lists Weeds of National Significance (WONS), noxious, environmental and other non-declared weed species identified across MTW and provides a framework to allow for structured weed management and control across operational and non-operational areas of MTW.

The following summarises the results of the weed survey undertaken during December 2023 and is based upon the NSW Biosecurity Act 2015 which came into force from 1 July 2017 and repealed 14 Acts including the Noxious Weeds Act 1993. The new legislation has resulted in the development of the Hunter Regional Strategic Weed Management Plan (2017-2022 and subsequently 2023-2027, released in early 2023), which covers the area occupied by MTW.

Five WONS were identified during the survey (including various pear species), including:

- African boxthorn *(Lycium ferocissimum)*
- Bitou bush *(Chrysanthemoides monilifera subsp rotundata)*
- Fireweed *(Scenecio madagascariensis)*
- Lantana *(Lantana camara)*
- Pear species (*Opuntioid Cacti, Opuntia humifusa, Opuntia stricta, Optunia aurantiaca)*

Eleven other priority weeds were identified at MTW during the survey, including:

- African lovegrass *(Eragrostis curvula).* Regional – Asset protection
- Blue heliotrope *(Heliotropium amplexicaule).* Regional – Asset protection
- Castor oil plant *(Ricinus communis).* General biosecurity duty
- Fleabane *(Conyza bonariensis).* General biosecurity duty
- Galenia *(Galenia pubescens).* Regional – Containment
- Green cestrum *(Cestrum parqui).* Regional - Asset protection
- Mother of millions *(Bryophyllum delagonese).* Regional - Asset protection
- Saffron and Scotch thistle *(Cartharmus lanatus,* Onopordum acanthium*).* General biosecurity duty
- St John's Wort *(Hypericum perforatum).* Regional – Containment
- Spiny Rush *(Juncas acutus)*. General biosecurity duty
- Telegraph weed (*Heterotheca grandiflora*). Regional – Asset protection

Twelve weeds that are not officially declared or listed were also recorded at MTW including:

- Blackberry nightshade *(Solanum nigram)*
- Century plant *(Agave americana)*
- Golden wreath wattle *(Acacia saligna)*
- Inkweed *(Phytolacca octandra)*
- Mustard weed *(Sisymbrium sp.)*
- Narrow leaved cotton bush *(Gomphocarpus fructicosus)*
- Noogoora burr *(Xanthium occidentale)*

- Paddy's lucerne *(Sida rhombifolia)*
- Purpletop *(Verbena bonariensis)*
- Rhodes grass *(Chloris gayana Kunth)*
- Stinking Rodger *(Tangetes minuta)*
- Tree tobacco *(Nicotiana glauca)*

Species identified during the 2023 survey will form the basis of ongoing weed management works during 2024.

7.3 Vertebrate Pest Management

As part of MTW's vertebrate pest management activities a baiting programme is carried out on a seasonal basis. Two 1080 ground baiting programmes consisting of approximately 60 bait sites utilising meat baits and ejector baits were undertaken during autumn and spring to target wild dogs and foxes. Baits were checked over a three-week period and replaced each week when taken. The programmes were undertaken in conjunction with neighbouring landholders where possible.

Table 7.1 summarises the results from the programmes carried out at MTW during 2023 with baiting locations and results for the programmes are illustrated in **Figure 36** and **37**.

TABLE 7.1 VERTEBRATE PEST CONTROL SUMMARY

Season	1080 Baiting			
	Total Lethal Baits Laid	Takes by Wild Dog	Takes by Fox	Takes by Feral Pigs
Autumn	119	40	8	4
Spring	118	18	30	0
Total	**237**	**58**	**38**	**4**

Additional pest management programmes included a feral pig trapping programme carried out across MTW in Spring that resulted in 27 feral pigs controlled. MTW will continue to carry out vertebrate pest control programmes during 2024 to limit feral pest impacts on landholdings and surrounding neighbours.

FIGURE 36: BAITING STATION LOCATIONS AND RESULTS AT MTW DURING AUTUMN 2023 VERTEBRATE PEST MANAGEMENT PROGRAMME

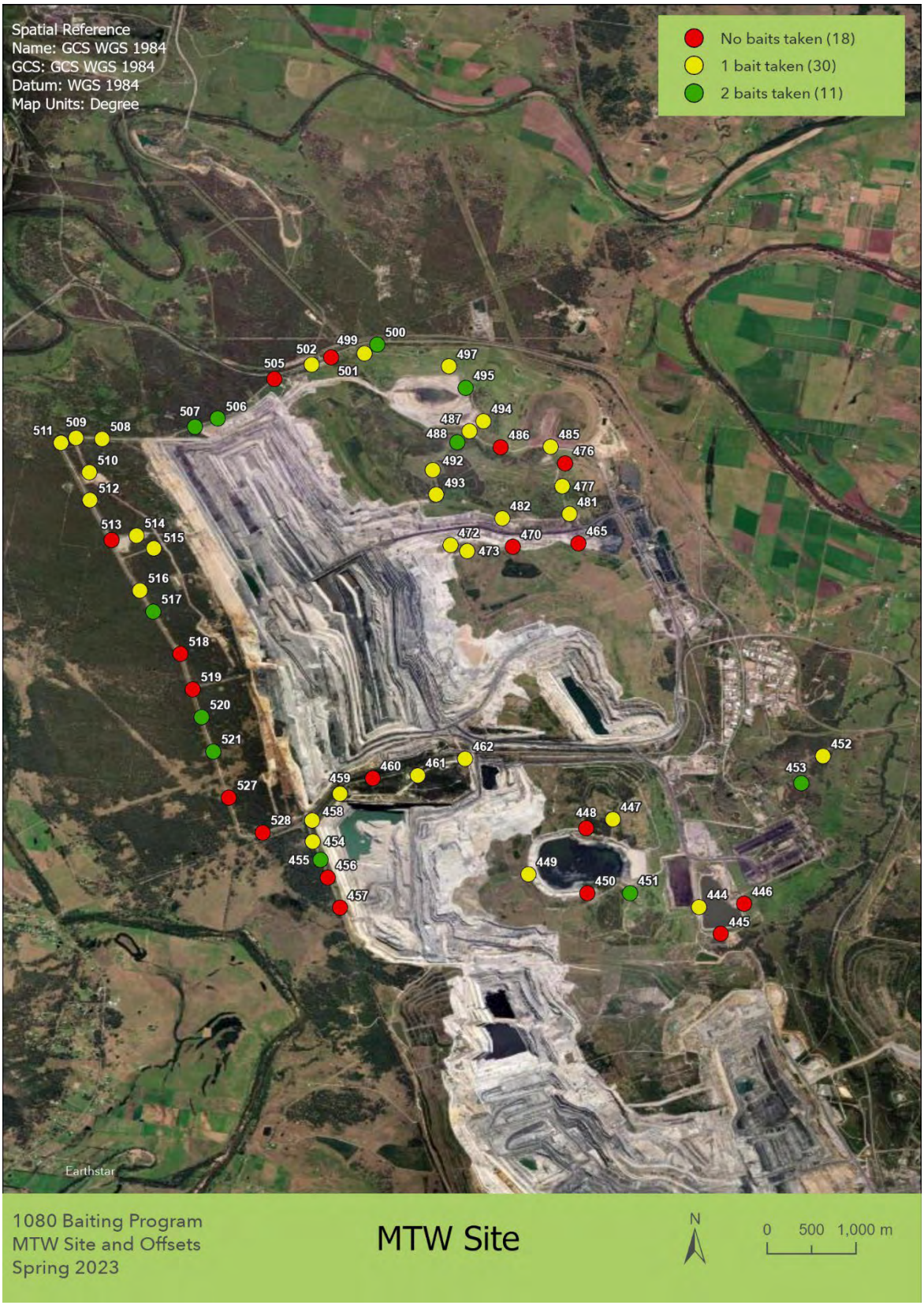


FIGURE 37: BAITING STATION LOCATIONS AND RESULTS AT MTW DURING SPRING 2023 VERTEBRATE PEST MANAGEMENT PROGRAMME

7.4 Biodiversity Offsets

7.4.1 Management

MTW's impacts on biodiversity values are offset through the protection and management of Biodiversity Areas (BAs). The BA's that are related to MTW illustrated in **Figure 38** and also listed in **Table 7.2**.

TABLE 7.2 MTW BIODIVERSITY AREAS

Biodiversity Areas	Area (ha)	Environmental Approvals				Offset Feature/s
		State		Federal		
		NSW 2003	NSW 2015	EPBC 2002/629	EPBC 2009/5081	
Southern	986	211	775		94	Warkworth Sands Woodland; Central Hunter Grey Box – Ironbark Woodland; Habitat for Swift Parrot, Regent Honeyeater, Southern Myotis and Large-eared Pied Bat.
Northern	341	39	302		341	Warkworth Sands Woodland; Central Hunter Grey Box – Ironbark Woodland; Habitat for Swift Parrot, Regent Honeyeater, Southern Myotis and Large-eared Pied Bat.
North Rothbury	41		41		41	North Rothbury Persoonia
Goulburn River (MTW Portion)	1,066		1,066	1,066		Central Hunter Valley Eucalypt Forest (CHVEF); Ironbark/Stringybark Communities; Box shrubby/grassy Woodlands; Habitat for Swift Parrot and Regent Honeyeater
Bowditch	602		602	520	82	CHVEF; Ironbark/Stringybark Communities; Habitat for Swift Parrot and Regent Honeyeater
Putty	383				383	CHVEF; Habitat for Swift Parrot and Regent Honeyeater
Seven oaks	519				519	CHVEF; Habitat for Swift Parrot and Regent Honeyeater
Condon View (MTW Portion)	345				345	CHVEF; Habitat for Swift Parrot and Regent Honeyeater

The MTW BA's are managed in accordance with site specific Offset Management Plans (OMPs). All of the OMPs are available on MTW's website.

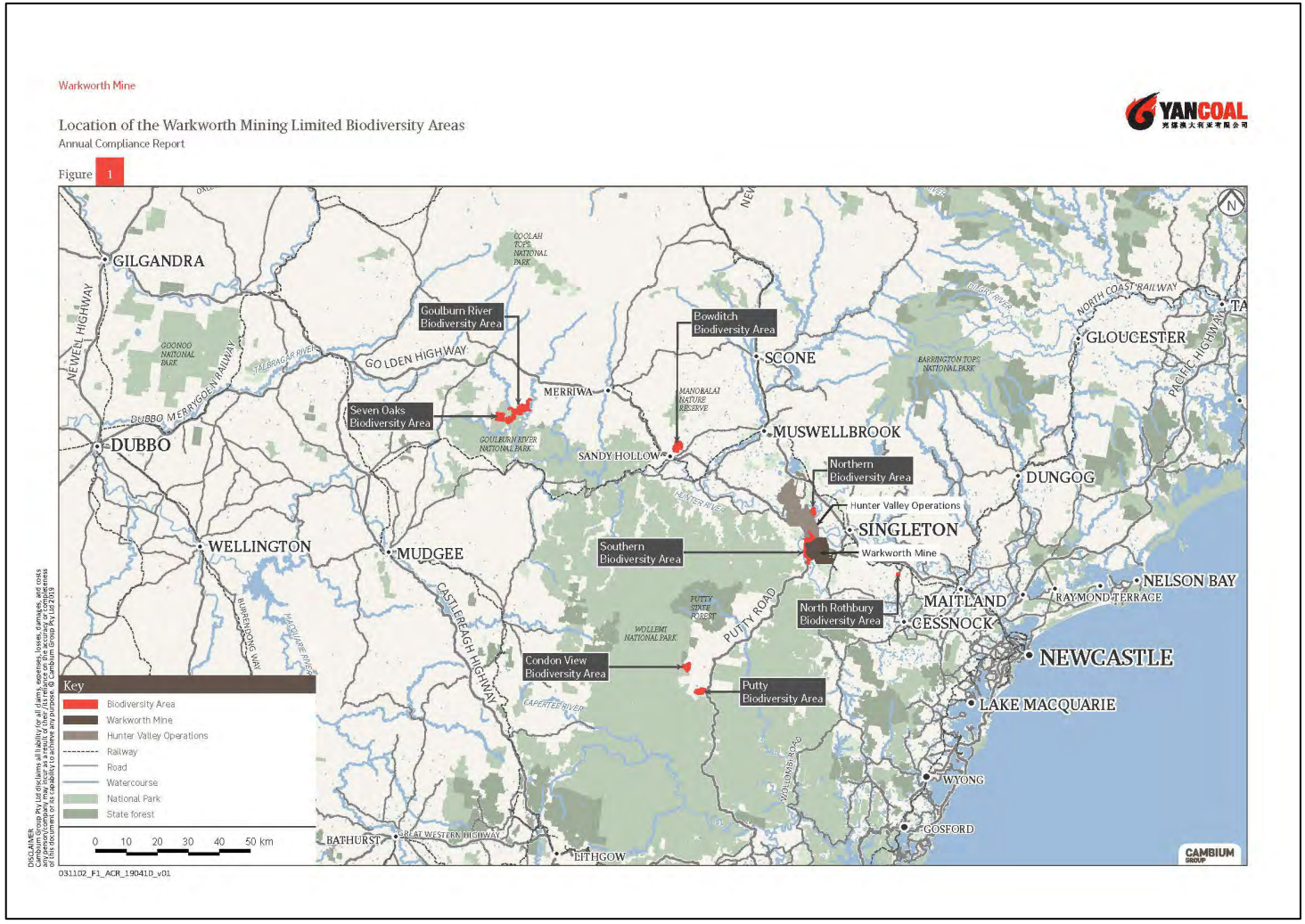


FIGURE 38: MTW BIODIVERSITY OFFSET LOCALITY MAP

7.4.2 Permanent Protection

MTW submitted an administrative modification to NSW development consent SSD-6464 on 29 April 2021 to clarify biodiversity offset requirements for the Warkworth Continuation Project and to facilitate in-perpetuity conservation of biodiversity offset land. Department of Planning, Housing and Infrastructure (DPHI) in consultation with Biodiversity, Conservation and Science (BCS) advised that a Biodiversity Stewardship Agreement (BSA) is the only mechanism acceptable to the NSW Government for in-perpetuity security of biodiversity offset land. The establishment of a BSA requires biodiversity offset credits to be retired. Biodiversity offset credits for the MTW offset land were determined under prior mechanisms and need to be converted to current Biodiversity Assessment Method (BAM) credits. BCS is currently finalising an equivalence assessment to determine the quantum of BAM credits associated with MTW's biodiversity offset land. Once the credit equivalence has been finalised, BSAs for each offset area will be progressed. The equivalent credit values established for each BSA will then be retired upon execution of the BSAs. The administrative modification to NSW development consent SSD-6464 will be withdrawn upon completion of the BSAs.

7.4.3 Biodiversity Area Management Activities

The OMPs describe the Conservation Management Strategies. The following are the key actions completed throughout 2023 across all the BAs:

7.4.3.1 Weed Control

Weed control at the Local BAs targeted the following species:

- African boxthorn (*Lycium ferocissimum)*
- African lovegrass *(Eragrostis curvulva)*
- African olive (*Olea europaea)*
- Bidens (*Bidens pilosa)*
- Blue and scarlet pimpernel (*Anagallis arvensis* sp.)
- Blue heliotrope *(Heliotropium amplexicaule)*
- Brazilian nightshade (*Solanum seaforthianum)*
- Bridal creeper (*Asparagus asparagoides)*
- Coolatai grass (*Hyparrhenia hirta)*
- Evening primrose (*Oenothera stricta)*
- Galenia (*Galenia pubescens)*
- Golden wreath wattle (*Acacia saligna)*
- Green cestrum (*Cestrum parqui)*
- Groundsel bush (*Baccharis halimifolia)*
- Inkweed (*Phytolacca octandra)*
- Lantana *(Lantana camara),*
- Mexican poppy (*Argemone mexicana)*
- Mother of millions (*Bryophyllum delagoense),*
- Moth vine (*Araujia sericifera)*
- Paterson's curse (*Echium plantagineum)*
- Prickly pear (*Opuntia stricta)*
- Prickly poppy (*Argemone ochroleuca)*
- Red natal grass (*Melinis repens)*

- Sheep sorrel (*Rumex acetosella)*
- Silky oak *(Grevillea robusta)*
- Stinking roger (*Tagetes minuta)*
- Telegraph weed *(Heterotheca grandiflora)*
- Tiger pear (*Opuntia aurantiaca)*
- Twiggy mullein (*Verbascum virgatum)*
- Whiskey grass (*Andropogon virginicus)*
- Vipers bugloss (*Echium vulgare)*

Weed control at the Regional BAs targeted the following species:

- African lovegrass *(Eragrostis curvulva)*
- African olive *((Olea europaea)*
- Blackberry *(Rubus fruticosus)*
- Blue heliotrope *(Heliotropium amplexicaule)*
- Bridal creeper *(Asparagus asparagoides)*
- Coolatai grass *((Hyparrhenia hirta),*
- Creeping pear *(Opuntia humifusa)*,
- Crofton weed *(Ageratina Adenophora)*,
- Farmers friends *(Bidens pilosa)*
- Fireweed *(Scenecio madagascariensis)*
- Fleabane *(Conyza bonariensis)*
- Green cestrum *(Cestrum parqui)*
- Ink weed *(Phytolacca octandra)*
- Lantana *(Lantana camara)*
- Moth vine (Araujia sericifera)
- Narrow-leaf cotton bush *(Gomphocarpus fruticosus)*
- Noogoora burr *(Xanthium occidentale)*
- Paddy's lucene *(Sida rhombifolia)*
- Prickly pear *(Opuntia stricta)*
- Purple top *(Verbena bonariensis)*
- Ragwort *(Senecio jacobaea)*
- Schinus mole *(Pepper tree)*
- St John's wort *(Hypericum perforatum)*
- Sticky nightshade *(Solanum sisymbriifolium),*
- Telegraph weed *(Heterotheca grandiflora)*
- Thistles *(Various spp.)*
- Tree of heaven *(Ailanthus altissima)*
- Whiskey grass *(Andropogon virginicus)*

7.4.3.2 Infrastructure Management and Improvement

In 2023 fence repair and replacement was undertaken at the Southern, Northern, North Rothbury and Putty BAs. Tracks were maintained as required to reduce encroaching vegetation and improve access. Regular property inspections were undertaken on all BAs.

7.4.3.3 Fire Management

Slashing of fire breaks was undertaken on the Southern, North Rothbury, Goulburn River and Seven Oaks BA's. A hazard reduction burn for the Seven Oaks BA was undertaken in May 2023, which treated approximately 90 Ha and reduced the fuel load to low. A Hazard Reduction Burn for North Rothbury BA was approved however conditions were outside the prescribed limits, so the burn was rescheduled for 2024.

Overall fuel load assessments were undertaken on all offsets.

7.4.3.4 Strategic Grazing

No strategic grazing was undertaken in the BAs in 2023.

7.4.3.5 Vertebrate Pest Management

Two 1080 ground baiting programmes targeting wild dogs and foxes were undertaken across the Local and Regional Biodiversity Areas. Baits were checked over a three-week period and replaced each week when taken. Baiting was carried out in autumn and spring and was undertaken in conjunction with neighbouring landholders where possible. **Table 7.3** summarises the results from the programmes during 2023.

TABLE 7.3 SUMMARY OF VERTEBRATE PEST MANAGEMENT 2023

Season	1080 Baiting				
	Total Lethal Baits Laid	Takes by Wild Dog	Takes by Fox	Takes by Feral Pigs	Takes by other/unknown
Autumn (Local BAs)	120	31	8	1	22
Spring (Local BAs)	110	31	28	1	6
Autumn (Regional BAs)	195	49	44	19	8
Spring (Regional BAs)	196	42	30	8	58
Total	**617**	**153**	**110**	**29**	**94**

Additional pest management programmes included:

- A ground shooting programme at the Goulburn River BA in March controlled 18 feral pigs, nine fallow deer and four foxes.
- A soft jaw trapping program at MTW's Southern and North Rothbury Biodiversity Areas in March controlled five wild dogs.
- A ground shooting programme at the Bowditch Biodiversity Area in April controlled 11 feral deer and one feral cat.
- Noisy Miner ground shoots were undertaken at the Goulburn River BA and the Bowditch BA in August under a Licence to Harm Protected Animals (Biodiversity Conservation Act 2016). The programmes aim to assist the survivability of the Regent Honeyeater. The Goulburn River BA programme, which is its seventh consecutive year, resulted in the control of 167 Noisy Miners over four days. The Bowditch BA programme resulted in the control of 116 Noisy Miners over four days. This is the second Noisy Miner programme undertaken on this offset and will continue in 2024.
- Aerial shoot conducted by National Parks and Wildlife Service at the Goulburn River and Seven Oaks BAs in May controlled 14 feral pigs and in October controlled 15 pigs.
- A pig trapping program undertaken in November at MTW and the Southern Biodiversity Area controlled 27 pigs.

Vertebrate pest management programmes will continue to be carried out during 2024 to limit feral pest impacts on landholdings and surrounding neighbours.

7.4.3.6 Seed Collection

Seed collection was undertaken by contractors in the Northern BA during 2023, focussing on the WSW vegetation community. Seed collection was also undertaken on the Goulburn River BA for Yellow Box – Grey Box – Red Gum grassy woodland and River Oak riparian woodland and on the Seven Oaks BA for Cassinia -Acacia woodland species.

7.4.3.7 Revegetation

MTW has committed to restoring the Endangered Ecological Communities of Warkworth Sands Woodland and Central Hunter Grey Box – Ironbark Woodland in the Southern and Northern Biodiversity Areas. Work commenced in 2014 and overall there is more than 500 hectares of grassland area to be planted and managed over 15 years to restore these Endangered Ecological Communities.

The Warkworth Sands Woodland planting of 10,000 tube stock at the Northern BA was undertaken in Autumn 2023. This included the relocation and spreading of ~5,000m3 of WSW topsoil sand prior to planting. The 2023 Warkworth Sands Woodland planting of 18,490 tubestock was delayed due to issues moving topsoil sand from ahead of mining areas at MTW to proposed planting areas. The relocation and spreading of ~13000m3 of WSW topsoil sand occurred in February 2024. In 2023, restoration work in the Southern BA included planting 800 Warkworth Sands Woodland tube stock into the northern section.

Infill planting of 10,000 tube stock at the Goulburn River Biodiversity area, to increase the suitability of habitat for the Regent Honeyeater, occurred in Autumn 2023.

The 2024 planting programme is planned for Autumn and will include 14,000 Warkworth Sands Woodland tubestock in the Northern BA and 7,990 in the Southern BA. The programme will also include planting 3000 Central Hunter Grey Box Ironbark Woodland and 2000 River Oak Forest tubestock in the Southern BA.

FIGURE 39: WSW INFILL PLANTING IN THE SOUTHERN BIODIVERSITY PLANTING AREA

FIGURE 40: WSW PLANTING IN THE NORTHERN BIODIVERSITY PLANTING AREA

FIGURE 41: PLANTING IN THE GOULBURN RIVER BIODIVERSITY PLANTING AREA

7.5 Monitoring Activities

The Local and Regional Biodiversity Areas Annual Compliance Reports respectively (provided in **Appendix 8**) provide a summary of the monitoring activities undertaken, which are consistent with the requirements of the relevant Biodiversity Management Plans.

7.5.1.1 Rapid Condition Assessments

The Rapid Condition Assessment technique is used as a preliminary assessment of woodland condition within the BA. Each year the sites in mature and regrowth vegetation are revisited to record the presence or absence of key habitat components and threatening processes. The results of the Rapid Condition Assessment, together with property inspection and plot reference points will be used to monitor woodland condition and identify emerging threats. The 2023 monitoring results showed general maintenance of woodland conditions across all BAs and supports the continued implementation of the conservation management strategies.

8 COMMUNITY

8.1 Complaints

A total of 193 complaints were recorded during the reporting period, representing an increase of approximately 59% compared to 2022. The 193 complaints were registered by approximately 30 people (some complainants remained anonymous), with over 70% of complaints received from 5 individuals. Most complaints were received from residents in the Bulga area. A breakdown of complaints by type is shown in **Table 8.1**.

Whilst blasting and noise remained a key concern for near neighbours during the 2023 reporting period, there has been a decrease in complaints regarding blasting and noise by ~25% in comparison to 2022. Lighting has also remained a key concern for the community, however 2023 recorded a reduction of complaints regarding lighting by 15% in comparison to 2022.

The highest number of complaints recorded in 2023 were for dust. Dust complaints increased during the reporting period compared to 2022. The increase from 2022 may be attributed to below average rainfall in 2023 (502 mm) compared to 2022 (1,070 mm). Approximately 50% of dust complaints were received from 3 complainants.

In summary:

- Noise and blasting complaints have decreased 25% since 2022.
- Total number of complaints increased approximately 59% compared to 2022.
- Dust complaints have significantly increased to 104 from 4 in 2022.
- Water and Other related complaint numbers have decreased 50% since 2022.

TABLE 8.1 SUMMARY OF COMPLAINTS BY TYPE FOR 2021 TO 2023

Complaint type	2023	2022	2021
Noise	35	47	49
Blasting	35	47	58
Dust	104	4	32
Lighting	17	20	34
Water	0	0	0
Other	2	3	4
Total	193	121	177

8.2 Review of Community Engagement

8.2.1 Communication

Members of the community are encouraged to contact MTW and engage in a way that suits them. Communication avenues in place to support MTW include:

- MTW free call Community Information Line (1800 727 745), which is advertised regularly in local newspapers and community newsletters;
- Online, via MTW's website (www.mtwcoal.com.au) with information about MTW including approvals documents, public reports, environmental monitoring results, blasting and road closures, and information about the MTW Community Consultative Committee (CCC) including the minutes of CCC meetings;
- MTW maintains a 24 hour freecall environmental hotline (1800 656 892), which allows community members to register a concern or complaint at any time of the day or night, 365 days a year. The hotline is advertised in telephone directories, on the MTW website, regularly in local newspapers, and in MTW publications;
- MTW maintains a Blast Information Line (1800 099 669) which provides information on blasts and road closures;
- Near neighbour engagement, including proactive visits to neighbours surrounding MTW; and
- MTW also issues correspondence to specific community members who may be affected by certain changes, to inform of upcoming consultation activities and as a feedback mechanism.

A range of consultation and engagement activities have continued in 2023, which included:

- The MTW Social Impact Management Plan was implemented. This plan collates together all commitments that were part of the Environmental Assessment for MTW's Continuation Project process and identifies where the company will undertake actions to mitigate some of the potential impacts in the area. The main topics include:-
    - Voluntary Planning Agreement;
    - Property Agreements Strategy, around acquisition and mitigation rights in the area.
    - Management of properties in and around Bulga that MTW has had to acquire.
    - Conservation funds and how MTW operate these.
    - Support for local Schools
    - Scholarships and Apprenticeships;
    - Acquisition of Commercial Facilities, for example the Bulga Tavern where MTW has worked to upgrade this facility to support the business sustainability, and the Bulga Service Station which has continued to operate after acquisition;
    - Ongoing Community Support Program; and
    - the MTW CCC, which is identified as one of the primary communication areas where the company reports back through the CCC on how their business is performing.

- Engagement and consultation with near neighbours to provide project updates at key project milestones and activities, and in response to concerns/queries raised by individual near neighbours;
- MTW are supportive of the Upper Hunter Mining Dialogue School Tours program.

8.2.2 Community Consultation Committee

The MTW CCC met on a quarterly basis to discuss our operations. The Committee is comprised of MTW representatives, community members and other key external stakeholders, including Singleton Council. The MTW CCC minutes were made available on the MTW website (www.mtwcoal.com.au). The community is invited to visit the MTW website to learn more about the MTW CCC, as well as other aspects of MTW operations and projects.

During the reporting period the CCC members were:

- Dr Col Gellatly - Independent Chair
- Cr Hollee Jenkins - Singleton Council Representative
- Mr Ian Hedley – Community Representative
- Mr Stewart Mitchell – Community Representative
- Mrs Barb Brown – Community Representative
- Mr Denis Maizey – Community Representative
- Mr Neville Hodkinson – Stakeholder Representative - Singleton Shire Healthy Environment Group
- Mr Graeme O'Brien – Community Representative (Alternate)

Company representatives attending the CCC included:

- Mr David Bennett - MTW General Manager
- Mr Gary Mulhearn – MTW Environment & Community Manager
- Mr Joshua van Bezouwen – MTW Environment & Community Advisor

8.2.3 Community Support and Development

In 2023, MTW continued its focus on ensuring the long-term sustainability of the communities in which it operates, through the facilitation of community development programmes such as:

- Voluntary Planning Agreement
- Mount Thorley Warkworth Community Support Program

8.2.3.1 Voluntary Planning Agreement

In 2023, MTW continued contributions to the voluntary planning agreement funds required by development consents SSD-6464 and SSD-6465, and as agreed with Singleton Council. During 2023, MTW contributed a further $650,000 excluding GST, bringing total VPA contributions at end of 2023 to $7.85M of the total commitment value of $11M.

Singleton Council operates the Mount Thorley Warkworth VPA Community Committee which discusses the Bulga Community Project Fund component ($6.6M) of the total VPA commitment value ($11M). During 2023, the committee was chaired by Mayor Sue Moore and includes senior staff from Council, community representatives, and a Yancoal representative. In 2023, the Bulga Community Project Funds provided from the VPA increased to $4.25M of the $6.6M fund total, and there has been $2.22M of funds committed to projects in the Bulga / Milbrodale area from the Bulga Community Project Fund. A summary of approved projects is provided in **Table 8.2.**

TABLE 8.2 MTW VPA BULGA COMMUNITY FUND APPROVED PROJECTS

Approved Project	Project Lead	Allocated Funding
Lockable noticeboard	Singleton Council	$2,000.00
Recreation area improvements and exercise equipment project	Singleton Council	$80,000.00
Bulga Recreation Ground RV dump point	Singleton Council	$60,000.00
Bulga Stock Reserve Plan of Management & Masterplan	Singleton Council	$60,000.00
Bulga Stock Reserve Stage 1 maintenance works	Singleton Council	$46,811.82
Bulga Stock Reserve Stage 2 detailed survey	Singleton Council	$15,000.00
Bulga Stock Reserve Stage 3 Aboriginal cultural study	Singleton Council	$10,000.00
Bulga Stock Reserve – Detailed landscape design	Singleton Council	$20,000
Bulga Stock Reserve Stage 4 detailed design plans	Singleton Council	$25,000
Bulga Stock Reserve – Ecological Restoration Plan	Singleton Council	$38,200
Milbrodale Public School - Welsh's Road sealing 600m	Singleton Council	$517,259.68
Gravel bus U-turn Bay off Welsh's Road	Singleton Council	$25,000
Baiame Caves Access Road	Singleton Council	$65,000
Bulga Hall media system and verandah	Bulga Hall Committee	$100,000.00
Bulga Hall additional funding – replacement of hall ceiling	Bulga Hall Committee	$53,000.00
Bulga Hall public wifi network	Bulga Hall Committee	$4,480.64
Bulga Hall additional improvement works	Bulga Hall Committee	$85,000.00
Old Bulga School restoration	Bulga Milbrodale Progress Association	$430,000.00
Electronic message board	Singleton Council	$27,014.00
Wollombi Brook Walking Trail Masterplan and land purchase exploration	Singleton Council	$20,000.00
Milbrodale Public School Yarning Circle	Milbrodale Public School	$3,000.00
Milbrodale public School storage room renovations	Milbrodale Public School	$22,000.00

Approved Project	Project Lead	Allocated Funding
Friends of St Mark's Cemetery - replacement fence	Friends of St Marks Cemetery	$19,349.48
Bulga Milbrodale Equestrian Centre Feasibility Study	Bulga Milbrodale Equestrian Centre	$80,000
Project management incidentals	Singleton Council	$24,000.00
Project Officer resource – 3 year contract	Singleton Council	$390,000.00
	TOTAL ALLOCATED FUNDING	**$2,222,115.62**

8.2.3.2 MTW Community Support Program

In 2023 MTW continued implementation of the Yancoal Community Support Program (CSP). The CSP intends to make a genuine positive difference to the communities in which Yancoal operates. Applications for CSP partnerships are formally received once per funding year. MTW considers and supports applications for local donations and sponsorships that have a clear community benefit and are aligned with the CSP guidelines.

The 2023 round of applications were advertised in September-October 2022 and closed 4 November 2022. There were 21 applications received. The following organisations were supported in 2023 through the CSP.

- Business Singleton - 2023 International Women's Day luncheon, 2023 Singleton Business Awards
- Food Pantry Singleton - Supply of fresh vegetables for weekly distribution.
- Maitland Regional Art Gallery - Liz O'Brien Artist Bursary
- Milbrodale Public School P&C - Covered Walkways
- Rotary Club of Singleton - 2023 Singleton Art Prize
- Singleton AFC - 2023 Medical and Sports Training Supplies
- Singleton Amateur Swimming Club - Construction of storage shed
- Singleton Council - Christmas on John St 2023
- Singleton Council - Singleton Library - Purchase 6 x Victor Reader Stratus 4M machines
- Singleton Fire Brigade Social Club - Santa Lolly Run 2023
- Singleton Ladies Golf Club - Singleton Ladies Golf Club Open Day 2023
- Singleton PCYC - School Holiday Activities
- Singleton Rugby Club - Training equipment replacement
- Singleton U3A - Brochure funding
- St Catherine's Catholic College - Dream Cricket equipment
- Westpac Rescue Helicopter - Hunter Valley Mining Charity Rugby League Day 2023
- University of Newcastle - Upper Hunter Science & Engineering Challenge and Upper Hunter SMART Schools program

Advertising for the 2024 Community Support Program occurred over August-September 2023 with applications closing 30 September 2023. A report on the 2024 CSP will be provided in the next reporting period.

For information on the Yancoal Community Support Program please visit our website at www.mtwcoal.com.au or email mtw.csp@yancoal.com.au.

9 INDEPENDENT ENVIRONMENTAL AUDIT

An Independent Environmental Audit was completed during the 2023 reporting period. An update of progress against the Action Plan developed in response to the 2023 Independent Environmental Audit is included in **Appendix 9**. The next MTW Independent Environmental Audit is due in 2026.

The environmental audit report and MTW's response to recommendations are available in full on the company website (https://www.mtwcoal.com.au/page/environment/environmental-reports-studies-and-audits/).

10 INCIDENTS AND NON-COMPLIANCE

A summary of the environmental incidents reported during 2023 are provided in **Table 10.1**.

TABLE 10.1 ENVIRONMENTAL INCIDENT SUMMARY 2023

Date	Incident Details	Follow up Actions
16/10/2023	The Department of Planning and Environment (DPE) received a complaint regarding the MTW Complaints Register on the MTW website. Whilst the Complaints Register was available, the version on the website had not been updated since April 2023. DPE advised MTW that this was a breach of Schedule 5, condition 11 of WML's development consent (SSD-6464), with no further enforcement action proposed.	The public version of the complaints register was updated to include details of all complaints to end of September 2023, and this was uploaded to the MTW website on 18 October 2023. DPE were advised of resolution of the matter by email on 18 October 2023.

11 ACTIVITIES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

MTW will endeavour to carry out the following activities during the 2024 reporting period at Mount Thorley Warkworth, as outlined in **Table 11.1**.

TABLE 11.1 PROPOSED ACTIVITIES FOR 2024 REPORTING PERIOD

ID	Performance Area	Activities Proposed
1	Noise	• Maintain and continue sound power level testing of attenuated fleet; • Continue undertaking noise management and monitoring actions in accordance with the MTW Noise Management Plan • Undertake quarterly comparison of real time and external noise monitoring to validate real time monitoring results. • Trial hand held new noise monitoring equipment, and analysis technology for supplementary noise readings by CROs with the intent to identify the presence of low frequency modifying factor to assist with managing noise emissions from MTW.
2	Blasting	• Implement the updated MTW Blast Management Plan (subject to DPE approval). • Testing and verification of a real time model, which will use real time meteorological data from weather stations throughout the Hunter Valley to better determine the effect of possible overpressure enhancement (real time model in development)
3	Air Quality	• Continue undertaking air quality management and monitoring actions in accordance with the MTW Air Quality Management Plan

ID	Performance Area	Activities Proposed
4	Aboriginal Cultural Heritage	• Ongoing Aboriginal Cultural Heritage management in accordance with the AHMP plans. • Implementation of actions identified by the 2023 AHMP Compliance Inspection. • Reconciliation of MTW Cultural Heritage Management Database with NSW Heritage AHIMS database. • Progression of registration of the respective Wollombi Brook and Loders Creek Aboriginal Cultural Heritage Conservation Agreements on title during the period. • Cultural Heritage Working Group (CHWG) and Conservation Area Plan of Management Implementation Group (PMIG) meetings are planned to occur. Appointments to vacant PMIG positions (CHWG), review and progression of the Implementation Plans for the Conservation Areas are key items for the period.
5	Historic Heritage	• Ongoing Historic Heritage management in accordance with the HHMP. • Routine inspection and maintenance works at Springwood Homestead, Red Brick (Jarvis) House, and the RAAF Cook House. • Treatment of the cat claw creeper vine at Springwood Homestead. A structural building inspection is planned to occur to inform building stabilisation works and options for removal of the trees against the building. Trees and other vegetation surrounding the building will be controlled, and then removed when safe to do so. • Track upgrade to allow MR/HR vehicle access to the RAAF Mess Hall is planned to allow access for future works. Staged removal of asbestos containing materials, removal of hazardous tree fall and surrounding vegetation, and structural inspection and stabilisation works will be progressed. • Meetings of the Cultural Heritage Advisory Group (CHAG).
6	Water	• Improving the general capacity of the site's water resources via construction of approved water storage facility (North Out Of Pit dam (NOOP)). • Implementation of actions/recommendations from the annual groundwater review. • Develop an action plan to address the findings of the annual stream health assessment for Loders Creek. • Continue to monitor Rehabilitation runoff water quality. • Upgrade pumping infrastructure at Dam 3S and 31N. • Construction of Hunter River Salinity Trade Scheme infrastructure at MTO to achieve increased discharge rates as approved under the Mount Thorley Operations Consent (SSD-6465).

ID	Performance Area	Activities Proposed
7	Rehabilitation	• The rehabilitation monitoring programme will continue in 2024 for native vegetation rehabilitation areas. The monitoring program will be varied to align with changes to performance criteria in the Rehabilitation Management Plan as required. • Weed spraying (boom and spot spraying), cut and paint and weed wiping will be conducted in establishing rehabilitation areas as required to control both noxious and environmental weeds that are likely to impact on successful rehabilitation being achieved. It is planned that 95ha of new rehabilitation will be undertaken at MTW during 2024. • Habitat augmentation measures, such as the construction of habitat ponds and the placement of salvaged logs in rehabilitation areas. • Surface water will be managed on Tailings Dam 2 with the aim to increase the strength of the tailings surface. Capping activities will continue on areas of the Tailings Dam 2 surface that allow for the safe placement of material, following ongoing geotechnical investigations. • Conduct studies to reduce the surface area of the Loders Pit TSF. The aim of this study is to reduce the capping requirement on this facility at closure. • Conduct an analysis of the final landform stability using a landform evolution model. • Review seed mixes used to ensure that appropriate species and rates are being applied to new rehabilitation areas.

ID	Performance Area	Activities Proposed
8	Biodiversity Management	• Planting works will continue to restore Warkworth Sands Woodland in the Northern and Southern BA's and Central Hunter Grey Box Ironbark Woodland and River Oak Forest in the Southern BA's. • Conservation management actions will be undertaken across the BAs in 2024 in accordance with the Offset Management Plans, these will include; weed management, vertebrate pest management including 1080 ground baiting programmes to target wild dogs and foxes scheduled for autumn and spring, 1080 baiting targeting feral pigs at the Goulburn River BA and a noisy miner control program in the regent honeyeater breeding area at the Goulburn River BA and Bowditch BA, thermal ground shooting programmes at Bowditch, Seven Oaks and Goulburn River, rapid condition assessments, overall fuel load assessments and property inspections will be undertaken across all BAs, habitat restoration monitoring and bird assemblage monitoring will be undertaken. • The hazard reduction burn planned for North Rothbury BA will be undertaken if conditions are within the parameters of the approved burn plan. • Infrastructure improvement including fence repairs, track maintenance and river crossing installations will be undertaken as required. • Progress the securing of biodiversity offset areas, after determination of credit equivalence by Biodiversity, Conservation and Science (BCS) through Biodiversity Stewardship Agreements for each offset area.
9	Community Engagement	• Continued operation of the Community Consultation Committee. • Implementation of the MTW Social Impact Management Plan (which outlines specific and general stakeholder engagement and consultation requirements).
10	Community Development	• Implementation of the Yancoal Community Support Program (CSP) during 2024. The CSP program provides an opportunity for multiple site or group-wide investment in larger, long-term, capacity building projects that make a positive difference. Focus areas include health, social and community, environment, education and training. • Continued funding and participation as a committee representative for the MTW Voluntary Planning Agreement to progress sustainable community projects in the local area.

Appendix 1:

Compliance Noise Monitoring Data

Compliance Noise Monitoring Data

Yancoal Mt Thorley Warkworth

2023

1.0 Noise

Routine attended noise monitoring is carried out in accordance with the MTW Noise Management Plan. The purpose of the noise surveys is to quantify and describe the acoustic environment around the site and compare results with specified limits. Attended noise monitoring locations are displayed in **Figure 1**.

1.1 Attended Noise Monitoring Results

Monthly attended monitoring was conducted at receiver locations surrounding MTW in 2023. All measurements complied with the relevant criteria. Results are detailed in **Table 1** to **Table 4.**

1.1.1 WML Noise Assessment

Compliance assessments undertaken against the WML noise criteria are presented in **Tables 1** and **2**.

Table 1: $L_{Aeq,\ 15\ minute}$ Warkworth Impact Assessment Criteria – 2023

Location	Date and Time	Wind Speed (m/s)	Stability Class	Criterion dB(A)	Criterion Applies?[1]	WML L_{Aeq} dB[2,3,4,6]	Exceedance[3,4]
Bulga RFS	17/01/2023 22:50	3.1	D	37	No	35	Nil
Bulga Village	17/01/2023 22:12	2.7	E	38	Yes	32	Nil
Gouldsville	17/01/2023 21:23	3.4	D	38	No	IA	Nil
Inlet Rd	17/01/2023 21:22	3.5	E	37	No	31	Nil
Inlet Rd West	17/01/2023 21:04	3.8	D	35	No	27	Nil
Long Point	17/01/2023 21:00	3.8	D	35	No	IA	Nil
South Bulga	17/01/2023 23:33	2.5	F	35	No	IA	Nil
Wambo Road	17/01/2023 21:48	3.1	E	38	No	33	Nil
Bulga RFS	20/02/2023 22:54	2.9	E	37	Yes	<30	Nil
Bulga Village	20/02/2023 22:15	3	E	38	Yes	<30	Nil
Gouldsville	20/02/2023 21:25	3.8	D	38	No	<25	NA
Inlet Rd	20/02/2023 21:23	3.8	D	37	No	35	NA
Inlet Rd West	20/02/2023 21:00	3.9	D	35	No	IA	NA
Long Point	20/02/2023 21:00	3.9	D	35	No	IA	NA
South Bulga	20/02/2023 23:39	2.9	E	35	Yes	IA	Nil
Wambo Road	20/02/2023 21:56	3.5	D	38	No	<30	NA
Bulga RFS	16/03/2023 23:02	1.4	F	37	Yes	IA	Nil
Bulga Village	16/03/2023 22:17	1.7	F	38	Yes	IA	Nil
Gouldsville	16/03/2023 21:26	2.2	D	38	Yes	26	Nil
Inlet Rd	16/03/2023 21:31	2.2	D	37	Yes	<20	Nil
Inlet Rd West	16/03/2023 21:09	2.2	D	35	Yes	IA	Nil
Long Point	16/03/2023 21:00	1.9	F	35	Yes	IA	Nil
South Bulga	16/03/2023 22:41	1.5	F	35	Yes	IA	Nil
Wambo Road	16/03/2023 21:56	1.8	D	38	Yes	IA	Nil
Bulga RFS	17/04/2023 22:48	2.8	D	37	Yes	31	Nil
Bulga Village	17/04/2023 22:05	2.2	D	38	Yes	33	Nil
Gouldsville	17/04/2023 21:24	1.7	E	38	Yes	<25	Nil

Location	Date and Time	Wind Speed (m/s)	Stability Class	Criterion dB(A)	Criterion Applies?[1]	WML L_{Aeq} dB[2,3,4,6]	Exceedance[3,4]
Inlet Rd	17/04/2023 21:31	1.3	E	37	Yes	33	Nil
Inlet Rd West	17/04/2023 21:09	1	E	35	Yes	33	Nil
Long Point	17/04/2023 21:00	1	E	35	Yes	IA	Nil
South Bulga	17/04/2023 22:41	2.4	D	35	Yes	IA	Nil
Wambo Road	17/04/2023 21:56	1.9	E	38	Yes	34	Nil
Bulga RFS	4/05/2023 23:01	1.8	D	37	Yes	32	Nil
Bulga Village	4/05/2023 22:08	2	D	38	Yes	35	Nil
Gouldsville	4/05/2023 21:21	2.4	D	38	Yes	<25	Nil
Inlet Rd	4/05/2023 21:43	2.2	E	37	Yes	30	Nil
Inlet Rd West	4/05/2023 21:15	2.4	D	35	Yes	26	Nil
Long Point	4/05/2023 21:00	2.4	E	35	Yes	IA	Nil
South Bulga	10/05/2023 23:36	1.3	E	35	Yes	IA	Nil
Wambo Road	4/05/2023 22:34	1.8	D	38	Yes	36	Nil
Bulga RFS	1/06/2023 22:53	0.8	F	37	Yes	NM	Nil
Bulga Village	1/06/2023 22:06	1.8	E	38	Yes	<30	Nil
Gouldsville	1/06/2023 21:21	2	D	38	Yes	30	Nil
Inlet Rd	1/06/2023 21:21	2	D	37	Yes	<30	Nil
Inlet Rd West	1/06/2023 21:00	1.8	D	35	Yes	<20	Nil
Long Point	1/06/2023 21:00	1.8	D	35	Yes	IA	Nil
South Bulga	1/06/2023 23:34	1.5	F	35	Yes	IA	Nil
Wambo Road	1/06/2023 21:46	1.9	D	38	Yes	IA	Nil
Bulga RFS	19/07/2023 23:28	2.1	E	37	Yes	<30	Nil
Bulga Village	19/07/2023 22:33	1.5	D	38	Yes	36	Nil
Gouldsville	19/07/2023 21:21	1.9	E	38	Yes	IA	Nil
Inlet Rd	19/07/2023 21:34	1.8	E	37	Yes	34	Nil
Inlet Rd West	19/07/2023 21:10	1.9	E	35	Yes	34	Nil
Long Point	19/07/2023 21:00	1.7	D	35	Yes	IA	Nil
South Bulga	19/07/2023 23:58	2.1	E	35	Yes	IA	Nil
Wambo Road	19/07/2023 22:07	1.7	E	38	Yes	35	Nil
Bulga RFS	7/08/2023 23:04	2.3	E	37	Yes	IA	Nil
Bulga Village	7/08/2023 22:22	2.9	D	38	Yes	IA	Nil
Gouldsville	7/08/2023 21:21	2.6	D	38	Yes	35	Nil
Inlet Rd	7/08/2023 21:35	2.5	D	37	Yes	IA	Nil
Inlet Rd West	7/08/2023 21:12	2.6	D	35	Yes	IA	Nil
Long Point	7/08/2023 21:00	2.4	D	35	Yes	<25	Nil
South Bulga	7/08/2023 23:52	2.8	D	35	Yes	IA	Nil
Wambo Road	7/08/2023 22:00	2.7	D	38	Yes	28	Nil
Bulga RFS	6/09/2023 23:35	2.5	D	37	Yes	33	Nil
Bulga Village	6/09/2023 22:45	2.1	F	38	Yes	36	Nil
Gouldsville	6/09/2023 21:21	2.2	F	38	Yes	<25	Nil
Inlet Rd	6/09/2023 21:39	2.1	F	37	Yes	35	Nil

Location	Date and Time	Wind Speed (m/s)	Stability Class	Criterion dB(A)	Criterion Applies?[1]	WML L_{Aeq} dB[2,3,4,6]	Exceedance[3,4]
Inlet Rd West	6/09/2023 21:03	2.4	D	35	Yes	33	Nil
Long Point	6/09/2023 21:00	2.4	D	35	Yes	IA	Nil
South Bulga	7/09/2023 0:27	2.2	D	35	Yes	IA	Nil
Wambo Road	6/09/2023 22:19	2.3	F	38	Yes	30	Nil
Wambo Road5	6/09/2023 23:35	2.5	D	37	Yes	33	Nil
Bulga RFS	5/10/2023 23:43	2.5	D	37	Yes	IA	Nil
Bulga Village	5/10/2023 22:44	3.3	D	38	No	<25	Nil
Gouldsville	5/10/2023 21:21	3.3	D	38	No	28	Nil
Inlet Rd	5/10/2023 21:58	3.6	D	37	No	<20	Nil
Inlet Rd West	5/10/2023 21:32	3.5	D	35	No	IA	Nil
Long Point	5/10/2023 21:00	3.6	D	35	No	25	Nil
South Bulga	6/10/2023 0:37	2.2	F	35	No	<25	Nil
Wambo Road	5/10/2023 22:22	2.9	D	38	Yes	<20	Nil
Bulga RFS	6/11/2023 23:02	2.9	E	37	Yes	31	Nil
Bulga Village	6/11/2023 22:14	3.1	D	38	No	36	Nil
Gouldsville	6/11/2023 21:22	3.3	D	38	No	33	Nil
Inlet Rd	6/11/2023 21:24	3.4	D	37	No	35	Nil
Inlet Rd West	6/11/2023 21:00	3.3	D	35	No	32	Nil
Long Point	6/11/2023 21:00	3.3	D	35	No	IA	Nil
South Bulga	6/11/2023 23:53	2.7	D	35	Yes	<30	Nil
Wambo Road	6/11/2023 21:50	3.5	D	38	No	34	Nil
Bulga RFS	18/12/2023 23:47	3.3	D	37	No	<30	NA
Bulga Village	18/12/2023 23:02	4.1	D	38	No	<30	NA
Gouldsville	18/12/2023 21:25	3.8	D	38	No	IA	NA
Inlet Rd	18/12/2023 21:22	3.8	D	37	No	32	NA
Inlet Rd West	18/12/2023 21:00	3.6	D	35	No	33	NA
Long Point	18/12/2023 21:03	3.6	D	35	No	IA	NA
South Bulga	19/12/2023 0:08	1.4	F	35	Yes	<30	Nil
Wambo Road	18/12/2023 21:46	2.9	D	38	Yes	<30	Nil

Notes:

1. Noise criteria apply during all meteorological conditions except the following: during periods of rain or hail; average wind speed at microphone height exceeds 5 m/s; wind speeds greater than 3 m/s measured at 10 metres above ground level; stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level; or stability category G temperature inversion conditions. Criterion may or may not apply due to rounding of meteorological data values;

2. Site-only LAeq,15minute attributed to WML, including modifying factors if applicable;

4. NA in exceedance column means atmospheric conditions outside conditions specified in consent, therefore criterion was not applicable;

6. IA denotes 'Inaudible'.

Table 2: $L_{A1,\ 1\ minute}$ Warkworth - Impact Assessment Criteria – 2023

Location	Date and Time	Wind Speed (m/s)	Stability Class	Criterion dB(A)	Criterion Applies?[1]	WML $L_{A1,\ 1min}$ dB[2,3,4,6]	Exceedance[3,4]
Bulga RFS	17/01/2023 22:50	3.1	D	47	No	38	Nil
Bulga Village	17/01/2023 22:12	2.7	E	48	Yes	35	Nil
Gouldsville	17/01/2023 21:23	3.4	D	48	No	IA	Nil
Inlet Rd	17/01/2023 21:22	3.5	E	47	No	35	Nil
Inlet Rd West	17/01/2023 21:04	3.8	D	45	No	32	Nil
Long Point	17/01/2023 21:00	3.8	D	45	No	IA	Nil
South Bulga	17/01/2023 23:33	2.5	F	45	No	IA	Nil
Wambo Road	17/01/2023 21:48	3.1	E	48	No	40	Nil
Bulga RFS	20/02/2023 22:54	2.9	E	47	Yes	<30	Nil
Bulga Village	20/02/2023 22:15	3	E	48	Yes	<30	Nil
Gouldsville	20/02/2023 21:25	3.8	D	48	No	30	NA
Inlet Rd	20/02/2023 21:23	3.8	D	47	No	38	NA
Inlet Rd West	20/02/2023 21:00	3.9	D	45	No	IA	NA
Long Point	20/02/2023 21:00	3.9	D	45	No	IA	NA
South Bulga	20/02/2023 23:39	2.9	E	45	Yes	IA	Nil
Wambo Road	20/02/2023 21:56	3.5	D	48	No	<30	NA
Bulga RFS	16/03/2023 23:02	1.4	F	47	Yes	IA	Nil
Bulga Village	16/03/2023 22:17	1.7	F	48	Yes	IA	Nil
Gouldsville	16/03/2023 21:26	2.2	D	48	Yes	30	Nil
Inlet Rd	16/03/2023 21:31	2.2	D	47	Yes	21	Nil
Inlet Rd West	16/03/2023 21:09	2.2	D	45	Yes	IA	Nil
Long Point	16/03/2023 21:00	1.9	F	45	Yes	IA	Nil
South Bulga	16/03/2023 22:41	1.5	F	45	Yes	IA	Nil
Wambo Road	16/03/2023 21:56	1.8	D	48	Yes	IA	Nil
Bulga	17/04/2023 22:48	2.8	D	47	Yes	32	Nil
Bulga	17/04/2023 22:05	2.2	D	48	Yes	36	Nil
Gouldsville	17/04/2023 21:24	1.7	E	48	Yes	30	Nil
Inlet Rd	17/04/2023 21:31	1.3	E	47	Yes	36	Nil
Inlet Rd West	17/04/2023 21:09	1	E	45	Yes	37	Nil
Long Point	17/04/2023 21:00	1	E	45	Yes	IA	Nil
South Bulga	17/04/2023 22:41	2.4	D	45	Yes	IA	Nil
Wambo Road	17/04/2023 21:56	1.9	E	48	Yes	38	Nil
Bulga RFS	4/05/2023 23:01	1.8	D	47	Yes	47	Nil
Bulga Village	4/05/2023 22:08	2	D	48	Yes	42	Nil
Gouldsville	4/05/2023 21:21	2.4	D	48	Yes	26	Nil
Inlet Rd	4/05/2023 21:43	2.2	E	47	Yes	35	Nil

Location	Date and Time	Wind Speed (m/s)	Stability Class	Criterion dB(A)	Criterion Applies?[1]	WML $L_{A1, 1min}$ dB[2,3,4,6]	Exceedance[3,4]
Inlet Rd West	4/05/2023 21:15	2.4	D	45	Yes	28	Nil
Long Point	4/05/2023 21:00	2.4	E	45	Yes	IA	Nil
South Bulga	10/05/2023 23:36	1.3	E	45	Yes	IA	Nil
Wambo Road	4/05/2023 22:34	1.8	D	48	Yes	44	Nil
Bulga RFS	1/06/2023 22:53	0.8	F	47	Yes	NM	Nil
Bulga Village	1/06/2023 22:06	1.8	E	48	Yes	<30	Nil
Gouldsville	1/06/2023 21:21	2	D	48	Yes	40	Nil
Inlet Rd	1/06/2023 21:21	2	D	47	Yes	<30	Nil
Inlet Rd West	1/06/2023 21:00	1.8	D	45	Yes	<20	Nil
Long Point	1/06/2023 21:00	1.8	D	45	Yes	IA	Nil
South Bulga	1/06/2023 23:34	1.5	F	45	Yes	IA	Nil
Wambo Road	1/06/2023 21:46	1.9	D	48	Yes	IA	Nil
Bulga RFS	19/07/2023 23:28	2.1	E	47	Yes	35	Nil
Bulga Village	19/07/2023 22:33	1.5	D	48	Yes	38	Nil
Gouldsville	19/07/2023 21:21	1.9	E	48	Yes	IA	Nil
Inlet Rd	19/07/2023 21:34	1.8	E	47	Yes	37	Nil
Inlet Rd West	19/07/2023 21:10	1.9	E	45	Yes	36	Nil
Long Point	19/07/2023 21:00	1.7	D	45	Yes	IA	Nil
South Bulga	19/07/2023 23:58	2.1	E	45	Yes	IA	Nil
Wambo Road	19/07/2023 22:07	1.7	E	48	Yes	37	Nil
Bulga RFS	7/08/2023 23:04	2.3	E	47	Yes	IA	Nil
Bulga Village	7/08/2023 22:22	2.9	D	48	Yes	IA	Nil
Gouldsville	7/08/2023 21:21	2.6	D	48	Yes	38	Nil
Inlet Rd	7/08/2023 21:35	2.5	D	47	Yes	IA	Nil
Inlet Rd West	7/08/2023 21:12	2.6	D	45	Yes	IA	Nil
Long Point	7/08/2023 21:00	2.4	D	45	Yes	<25	Nil
South Bulga	7/08/2023 23:52	2.8	D	45	Yes	IA	Nil
Wambo Road	7/08/2023 22:00	2.7	D	48	Yes	34	Nil
Bulga RFS	6/09/2023 23:35	2.5	D	47	Yes	35	Nil
Bulga Village	6/09/2023 22:45	2.1	F	48	Yes	39	Nil
Gouldsville	6/09/2023 21:21	2.2	F	48	Yes	<25	Nil
Inlet Rd	6/09/2023 21:39	2.1	F	47	Yes	47	Nil
Inlet Rd West	6/09/2023 21:03	2.4	D	45	Yes	44	Nil
Long Point	6/09/2023 21:00	2.4	D	45	Yes	IA	Nil
South Bulga	7/09/2023 0:27	2.2	D	45	Yes	IA	Nil
Wambo Road	6/09/2023 22:19	2.3	F	48	Yes	40	Nil
Bulga RFS	5/10/2023 23:43	2.5	D	47	Yes	IA	Nil

Location	Date and Time	Wind Speed (m/s)	Stability Class	Criterion dB(A)	Criterion Applies?[1]	WML $L_{A1, 1min}$ dB[2,3,4,6]	Exceedance[3,4]
Bulga Village	5/10/2023 22:44	3.3	D	48	No	<25	Nil
Gouldsville	5/10/2023 21:21	3.3	D	48	No	30	Nil
Inlet Rd	5/10/2023 21:58	3.6	D	47	No	<25	Nil
Inlet Rd West	5/10/2023 21:32	3.5	D	45	No	IA	Nil
Long Point	5/10/2023 21:00	3.6	D	45	No	30	Nil
South Bulga	6/10/2023 0:37	2.2	F	45	No	<25	Nil
Wambo Road	5/10/2023 22:22	2.9	D	48	Yes	<25	Nil
Bulga RFS	6/11/2023 23:02	2.9	E	47	Yes	40	Nil
Bulga Village	6/11/2023 22:14	3.1	D	48	No	43	Nil
Gouldsville	6/11/2023 21:22	3.3	D	48	No	38	Nil
Inlet Rd	6/11/2023 21:24	3.4	D	47	No	39	Nil
Inlet Rd West	6/11/2023 21:00	3.3	D	45	No	36	Nil
Long Point	6/11/2023 21:00	3.3	D	45	No	IA	Nil
South Bulga	6/11/2023 23:53	2.7	D	45	Yes	32	Nil
Wambo Road	6/11/2023 21:50	3.5	D	48	No	39	Nil
Bulga RFS	18/12/2023 23:47	3.3	D	47	No	<30	NA
Bulga Village	18/12/2023 23:02	4.1	D	48	No	31	NA
Gouldsville	18/12/2023 21:25	3.8	D	48	No	IA	NA
Inlet Rd	18/12/2023 21:22	3.8	D	47	No	34	NA
Inlet Rd West	18/12/2023 21:00	3.6	D	45	No	35	NA
Long Point	18/12/2023 21:03	3.6	D	45	No	IA	NA
South Bulga	19/12/2023 0:08	1.4	F	45	Yes	<30	Nil
Wambo Road	18/12/2023 21:46	2.9	D	48	Yes	30	Nil

Notes:

1. Noise criteria apply during all meteorological conditions except the following: during periods of rain or hail; average wind speed at microphone height exceeds 5 m/s; wind speeds greater than 3 m/s measured at 10 metres above ground level; stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level; or stability category G temperature inversion conditions. Criterion may or may not apply due to rounding of meteorological data values;

2. Site-only LAeq,15minute attributed to WML, including modifying factors if applicable;

4. NA in exceedance column means atmospheric conditions outside conditions specified in consent, therefore criterion was not applicable;

6. IA denotes 'Inaudible'.

1.1.2 MTO Noise Assessment

Compliance assessments undertaken against the MTO noise criteria are presented in Error! Reference source not found. and **4**.

Table 3: $L_{Aeq,\ 15minute}$ Mount Thorley - Impact Assessment Criteria – 2023

Location	Date and Time	Wind Speed (m/s)	Stability Class	Criterion dB	Criterion Applies?[1]	MTO L_{Aeq} dB[2,3,4,6]	Exceedance[3,4]
Bulga RFS	17/01/2023 22:50	3.1	D	37	No	IA	Nil
Bulga Village	17/01/2023 22:12	2.7	E	38	Yes	IA	Nil
Gouldsville	17/01/2023 21:23	3.4	D	35	No	IA	Nil
Inlet Rd	17/01/2023 21:22	3.5	E	37	No	31	Nil
Inlet Rd West	17/01/2023 21:04	3.8	D	35	No	NM	Nil
Long Point	17/01/2023 21:00	3.8	D	35	No	IA	Nil
South Bulga	17/01/2023 23:33	2.5	F	36	No	30	Nil
Wambo Road	17/01/2023 21:48	3.1	E	38	No	IA	Nil
Bulga RFS	20/02/2023 22:54	2.9	E	37	Yes	<30	Nil
Bulga Village	20/02/2023 22:15	3	E	38	Yes	IA	Nil
Gouldsville	20/02/2023 21:25	3.8	D	35	No	IA	NA
Inlet Rd	20/02/2023 21:23	3.8	D	37	No	IA	NA
Inlet Rd West	20/02/2023 21:00	3.9	D	35	No	<30	NA
Long Point	20/02/2023 21:00	3.9	D	35	No	IA	NA
South Bulga	20/02/2023 23:39	2.9	E	36	Yes	<30	Nil
Wambo Road	20/02/2023 21:56	3.5	D	38	No	IA	NA
Bulga RFS	16/03/2023 23:02	1.4	F	37	Yes	27	Nil
Bulga Village	16/03/2023 22:17	1.7	F	38	Yes	IA	Nil
Gouldsville	16/03/2023 21:26	2.2	D	35	Yes	IA	Nil
Inlet Rd	16/03/2023 21:31	2.2	D	37	Yes	IA	Nil
Inlet Rd West	16/03/2023 21:09	2.2	D	35	Yes	IA	Nil
Long Point	16/03/2023 21:00	1.9	F	35	Yes	23	Nil
South Bulga	16/03/2023 22:41	1.5	F	36	Yes	26	Nil
Wambo Road	16/03/2023 21:56	1.8	D	38	Yes	IA	Nil
Bulga RFS	17/04/2023 22:48	2.8	D	37	Yes	31	Nil
Bulga Village	17/04/2023 22:05	2.2	D	38	Yes	33	Nil
Gouldsville	17/04/2023 21:24	1.7	E	35	Yes	IA	Nil
Inlet Rd	17/04/2023 21:31	1.3	E	37	Yes	33	Nil
Inlet Rd West	17/04/2023 21:09	1	E	35	Yes	33	Nil
Long Point	17/04/2023 21:00	1	E	35	Yes	IA	Nil
South Bulga	17/04/2023 22:41	2.4	D	36	Yes	<30	Nil
Wambo Road	17/04/2023 21:56	1.9	E	38	Yes	31	Nil

Location	Date and Time	Wind Speed (m/s)	Stability Class	Criterion dB	Criterion Applies?[1]	MTO L_{Aeq} dB[2,3,4,6]	Exceedance[3,4]
Bulga RFS	4/05/2023 23:01	1.8	D	37	Yes	37	Nil
Bulga Village	4/05/2023 22:08	2	D	38	Yes	37	Nil
Gouldsville	4/05/2023 21:21	2.4	D	35	Yes	IA	Nil
Inlet Rd	4/05/2023 21:43	2.2	E	37	Yes	32	Nil
Inlet Rd West	4/05/2023 21:15	2.4	D	35	Yes	31	Nil
Long Point	4/05/2023 21:00	2.4	E	35	Yes	IA	Nil
South Bulga	10/05/2023 23:36	1.3	E	36	Yes	IA	Nil
Wambo Road	4/05/2023 22:34	1.8	D	38	Yes	IA	Nil
Bulga RFS	1/06/2023 22:53	0.8	D	37	Yes	34	Nil
Bulga Village	1/06/2023 22:06	1.8	D	38	Yes	<30	Nil
Gouldsville	1/06/2023 21:21	2	D	35	Yes	IA	Nil
Inlet Rd	1/06/2023 21:21	2	E	37	Yes	IA	Nil
Inlet Rd West	1/06/2023 21:00	1.8	D	35	Yes	IA	Nil
Long Point	1/06/2023 21:00	1.8	E	35	Yes	IA	Nil
South Bulga	1/06/2023 23:34	1.5	E	36	Yes	<30	Nil
Wambo Road	1/06/2023 21:46	1.9	D	38	Yes	IA	Nil
Bulga RFS	19/07/2023 23:28	2.1	E	37	Yes	36	Nil
Bulga Village	19/07/2023 22:33	1.5	D	38	Yes	32	Nil
Gouldsville	19/07/2023 21:21	1.9	E	35	Yes	IA	Nil
Inlet Rd	19/07/2023 21:34	1.8	E	37	Yes	<30	Nil
Inlet Rd West	19/07/2023 21:10	1.9	E	35	Yes	<30	Nil
Long Point	19/07/2023 21:00	1.7	D	35	Yes	IA	Nil
South Bulga	19/07/2023 23:58	2.1	E	36	Yes	<30	Nil
Wambo Road	19/07/2023 22:07	1.7	E	38	Yes	IA	Nil
Bulga RFS	7/08/2023 23:04	2.3	E	37	Yes	25	Nil
Bulga Village	7/08/2023 22:22	2.9	D	38	Yes	28	Nil
Gouldsville	7/08/2023 21:21	2.6	D	35	Yes	IA	Nil
Inlet Rd	7/08/2023 21:35	2.5	D	37	Yes	29	Nil
Inlet Rd West	7/08/2023 21:12	2.6	D	35	Yes	30	Nil
Long Point	7/08/2023 21:00	2.4	D	35	Yes	IA	Nil
South Bulga	7/08/2023 23:52	2.8	D	36	Yes	IA	Nil
Wambo Road	7/08/2023 22:00	2.7	D	38	Yes	IA	Nil
Bulga RFS	6/09/2023 23:35	2.5	D	37	Yes	33	Nil
Bulga Village	6/09/2023 22:45	2.1	F	38	Yes	IA	Nil
Gouldsville	6/09/2023 21:21	2.2	F	35	Yes	IA	Nil
Inlet Rd	6/09/2023 21:39	2.1	F	37	Yes	IA	Nil

Location	Date and Time	Wind Speed (m/s)	Stability Class	Criterion dB	Criterion Applies?[1]	MTO L_{Aeq} dB[2,3,4,6]	Exceedance[3,4]
Inlet Rd West	6/09/2023 21:03	2.4	D	35	Yes	<30	Nil
Long Point	6/09/2023 21:00	2.4	D	35	Yes	IA	Nil
South Bulga	7/09/2023 0:27	2.2	D	36	Yes	IA	Nil
Wambo Road	6/09/2023 22:19	2.3	F	38	Yes	IA	Nil
Wambo Road[5]	6/09/2023 23:35	2.5	D	37	Yes	33	Nil
Bulga RFS	5/10/2023 23:43	2.5	D	37	Yes	IA	Nil
Bulga Village	5/10/2023 22:44	3.3	D	38	No	IA	Nil
Gouldsville	5/10/2023 21:21	3.3	D	35	No	IA	Nil
Inlet Rd	5/10/2023 21:58	3.6	D	37	No	IA	Nil
Inlet Rd West	5/10/2023 21:32	3.5	D	35	No	IA	Nil
Long Point	5/10/2023 21:00	3.6	D	35	No	IA	Nil
South Bulga	6/10/2023 0:37	2.2	F	36	No	<25	Nil
Wambo Road	5/10/2023 22:22	2.9	D	38	Yes	IA	Nil
Bulga RFS	6/11/2023 23:02	2.9	E	37	Yes	30	Nil
Bulga Village	6/11/2023 22:14	3.1	D	38	No	<30	Nil
Gouldsville	6/11/2023 21:22	3.3	D	35	No	IA	Nil
Inlet Rd	6/11/2023 21:24	3.4	D	37	No	<25	Nil
Inlet Rd West	6/11/2023 21:00	3.3	D	35	No	IA	Nil
Long Point	6/11/2023 21:00	3.3	D	35	No	IA	Nil
South Bulga	6/11/2023 23:53	2.7	D	36	Yes	32	Nil
Wambo Road	6/11/2023 21:50	3.5	D	38	No	IA	Nil
Bulga RFS	18/12/2023 23:47	3.3	D	37	No	32	NA
Bulga Village	18/12/2023 23:02	4.1	D	38	No	<25	NA
Gouldsville	18/12/2023 21:25	3.8	D	35	No	IA	NA
Inlet Rd	18/12/2023 21:22	3.8	D	37	No	<30	NA
Inlet Rd West	18/12/2023 21:00	3.6	D	35	No	<30	NA
Long Point	18/12/2023 21:03	3.6	D	35	No	IA	NA
South Bulga	19/12/2023 0:08	1.4	F	36	Yes	28	Nil
Wambo Road	18/12/2023 21:46	2.9	D	38	Yes	<30	Nil

Notes:

1. Noise criteria apply during all meteorological conditions except the following: during periods of rain or hail; average wind speed at microphone height exceeds 5 m/s; wind speeds greater than 3 m/s measured at 10 metres above ground level; stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level; or stability category G temperature inversion conditions. Criterion may or may not apply due to rounding of meteorological data values;

2. Site-only LAeq,15minute attributed to WML, including modifying factors if applicable;

4. NA in exceedance column means atmospheric conditions outside conditions specified in consent, therefore criterion was not applicable;

6. IA denotes 'Inaudible'.

Table 4: $L_{A1, 1Minute}$ Mount Thorley - Impact Assessment Criteria – 2023

Location	Date and Time	Wind Speed (m/s)	Stability Class	Criterion dB	Criterion Applies?[1]	MTO $L_{A1, 1min}$ dB[2,3,4, 6]	Exceedance[3,4]
Bulga RFS	17/01/2022 21:44	0.2	E	47	Yes	<25	NA
Bulga Village	17/01/2023 22:50	3.1	D	47	No	IA	Nil
Gouldsville	17/01/2023 22:12	2.7	E	48	Yes	IA	Nil
Inlet Rd	17/01/2023 21:23	3.4	D	45	No	IA	Nil
Inlet Rd West	17/01/2023 21:22	3.5	E	47	No	35	Nil
Long Point	17/01/2023 21:04	3.8	D	45	No	NM	Nil
South Bulga	17/01/2023 21:00	3.8	D	45	No	IA	Nil
Wambo Road	17/01/2023 23:33	2.5	F	46	No	35	Nil
Bulga RFS	20/02/2023 22:54	2.9	E	47	Yes	35	Nil
Bulga Village	20/02/2023 22:15	3	E	48	Yes	IA	Nil
Gouldsville	20/02/2023 21:25	3.8	D	45	No	IA	NA
Inlet Rd	20/02/2023 21:23	3.8	D	47	No	IA	NA
Inlet Rd West	20/02/2023 21:00	3.9	D	45	No	35	NA
Long Point	20/02/2023 21:00	3.9	D	45	No	IA	NA
South Bulga	20/02/2023 23:39	2.9	E	46	Yes	<30	Nil
Wambo Road	20/02/2023 21:56	3.5	D	48	No	IA	NA
Bulga RFS	16/03/2023 23:02	1.4	F	47	Yes	30	Nil
Bulga Village	16/03/2023 22:17	1.7	F	48	Yes	IA	Nil
Gouldsville	16/03/2023 21:26	2.2	D	45	Yes	IA	Nil
Inlet Rd	16/03/2023 21:31	2.2	D	47	Yes	IA	Nil
Inlet Rd West	16/03/2023 21:09	2.2	D	45	Yes	IA	Nil
Long Point	16/03/2023 21:00	1.9	F	45	Yes	25	Nil
South Bulga	16/03/2023 22:41	1.5	F	46	Yes	30	Nil
Wambo Road	16/03/2023 21:56	1.8	D	48	Yes	IA	Nil
Bulga RFS	17/04/2023 22:48	2.8	D	47	Yes	34	Nil
Bulga Village	17/04/2023 22:05	2.2	D	48	Yes	37	Nil
Gouldsville	17/04/2023 21:24	1.7	E	45	Yes	IA	Nil
Inlet Rd	17/04/2023 21:31	1.3	E	47	Yes	36	Nil
Inlet Rd West	17/04/2023 21:09	1	E	45	Yes	37	Nil
Long Point	17/04/2023 21:00	1	E	45	Yes	IA	Nil
South Bulga	17/04/2023 22:41	2.4	D	46	Yes	<30	Nil
Wambo Road	17/04/2023 21:56	1.9	E	48	Yes	35	Nil
Bulga RFS	4/05/2023 23:01	1.8	D	47	Yes	38	Nil
Bulga Village	4/05/2023 22:08	2	D	48	Yes	38	Nil
Gouldsville	4/05/2023 21:21	2.4	D	45	Yes	IA	Nil

Location	Date and Time	Wind Speed (m/s)	Stability Class	Criterion dB	Criterion Applies?[1]	MTO $L_{A1, 1min}$ dB[2,3,4, 6]	Exceedance[3,4]
Inlet Rd	4/05/2023 21:43	2.2	E	47	Yes	36	Nil
Inlet Rd West	4/05/2023 21:15	2.4	D	45	Yes	33	Nil
Long Point	4/05/2023 21:00	2.4	E	45	Yes	IA	Nil
South Bulga	10/05/2023 23:36	1.3	E	46	Yes	IA	Nil
Wambo Road	4/05/2023 22:34	1.8	D	48	Yes	IA	Nil
Bulga RFS	1/06/2023 22:53	0.8	D	47	Yes	37	Nil
Bulga Village	1/06/2023 22:06	1.8	D	48	Yes	<30	Nil
Gouldsville	1/06/2023 21:21	2	D	45	Yes	IA	Nil
Inlet Rd	1/06/2023 21:21	2	E	47	Yes	IA	Nil
Inlet Rd West	1/06/2023 21:00	1.8	D	45	Yes	IA	Nil
Long Point	1/06/2023 21:00	1.8	E	45	Yes	IA	Nil
South Bulga	1/06/2023 23:34	1.5	E	46	Yes	<30	Nil
Wambo Road	1/06/2023 21:46	1.9	D	48	Yes	IA	Nil
Bulga RFS	19/07/2023 23:28	2.1	E	47	Yes	41	Nil
Bulga Village	19/07/2023 22:33	1.5	D	48	Yes	33	Nil
Gouldsville	19/07/2023 21:21	1.9	E	45	Yes	IA	Nil
Inlet Rd	19/07/2023 21:34	1.8	E	47	Yes	32	Nil
Inlet Rd West	19/07/2023 21:10	1.9	E	45	Yes	<30	Nil
Long Point	19/07/2023 21:00	1.7	D	45	Yes	IA	Nil
South Bulga	19/07/2023 23:58	2.1	E	46	Yes	33	Nil
Wambo Road	19/07/2023 22:07	1.7	E	48	Yes	IA	Nil
Bulga RFS	7/08/2023 23:04	2.3	E	47	Yes	28	Nil
Bulga Village	7/08/2023 22:22	2.9	D	48	Yes	31	Nil
Gouldsville	7/08/2023 21:21	2.6	D	45	Yes	IA	Nil
Inlet Rd	7/08/2023 21:35	2.5	D	47	Yes	33	Nil
Inlet Rd West	7/08/2023 21:12	2.6	D	45	Yes	34	Nil
Long Point	7/08/2023 21:00	2.4	D	45	Yes	IA	Nil
South Bulga	7/08/2023 23:52	2.8	D	46	Yes	IA	Nil
Wambo Road	7/08/2023 22:00	2.7	D	48	Yes	IA	Nil
Bulga RFS	6/09/2023 23:35	2.5	D	47	Yes	40	Nil
Bulga Village	6/09/2023 22:45	2.1	F	48	Yes	IA	Nil
Gouldsville	6/09/2023 21:21	2.2	F	45	Yes	IA	Nil
Inlet Rd	6/09/2023 21:39	2.1	F	47	Yes	IA	Nil
Inlet Rd West	6/09/2023 21:03	2.4	D	45	Yes	<30	Nil
Long Point	6/09/2023 21:00	2.4	D	45	Yes	IA	Nil
South Bulga	7/09/2023 0:27	2.2	D	46	Yes	IA	Nil

Location	Date and Time	Wind Speed (m/s)	Stability Class	Criterion dB	Criterion Applies?[1]	MTO $L_{A1, 1min}$ dB[2,3,4, 6]	Exceedance[3,4]
Wambo Road	6/09/2023 22:19	2.3	F	48	Yes	IA	Nil
Bulga RFS	5/10/2023 23:43	2.5	D	47	Yes	IA	Nil
Bulga Village	5/10/2023 22:44	3.3	D	48	No	IA	Nil
Gouldsville	5/10/2023 21:21	3.3	D	45	No	IA	Nil
Inlet Rd	5/10/2023 21:58	3.6	D	47	No	IA	Nil
Inlet Rd West	5/10/2023 21:32	3.5	D	45	No	IA	Nil
Long Point	5/10/2023 21:00	3.6	D	45	No	IA	Nil
South Bulga	6/10/2023 0:37	2.2	F	46	No	28	Nil
Wambo Road	5/10/2023 22:22	2.9	D	48	Yes	IA	Nil
Bulga RFS	6/11/2023 23:02	2.9	E	47	Yes	32	Nil
Bulga Village	6/11/2023 22:14	3.1	D	48	No	<30	Nil
Gouldsville	6/11/2023 21:22	3.3	D	45	No	IA	Nil
Inlet Rd	6/11/2023 21:24	3.4	D	47	No	30	Nil
Inlet Rd West	6/11/2023 21:00	3.3	D	45	No	IA	Nil
Long Point	6/11/2023 21:00	3.3	D	45	No	IA	Nil
South Bulga	6/11/2023 23:53	2.7	D	46	Yes	34	Nil
Wambo Road	6/11/2023 21:50	3.5	D	48	No	IA	Nil
Bulga RFS	18/12/2023 23:47	3.3	D	47	No	36	NA
Bulga Village	18/12/2023 23:02	4.1	D	48	No	<25	NA
Gouldsville	18/12/2023 21:25	3.8	D	45	No	IA	NA
Inlet Rd	18/12/2023 21:22	3.8	D	47	No	31	NA
Inlet Rd West	18/12/2023 21:00	3.6	D	45	No	<30	NA
Long Point	18/12/2023 21:03	3.6	D	45	No	IA	NA
South Bulga	19/12/2023 0:08	1.4	F	46	Yes	30	Nil
Wambo Road	18/12/2023 21:46	2.9	D	48	Yes	38	Nil

Notes

1. Noise criteria apply during all meteorological conditions except the following: during periods of rain or hail; average wind speed at microphone height exceeds 5 m/s; wind speeds greater than 3 m/s measured at 10 metres above ground level; stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level; or stability category G temperature inversion conditions. Criterion may or may not apply due to rounding of meteorological data values;

2. Site-only LAeq,15minute attributed to WML, including modifying factors if applicable;

4. NA in exceedance column means atmospheric conditions outside conditions specified in consent, therefore criterion was not applicable;

6. IA denotes 'Inaudible'.

1.1.3 Low Frequency Assessment

In accordance with the requirements of the EPA's Noise Policy for Industry (NPfI), the applicability of the low frequency modification factor corrections has been assessed. There were two noise measurements taken during the reporting period which required the penalty to be applied. The WML assessment for low frequency noise is shown in **Table 5** and the MTO assessment for low frequency noise is shown in

Table 6.

Table 5: Warkworth Low Frequency Noise Assessment – 2023

Location	Date and Time	Measured WML LAeq dB[1]	Criterion Applies?	Intermittency Modifying Factor?	Tonality Modifying Factor?	Frequency of Tonality[2]	Low-frequency Modifying Factor?	Maximum Exceedance of Reference Spectrum [2,3]	Penalty dB[3]	Exceedance
Bulga RFS	17/01/2023 22:50	35	No	NA	NA	NA	NA	NA	Nil	NA
Bulga Village	17/01/2023 22:12	32	Yes	No	No	NA	No	NA	Nil	NA
Gouldsville	17/01/2023 21:23	IA	No	NA	NA	NA	NA	NA	Nil	NA
Inlet Rd	17/01/2023 21:22	31	No	NA	NA	NA	NA	NA	Nil	NA
Inlet Rd West	17/01/2023 21:04	27	No	NA	NA	NA	NA	NA	Nil	NA
Long Point	17/01/2023 21:00	IA	No	NA	NA	NA	NA	NA	Nil	NA
South Bulga	17/01/2023 23:33	IA	No	NA	NA	NA	NA	NA	Nil	NA
Wambo Road	17/01/2023 21:48	33	No	NA	NA	NA	NA	NA	Nil	NA
Bulga RFS	20/02/2023 22:54	<30	Yes	No	No	NA	No	NA	Nil	NA
Bulga Village	20/02/2023 22:15	<30	Yes	No	No	NA	No	NA	Nil	NA
Gouldsville	20/02/2023 21:25	<25	No	NA	NA	NA	NA	NA	Nil	NA
Inlet Rd	20/02/2023 21:23	35	No	NA	NA	NA	NA	NA	Nil	NA
Inlet Rd West	20/02/2023 21:00	IA	No	NA	NA	NA	NA	NA	Nil	NA
Long Point	20/02/2023 21:00	IA	No	NA	NA	NA	NA	NA	Nil	NA
South Bulga	20/02/2023 23:39	IA	Yes	No	No	NA	No	NA	Nil	NA
Wambo Road	20/02/2023 21:56	<30	No	NA	NA	NA	NA	NA	Nil	NA
Bulga RFS	16/03/2023 23:02	IA	Yes	No	No	NA	No	NA	Nil	NA
Bulga Village	16/03/2023 22:17	IA	Yes	No	No	NA	No	NA	Nil	NA
Gouldsville	16/03/2023 21:26	26	Yes	No	No	NA	No	NA	Nil	NA
Inlet Rd	16/03/2023 21:31	<20	Yes	No	No	NA	No	NA	Nil	NA

Location	Date and Time	Measured WML LAeq dB[1]	Criterion Applies?	Intermittency Modifying Factor?	Tonality Modifying Factor?	Frequency of Tonality[2]	Low-frequency Modifying Factor?	Maximum Exceedance of Reference Spectrum [2,3]	Penalty dB[3]	Exceedance
Inlet Rd West	16/03/2023 21:09	IA	Yes	No	No	NA	No	NA	Nil	NA
Long Point	16/03/2023 21:00	IA	Yes	No	No	NA	No	NA	Nil	NA
South Bulga	16/03/2023 22:41	IA	Yes	No	No	NA	No	NA	Nil	NA
Wambo Road	16/03/2023 21:56	IA	Yes	No	No	NA	No	NA	Nil	NA
Bulga RFS	17/04/2023 22:48	31	Yes	No	No	NA	No	NA	Nil	NA
Bulga Village	17/04/2023 22:05	33	Yes	No	No	NA	No	NA	Nil	NA
Gouldsville	17/04/2023 21:24	<25	Yes	No	No	NA	No	NA	Nil	NA
Inlet Rd	17/04/2023 21:31	33	Yes	No	No	NA	No	NA	Nil	NA
Inlet Rd West	17/04/2023 21:09	33	Yes	No	No	NA	No	NA	Nil	NA
Long Point	17/04/2023 21:00	IA	Yes	No	No	NA	No	NA	Nil	NA
South Bulga	17/04/2023 22:41	IA	Yes	No	No	NA	No	NA	Nil	NA
Wambo Road	17/04/2023 21:56	34	Yes	No	No	NA	No	NA	Nil	NA
Bulga RFS	4/05/2023 23:01	32	Yes	No	No	NA	No	NA	Nil	NA
Bulga Village	4/05/2023 22:08	35	Yes	No	No	NA	No	NA	Nil	NA
Gouldsville	4/05/2023 21:21	<25	Yes	No	No	NA	No	NA	Nil	Nil
Inlet Rd	4/05/2023 21:43	30	Yes	No	No	NA	No	NA	Nil	NA
Inlet Rd West	4/05/2023 21:15	26	Yes	No	No	NA	No	NA	Nil	NA
Long Point	4/05/2023 21:00	IA	Yes	No	No	NA	No	NA	Nil	NA
South Bulga	10/05/2023 21:36	IA	Yes	No	No	NA	No	NA	Nil	NA
Wambo Road	4/05/2023 22:34	36	Yes	No	No	NA	No	NA	Nil	NA
Bulga RFS	1/06/2023 22:53	NM	Yes	No	No	NA	No	NA	Nil	NA
Bulga Village	1/06/2023 22:06	<30	Yes	No	No	NA	No	NA	Nil	Nil

Location	Date and Time	Measured WML LAeq dB[1]	Criterion Applies?	Intermittency Modifying Factor?	Tonality Modifying Factor?	Frequency of Tonality[2]	Low-frequency Modifying Factor?	Maximum Exceedance of Reference Spectrum [2,3]	Penalty dB[3]	Exceedance
Gouldsville	1/06/2023 21:21	30	Yes	No	No	NA	No	NA	Nil	NA
Inlet Rd	1/06/2023 21:21	<30	Yes	No	No	NA	No	NA	Nil	Nil
Inlet Rd West	1/06/2023 21:00	<20	Yes	No	No	NA	No	NA	Nil	NA
Long Point	1/06/2023 21:00	IA	Yes	No	No	NA	No	NA	Nil	NA
South Bulga	1/06/2023 23:34	IA	Yes	No	No	NA	No	NA	Nil	NA
Wambo Road	1/06/2023 21:46	IA	Yes	No	No	NA	No	NA	Nil	NA
Bulga RFS	19/07/2023 23:28	<30	Yes	No	No	NA	No	NA	Nil	NA
Bulga Village	19/07/2023 22:33	36	Yes	No	No	NA	No	NA	Nil	NA
Gouldsville	19/07/2023 21:21	IA	Yes	No	No	NA	No	NA	Nil	NA
Inlet Rd	19/07/2023 21:34	34	Yes	No	No	NA	No	NA	Nil	NA
Inlet Rd West	19/07/2023 21:10	34	Yes	No	No	NA	No	NA	Nil	NA
Long Point	19/07/2023 21:00	IA	Yes	No	No	NA	No	NA	Nil	NA
South Bulga	19/07/2023 23:58	IA	Yes	No	No	NA	No	NA	Nil	NA
Wambo Road	19/07/2023 22:07	35	Yes	No	No	NA	No	NA	Nil	NA
Bulga RFS	7/08/2023 23:04	IA	Yes	No	No	NA	No	NA	Nil	NA
Bulga Village	7/08/2023 22:22	IA	Yes	No	No	NA	No	NA	Nil	NA
Gouldsville	7/08/2023 21:21	35	Yes	No	No	NA	No	NA	Nil	NA
Inlet Rd	7/08/2023 21:35	IA	Yes	No	No	NA	No	NA	Nil	NA
Inlet Rd West	7/08/2023 21:12	IA	Yes	No	No	NA	No	NA	Nil	NA
Long Point	7/08/2023 21:00	<25	Yes	No	No	NA	No	NA	Nil	NA
South Bulga	7/08/2023 23:52	IA	Yes	No	No	NA	No	NA	Nil	NA
Wambo Road	7/08/2023 22:00	28	Yes	No	No	NA	No	NA	Nil	NA

Location	Date and Time	Measured WML LAeq dB[1]	Criterion Applies?	Intermittency Modifying Factor?	Tonality Modifying Factor?	Frequency of Tonality[2]	Low-frequency Modifying Factor?	Maximum Exceedance of Reference Spectrum [2,3]	Penalty dB[3]	Exceedance
Bulga RFS	6/09/2023 23:35	33	Yes	No	No	NA	No	NA	Nil	NA
Bulga Village	6/09/2023 22:45	36	No	NA	NA	NA	NA	NA	Nil	NA
Gouldsville	6/09/2023 21:21	<25	No	NA	NA	NA	NA	NA	Nil	NA
Inlet Rd	6/09/2023 21:39	35	No	NA	NA	NA	NA	NA	Nil	NA
Inlet Rd West	6/09/2023 21:03	33	Yes	No	No	NA	No	NA	Nil	NA
Long Point	6/09/2023 21:00	IA	Yes	No	No	NA	No	NA	Nil	NA
South Bulga	7/09/2023 0:27	IA	Yes	No	No	NA	No	NA	Nil	NA
Wambo Road	6/09/2023 22:19	30	No	NA	NA	NA	NA	NA	Nil	NA
Bulga RFS	5/10/2023 23:43	IA	Yes	No	No	NA	No	NA	Nil	NA
Bulga Village	5/10/2023 22:44	<25	No	NA	NA	NA	NA	NA	Nil	NA
Gouldsville	5/10/2023 21:21	28	No	NA	NA	NA	NA	NA	Nil	NA
Inlet Rd	5/10/2023 21:58	<20	No	NA	NA	NA	NA	NA	Nil	NA
Inlet Rd West	5/10/2023 21:32	IA	No	NA	NA	NA	NA	NA	Nil	NA
Long Point	5/10/2023 21:00	25	No	NA	NA	NA	NA	NA	Nil	NA
South Bulga	6/10/2023 0:37	<25	No	NA	NA	NA	NA	NA	Nil	NA
Wambo Road	5/10/2023 22:22	<20	Yes	No	No	NA	No	No	Nil	NA
Bulga RFS	6/11/2023 23:02	31	Yes	No	No	NA	No	NA	Nil	NA
Bulga Village	6/11/2023 22:14	36	No	NA	NA	NA	NA	NA	Nil	NA
Gouldsville	6/11/2023 21:22	33	No	NA	NA	NA	NA	NA	Nil	NA
Inlet Rd	6/11/2023 21:24	35	No	NA	NA	NA	NA	NA	Nil	NA
Inlet Rd West	6/11/2023 21:00	32	No	NA	NA	NA	NA	NA	Nil	NA
Long Point	6/11/2023 21:00	IA	No	NA	NA	NA	NA	NA	Nil	NA

Location	Date and Time	Measured WML LAeq dB[1]	Criterion Applies?	Intermittency Modifying Factor?	Tonality Modifying Factor?	Frequency of Tonality[2]	Low-frequency Modifying Factor?	Maximum Exceedance of Reference Spectrum [2,3]	Penalty dB[3]	Exceedance
South Bulga	6/11/2023 23:53	<30	Yes	No	No	NA	No	NA	Nil	NA
Wambo Road	6/11/2023 21:50	34	No	NA	NA	NA	NA	NA	Nil	NA
Bulga RFS	18/12/2023 23:47	<30	No	NA	NA	NA	NA	NA	Nil	NA
Bulga Village	18/12/2023 23:02	<30	No	NA	NA	NA	NA	NA	Nil	NA
Gouldsville	18/12/2023 21:25	IA	No	NA	NA	NA	NA	NA	Nil	NA
Inlet Rd	18/12/2023 21:22	32	No	NA	NA	NA	NA	NA	Nil	NA
Inlet Rd West	18/12/2023 21:00	33	No	NA	NA	NA	NA	NA	Nil	NA
Long Point	18/12/2023 21:03	IA	No	NA	NA	NA	NA	NA	Nil	NA
South Bulga	19/12/2023 0:08	<30	Yes	No	No	NA	No	NA	Nil	NA
Wambo Road	18/12/2023 21:46	<30	Yes	No	No	NA	No	NA	Nil	NA

Notes:
1. IA denotes 'Inaudible';
2. NA denotes 'not applicable';

Table 6: Mount Thorley Operations Low Frequency Noise Assessment – 2022

Location	Date and Time	Measured WML LAeq dB[1]	Criterion Applies?	Intermittency Modifying Factor?	Tonality Modifying Factor?	Frequency of Tonality[2]	Low-frequency Modifying Factor?	Maximum Exceedance of Reference Spectrum [2,3]	Penalty dB[3]	Exceedance
Bulga RFS	17/01/2023 22:50	IA	No	NA	NA	NA	NA	NA	Nil	NA
Bulga Village	17/01/2023 22:12	IA	Yes	No	No	NA	No	NA	Nil	NA
Gouldsville	17/01/2023 21:23	IA	No	NA	NA	NA	NA	NA	Nil	NA
Inlet Rd	17/01/2023 21:22	31	No	NA	NA	NA	NA	NA	Nil	NA
Inlet Rd West	17/01/2023 21:04	NM	No	NA	NA	NA	NA	NA	Nil	NA
Long Point	17/01/2023 21:00	IA	No	NA	NA	NA	NA	NA	Nil	NA
South Bulga	17/01/2023 23:33	30	No	NA	NA	NA	NA	NA	Nil	NA
Wambo Road	17/01/2023 21:48	IA	No	NA	NA	NA	NA	NA	Nil	NA
Bulga RFS	20/02/2023 22:54	<30	Yes	No	No	NA	No	NA	Nil	NA
Bulga Village	20/02/2023 22:15	IA	Yes	No	No	NA	No	NA	Nil	NA
Gouldsville	20/02/2023 21:25	IA	No	NA	NA	NA	NA	NA	Nil	NA
Inlet Rd	20/02/2023 21:23	IA	No	NA	NA	NA	NA	NA	Nil	NA
Inlet Rd West	20/02/2023 21:00	<30	No	NA	NA	NA	NA	NA	Nil	NA
Long Point	20/02/2023 21:00	IA	No	NA	NA	NA	NA	NA	Nil	NA
South Bulga	20/02/2023 23:39	<30	Yes	No	No	NA	No	NA	Nil	NA
Wambo Road	20/02/2023 21:56	IA	No	NA	NA	NA	NA	NA	Nil	NA
Bulga RFS	16/03/2023 23:02	27	Yes	No	No	NA	No	NA	Nil	NA
Bulga Village	16/03/2023 22:17	IA	Yes	No	No	NA	No	NA	Nil	NA
Gouldsville	16/03/2023 21:26	IA	Yes	No	No	NA	No	NA	Nil	NA
Inlet Rd	16/03/2023 21:31	IA	Yes	No	No	NA	No	NA	Nil	NA
Inlet Rd West	16/03/2023 21:09	IA	Yes	No	No	NA	No	NA	Nil	NA

Location	Date and Time	Measured WML LAeq dB[1]	Criterion Applies?	Intermittency Modifying Factor?	Tonality Modifying Factor?	Frequency of Tonality[2]	Low-frequency Modifying Factor?	Maximum Exceedance of Reference Spectrum [2,3]	Penalty dB[3]	Exceedance
Long Point	16/03/2023 21:00	23	Yes	No	No	NA	No	NA	Nil	NA
South Bulga	16/03/2023 22:41	26	Yes	No	No	NA	No	NA	Nil	NA
Wambo Road	16/03/2023 21:56	IA	Yes	No	No	NA	No	NA	Nil	NA
Bulga RFS	17/04/2023 22:48	31	Yes	No	No	NA	No	NA	Nil	NA
Bulga Village	17/04/2023 22:05	33	Yes	No	No	NA	No	NA	Nil	NA
Gouldsville	17/04/2023 21:24	IA	Yes	No	No	NA	No	NA	Nil	NA
Inlet Rd	17/04/2023 21:31	33	Yes	No	No	NA	No	NA	Nil	NA
Inlet Rd West	17/04/2023 21:09	33	Yes	No	No	NA	No	NA	Nil	NA
Long Point	17/04/2023 21:00	IA	Yes	No	No	NA	No	NA	Nil	NA
South Bulga	17/04/2023 22:41	<30	Yes	No	No	NA	No	NA	Nil	NA
Wambo Road	17/04/2023 21:56	31	Yes	No	No	NA	No	NA	Nil	NA
Bulga RFS	4/05/2023 23:01	35	Yes	No	No	NA	Yes	**2 dB @ 80 Hz**	**2**	No
Bulga Village	4/05/2023 22:08	35	Yes	No	No	NA	Yes	**2 dB @ 80 Hz**	**2**	No
Gouldsville	4/05/2023 21:21	IA	Yes	No	No	NA	No	NA	Nil	NA
Inlet Rd	4/05/2023 21:43	32	Yes	No	No	NA	No	NA	Nil	NA
Inlet Rd West	4/05/2023 21:15	31	Yes	No	No	NA	No	NA	Nil	NA
Long Point	4/05/2023 21:00	IA	Yes	No	No	NA	No	NA	Nil	NA
South Bulga	10/05/2023 21:36	IA	Yes	No	No	NA	No	NA	Nil	NA
Wambo Road	4/05/2023 22:34	IA	Yes	No	No	NA	No	NA	Nil	NA
Bulga RFS	1/06/2023 22:53	34	Yes	No	No	NA	Yes	NA	Nil	NA
Bulga Village	1/06/2023 22:06	<30	Yes	No	No	NA	Yes	NA	Nil	NA
Gouldsville	1/06/2023 21:21	IA	Yes	No	No	NA	No	NA	Nil	NA

Location	Date and Time	Measured WML LAeq dB[1]	Criterion Applies?	Intermittency Modifying Factor?	Tonality Modifying Factor?	Frequency of Tonality[2]	Low-frequency Modifying Factor?	Maximum Exceedance of Reference Spectrum [2,3]	Penalty dB[3]	Exceedance
Inlet Rd	1/06/2023 21:21	IA	Yes	No	No	NA	No	NA	Nil	NA
Inlet Rd West	1/06/2023 21:00	IA	Yes	No	No	NA	No	NA	Nil	NA
Long Point	1/06/2023 21:00	IA	Yes	No	No	NA	No	NA	Nil	NA
South Bulga	1/06/2023 23:34	<30	Yes	No	No	NA	No	NA	Nil	NA
Wambo Road	1/06/2023 21:46	IA	Yes	No	No	NA	No	NA	Nil	NA
Bulga RFS	19/07/2023 23:28	36	Yes	No	No	NA	Yes	NA	Nil	NA
Bulga Village	19/07/2023 22:33	32	Yes	No	No	NA	Yes	NA	Nil	NA
Gouldsville	19/07/2023 21:21	IA	Yes	No	No	NA	No	NA	Nil	NA
Inlet Rd	19/07/2023 21:34	<30	Yes	No	No	NA	No	NA	Nil	NA
Inlet Rd West	19/07/2023 21:10	<30	Yes	No	No	NA	No	NA	Nil	NA
Long Point	19/07/2023 21:00	IA	Yes	No	No	NA	No	NA	Nil	NA
South Bulga	19/07/2023 23:58	<30	Yes	No	No	NA	No	NA	Nil	NA
Wambo Road	19/07/2023 22:07	IA	Yes	No	No	NA	No	NA	Nil	NA
Bulga RFS	7/08/2023 23:04	25	Yes	No	No	NA	Yes	NA	Nil	NA
Bulga Village	7/08/2023 22:22	28	Yes	No	No	NA	Yes	NA	Nil	NA
Gouldsville	7/08/2023 21:21	IA	Yes	No	No	NA	No	NA	Nil	NA
Inlet Rd	7/08/2023 21:35	29	Yes	No	No	NA	No	NA	Nil	NA
Inlet Rd West	7/08/2023 21:12	30	Yes	No	No	NA	No	NA	Nil	NA
Long Point	7/08/2023 21:00	IA	Yes	No	No	NA	No	NA	Nil	NA
South Bulga	7/08/2023 23:52	IA	Yes	No	No	NA	No	NA	Nil	NA
Wambo Road	7/08/2023 22:00	IA	Yes	No	No	NA	No	NA	Nil	NA
Bulga RFS	6/09/2023 23:35	33	Yes	No	No	NA	No	NA	Nil	NA

Location	Date and Time	Measured WML LAeq dB[1]	Criterion Applies?	Intermittency Modifying Factor?	Tonality Modifying Factor?	Frequency of Tonality[2]	Low-frequency Modifying Factor?	Maximum Exceedance of Reference Spectrum [2,3]	Penalty dB[3]	Exceedance
Bulga Village	6/09/2023 22:45	IA	No	NA	NA	NA	NA	NA	Nil	NA
Gouldsville	6/09/2023 21:21	IA	No	NA	NA	NA	NA	NA	Nil	NA
Inlet Rd	6/09/2023 21:39	IA	No	NA	NA	NA	NA	NA	Nil	NA
Inlet Rd West	6/09/2023 21:03	<30	Yes	No	No	NA	No	NA	Nil	NA
Long Point	6/09/2023 21:00	IA	Yes	No	No	NA	No	NA	Nil	NA
South Bulga	7/09/2023 0:27	IA	Yes	No	No	NA	No	NA	Nil	NA
Wambo Road	6/09/2023 22:19	IA	No	NA	NA	NA	NA	NA	Nil	NA
Wambo Road[4]	6/09/2023 23:35	33	Yes	No	No	NA	No	NA	Nil	NA
Bulga RFS	5/10/2023 23:43	IA	Yes	No	No	NA	No	NA	Nil	NA
Bulga Village	5/10/2023 22:44	IA	No	NA	NA	NA	NA	NA	Nil	NA
Gouldsville	5/10/2023 21:21	IA	No	NA	NA	NA	NA	NA	Nil	NA
Inlet Rd	5/10/2023 21:58	IA	No	NA	NA	NA	NA	NA	Nil	NA
Inlet Rd West	5/10/2023 21:32	IA	No	NA	NA	NA	NA	NA	Nil	NA
Long Point	5/10/2023 21:00	IA	No	NA	NA	NA	NA	NA	Nil	NA
South Bulga	6/10/2023 0:37	<25	No	NA	NA	NA	NA	NA	Nil	NA
Wambo Road	5/10/2023 22:22	IA	Yes	No	No	NA	No	No	Nil	NA
Bulga RFS	6/11/2023 23:02	30	Yes	No	No	NA	No	NA	Nil	NA
Bulga Village	6/11/2023 22:14	<30	No	NA	NA	NA	NA	NA	Nil	NA
Gouldsville	6/11/2023 21:22	IA	No	NA	NA	NA	NA	NA	Nil	NA
Inlet Rd	6/11/2023 21:24	<25	No	NA	NA	NA	NA	NA	Nil	NA
Inlet Rd West	6/11/2023 21:00	IA	No	NA	NA	NA	NA	NA	Nil	NA
Long Point	6/11/2023 21:00	IA	No	NA	NA	NA	NA	NA	Nil	NA

Location	Date and Time	Measured WML LAeq dB[1]	Criterion Applies?	Intermittency Modifying Factor?	Tonality Modifying Factor?	Frequency of Tonality[2]	Low-frequency Modifying Factor?	Maximum Exceedance of Reference Spectrum [2,3]	Penalty dB[3]	Exceedance
South Bulga	6/11/2023 23:53	32	Yes	No	No	NA	No	NA	Nil	NA
Wambo Road	6/11/2023 21:50	IA	No	NA	NA	NA	NA	NA	Nil	NA
Bulga RFS	18/12/2023 23:47	32	No	NA	NA	NA	NA	NA	Nil	NA
Bulga Village	18/12/2023 23:02	<25	No	NA	NA	NA	NA	NA	Nil	NA
Gouldsville	18/12/2023 21:25	IA	No	NA	NA	NA	NA	NA	Nil	NA
Inlet Rd	18/12/2023 21:22	<30	No	NA	NA	NA	NA	NA	Nil	NA
Inlet Rd West	18/12/2023 21:00	<30	No	NA	NA	NA	NA	NA	Nil	NA
Long Point	18/12/2023 21:03	IA	No	NA	NA	NA	NA	NA	Nil	NA
South Bulga	19/12/2023 0:08	28	Yes	No	No	NA	No	NA	Nil	NA
Wambo Road	18/12/2023 21:46	<30	Yes	No	No	NA	No	NA	Nil	NA

Notes:
1. IA denotes 'Inaudible';
2. NA denotes 'not applicable';
3. Bold results indicate that application of NPfI modifying factor/s is required;

Figure 1: Noise Monitoring Location Plan

Appendix 2:

Summary of 24 Hour PM10 Exceedance Investigations

Summary of 24 Hour PM_{10} Exceedance Investigations

Yancoal Mt Thorley Warkworth

2023

TABLE 1 24 HOUR PM_{10} INVESTIGATIONS - 2023

Date	Site	24hr PM_{10} result ($\mu g/m^3$)	Maximum Estimated contribution from MTW ($\mu g/m^3$)	Discussion
24/01/2023	Warkworth TEOM	54.6	33.6	An analysis of meteorological data and background PM10 levels has determined the maximum potential MTW contribution to the result to be in the order of 33.6µg/m3 or ~62% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
27/01/2023	Warkworth TEOM	50.3	27.9	An analysis of meteorological data and background PM10 levels has determined the maximum potential MTW contribution to the result to be in the order of 27.9µg/m3 or ~56% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
06/02/2023	Warkworth TEOM	55.5	33.7	An analysis of meteorological data and background PM10 levels has determined the maximum potential MTW contribution to the result to be in the order of 33.7µg/m3 or ~61% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
06/03/2023	Warkworth TEOM	54.1	12.3	An analysis of meteorological data has determined the maximum potential MTW contribution to the result to be in the order of 12.3µg/m3 or ~29% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.

Date	Site	24hr PM_{10} result ($\mu g/m^3$)	Maximum Estimated contribution from MTW ($\mu g/m^3$)	Discussion
07/03/2023	Warkworth TEOM	63.1	0.0	An analysis of meteorological data has determined that the wind direction was not from MTW's angle of influence and so that MTW was not a contributor to the result.
08/03/2023	Warkworth TEOM	56.5	0.0	An analysis of meteorological data has determined that the wind direction was not from MTW's angle of influence and so that MTW was not a contributor to the result.
20/03/2023	Warkworth TEOM	60.7	33.3	An analysis of meteorological data and background PM10 levels has determined the maximum potential MTW contribution to the result to be in the order of 33.3µg/m3 or ~60% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
25/05/2023	Warkworth TEOM	54.8	0.4	An analysis of meteorological data has determined the maximum potential MTW contribution to the result to be in the order of 0.4µg/m3 or ~1% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
31/05/2023	Warkworth TEOM	50.8	0.0	An analysis of meteorological data has determined that the wind direction was not from MTW's angle of influence and so that MTW was not a contributor to the result.

Date	Site	24hr PM_{10} result ($\mu g/m^3$)	Maximum Estimated contribution from MTW ($\mu g/m^3$)	Discussion
07/09/2023	Warkworth TEOM	53.5	6.2	An analysis of meteorological data and background PM10 levels has determined the maximum potential MTW contribution to the result to be in the order of 6.2µg/m3 or ~12% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
07/09/2023	Bulga TEOM	51.1	26.8	An analysis of meteorological data has determined the maximum potential MTW contribution to the result to be in the order of 26.8µg/m3 or ~53% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
16/09/2023	Warkworth TEOM	59.2	1.1	An analysis of meteorological data has determined the maximum potential MTW contribution to the result to be in the order of 1.1µg/m3 or ~2% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
17/09/2023	Warkworth TEOM	51.9	15.1	An analysis of meteorological data has determined the maximum potential MTW contribution to the result to be in the order of 15.1µg/m3 or ~30% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.

Date	Site	24hr PM_{10} result ($\mu g/m^3$)	Maximum Estimated contribution from MTW ($\mu g/m^3$)	Discussion
18/09/2023	Warkworth TEOM	50.9	13.1	An analysis of meteorological data has determined the maximum potential MTW contribution to the result to be in the order of 13.1µg/m3 or ~26% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
19/09/2023	Warkworth TEOM	93.6	1.3	An analysis of meteorological data has determined the maximum potential MTW contribution to the result to be in the order of 1.3µg/m3 or ~2% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
20/09/2023	Warkworth TEOM	93.6	11.8	An analysis of meteorological data has determined the maximum potential MTW contribution to the result to be in the order of 11.8µg/m3 or ~13% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
01/10/2023	Warkworth TEOM	74.7	2.4	An analysis of meteorological data has determined the maximum potential MTW contribution to the result to be in the order of 2.4µg/m3 or ~4% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.

Date	Site	24hr PM_{10} result ($\mu g/m^3$)	Maximum Estimated contribution from MTW ($\mu g/m^3$)	Discussion
02/10/2023	Wambo Road TEOM	55.8	10.8	An analysis of meteorological data and background PM10 levels has determined the maximum potential MTW contribution to the result to be in the order of 10.8µg/m3 or ~20% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
02/10/2023	Warkworth TEOM	65.7	22.1	An analysis of meteorological data and background PM10 levels has determined the maximum potential MTW contribution to the result to be in the order of 22.1µg/m3 or ~34% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
03/10/2023	Warkworth TEOM	63.3	6.4	An analysis of meteorological data has determined the maximum potential MTW contribution to the result to be in the order of 6.4µg/m3 or ~11% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
04/10/2023	Warkworth TEOM	62.6	0.0	An analysis of meteorological data has determined that the wind direction was not from MTW's angle of influence and so that MTW was not a contributor to the result.

Date	Site	24hr PM_{10} result ($\mu g/m^3$)	Maximum Estimated contribution from MTW ($\mu g/m^3$)	Discussion
16/10/2023	Warkworth TEOM	54.8	4.1	An analysis of meteorological data has determined the maximum potential MTW contribution to the result to be in the order of 4.1µg/m3 or ~8% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
21/10/2023	Warkworth TEOM	55.7	19.3	An analysis of meteorological data and background PM10 levels has determined the maximum potential MTW contribution to the result to be in the order of 19.3µg/m3 or ~35% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
22/10/2023	Warkworth TEOM	70.4	7.3	An analysis of meteorological data has determined the maximum potential MTW contribution to the result to be in the order of 7.3µg/m3 or ~11% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
23/10/2023	Warkworth TEOM	55.1	11.1	An analysis of meteorological data has determined the maximum potential MTW contribution to the result to be in the order of 11.1µg/m3 or ~21% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.

Date	Site	24hr PM_{10} result ($\mu g/m^3$)	Maximum Estimated contribution from MTW ($\mu g/m^3$)	Discussion
24/10/2023	Warkworth TEOM	53.7	12.0	An analysis of meteorological data has determined the maximum potential MTW contribution to the result to be in the order of 12.0µg/m3 or ~23% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
25/10/2023	Warkworth TEOM	65.2	14.5	An analysis of meteorological data has determined the maximum potential MTW contribution to the result to be in the order of 14.5µg/m3 or ~23% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
30/10/2023	Warkworth TEOM	54.9	3.4	An analysis of meteorological data has determined the maximum potential MTW contribution to the result to be in the order of 3.4µg/m3 or ~7% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
31/10/2023	Warkworth TEOM	73.8	23.3	An analysis of meteorological data has determined the maximum potential MTW contribution to the result to be in the order of 23.3µg/m3 or ~32% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.

Date	Site	24hr PM_{10} result ($\mu g/m^3$)	Maximum Estimated contribution from MTW ($\mu g/m^3$)	Discussion
12/11/2023	Warkworth TEOM	57.8	13.0	An analysis of meteorological data has determined the maximum potential MTW contribution to the result to be in the order of 13µg/m3 or ~23% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
14/11/2023	Warkworth TEOM	53.4	20.0	An analysis of meteorological data and background PM10 levels has determined the maximum potential MTW contribution to the result to be in the order of 20µg/m3 or ~38% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
19/11/2023	Warkworth TEOM	57.4	26.5	An analysis of meteorological data and background PM10 levels has determined the maximum potential MTW contribution to the result to be in the order of 26.5µg/m3 or ~46% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
06/12/2023	Wambo Road TEOM	51.3	4.8	An analysis of meteorological data and background PM10 levels has determined the maximum potential MTW contribution to the result to be in the order of 4.8µg/m3 or ~10% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.

Date	Site	24hr PM_{10} result ($\mu g/m^3$)	Maximum Estimated contribution from MTW ($\mu g/m^3$)	Discussion
06/12/2023	Warkworth TEOM	52.8	5.7	An analysis of meteorological data and background PM10 levels has determined the maximum potential MTW contribution to the result to be in the order of 5.7µg/m3 or ~11% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
07/12/2023	Bulga TEOM	53.2	23.4	An analysis of meteorological data and background PM10 levels has determined the maximum potential MTW contribution to the result to be in the order of 23.4µg/m3 or ~44% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
07/12/2023	Wambo Road TEOM	66.2	35.2	An analysis of meteorological data and background PM10 levels has determined the maximum potential MTW contribution to the result to be in the order of 35.2µg/m3 or ~53% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
09/12/2023	Warkworth TEOM	51.3	7.0	An analysis of meteorological data and background PM10 levels has determined the maximum potential MTW contribution to the result to be in the order of 7µg/m3 or ~16% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.

Date	Site	24hr PM_{10} result ($\mu g/m^3$)	Maximum Estimated contribution from MTW ($\mu g/m^3$)	Discussion
10/12/2023	Warkworth TEOM	60.2	39.7	An analysis of meteorological data and background PM10 levels has determined the maximum potential MTW contribution to the result to be in the order of 39.7µg/m3 or ~66% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
11/12/2023	Warkworth TEOM	58.4	23.1	An analysis of meteorological data and background PM10 levels has determined the maximum potential MTW contribution to the result to be in the order of 23.1µg/m3 or ~40% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
14/12/2023	Warkworth TEOM	53.5	4.6	An analysis of meteorological data has determined the maximum potential MTW contribution to the result to be in the order of 4.6µg/m3 or ~9% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
15/12/2023	Warkworth TEOM	50.2	9.6	An analysis of meteorological data and background PM10 levels has determined the maximum potential MTW contribution to the result to be in the order of 9.6µg/m3 or ~19% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.

Date	Site	24hr PM_{10} result ($\mu g/m^3$)	Maximum Estimated contribution from MTW ($\mu g/m^3$)	Discussion
16/12/2023	Warkworth TEOM	58.4	24.1	An analysis of meteorological data has determined the maximum potential MTW contribution to the result to be in the order of 24.1µg/m3 or ~41% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
17/12/2023	Warkworth TEOM	54.9	25.3	An analysis of meteorological data and background PM10 levels has determined the maximum potential MTW contribution to the result to be in the order of 25.3µg/m3 or ~46% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
18/12/2023	Warkworth TEOM	57.7	18.2	An analysis of meteorological data and background PM10 levels has determined the maximum potential MTW contribution to the result to be in the order of 18.2µg/m3 or ~32% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.
19/12/2023	Warkworth TEOM	60.1	11.5	An analysis of meteorological data and background PM10 levels has determined the maximum potential MTW contribution to the result to be in the order of 11.5µg/m3 or ~19% of the measured result. As the calculated contribution was less than 75% of the measured result, MTW operations are not considered to be a significant contributor to the result, as described in the MTW Air Quality Management Plan.

Appendix 3:

Aboriginal Heritage Management Plan Compliance Inspection Report

Mount Thorley Warkworth Aboriginal Heritage Management Plan 2023 Compliance Audit Inspection

Report prepared for

Yancoal Australia, Mount Thorley Warkworth

January 2024

Joel Deacon

ARROW
HERITAGE SOLUTIONS

Introduction

Yancoal Australia (Yancoal) manage the Mount Thorley Warkworth (MTW) mining complex located in the Hunter Valley, approximately 8km south-west of Singleton. Approval for the continuation and expansion of the mine was granted on 26 November 2015 under two separate project approvals: the Warkworth Continuation Project Approval (SSD-6464) and the Mount Thorley Operations Project Approval (SSD-6465).

Pursuant to Condition 43 of the Warkworth Continuation Project Approval and Condition 28 of the Mount Thorley Operations Project Approval, Yancoal developed an Aboriginal Heritage Management Plan (AHMP) to cover both mining operations which was first approved by the Department of Planning and Environment on 29 May 2017 and, most recently, on 12 August 2022 (Version 4.0). This AHMP sets out the principles, processes and measures through which Aboriginal cultural heritage (ACH) will be managed within the AHMP Area. This includes a commitment (Provision 25) to conduct annual AHMP compliance inspections with members of the Aboriginal community, through the auspices of the MTW Aboriginal Cultural Heritage Working Group (CHWG), throughout the life of operations. The purpose of the compliance inspections is to afford the Aboriginal stakeholders and MTW:

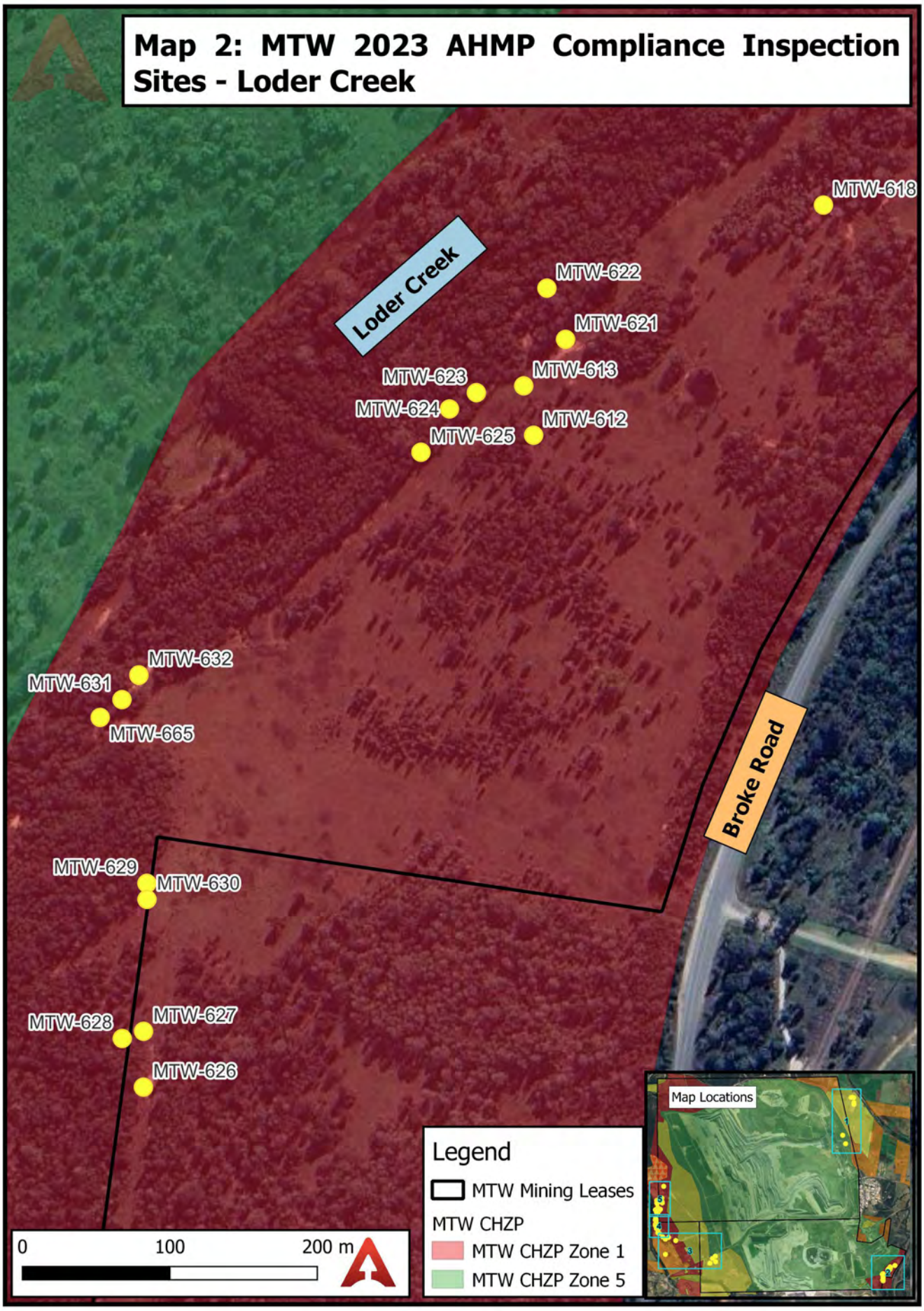
- the opportunity to visit mine operations and mine areas to inspect the operational compliance with AHMP provisions and Ground Disturbance Permit procedures;
- to inspect and monitor the condition and management of various sites over time; and
- to review the effectiveness and performance of AHMP provisions in the management of cultural heritage at the mine.

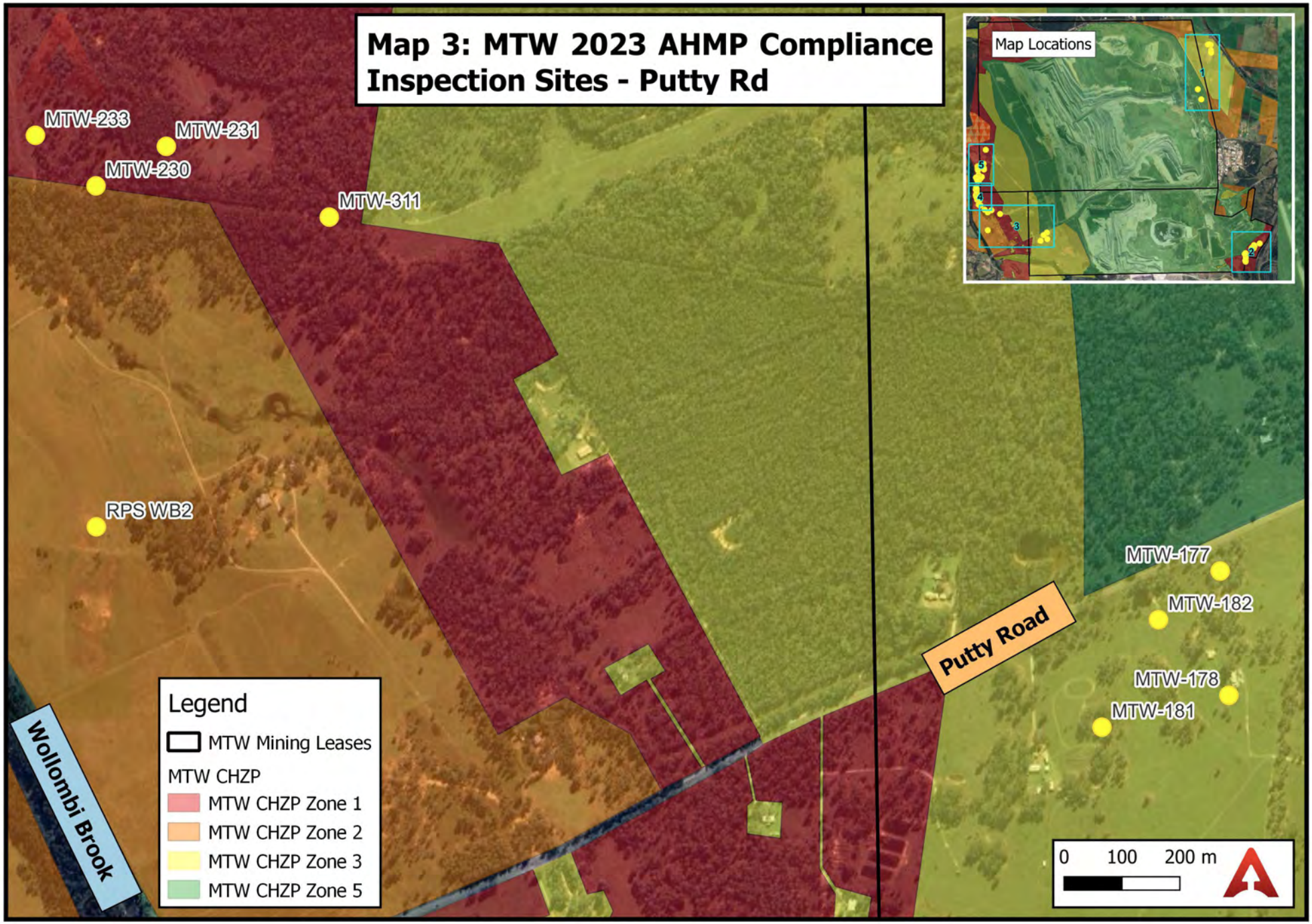
These compliance inspections are conducted at least annually. Due to the number of ACH sites at MTW and the time required to inspect all sites it is not feasible to inspect every site during the same field trip. Therefore, an annual, rolling program of compliance inspections has been implemented that will visit all sites progressively over a number of years. A record will be kept of each compliance inspection so that it can be ensured that each site is inspected regularly.

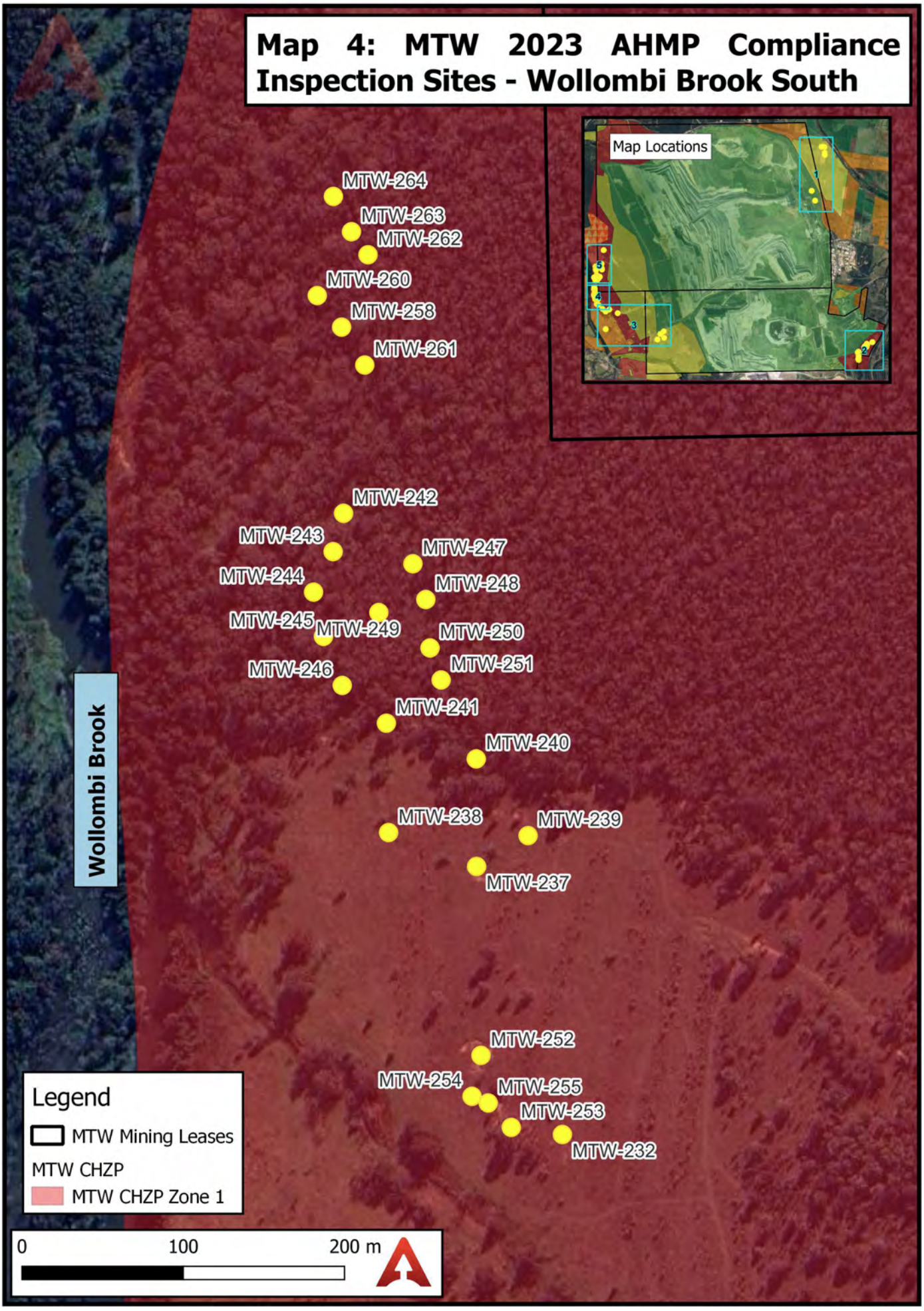
Proposed Activity and Project Brief

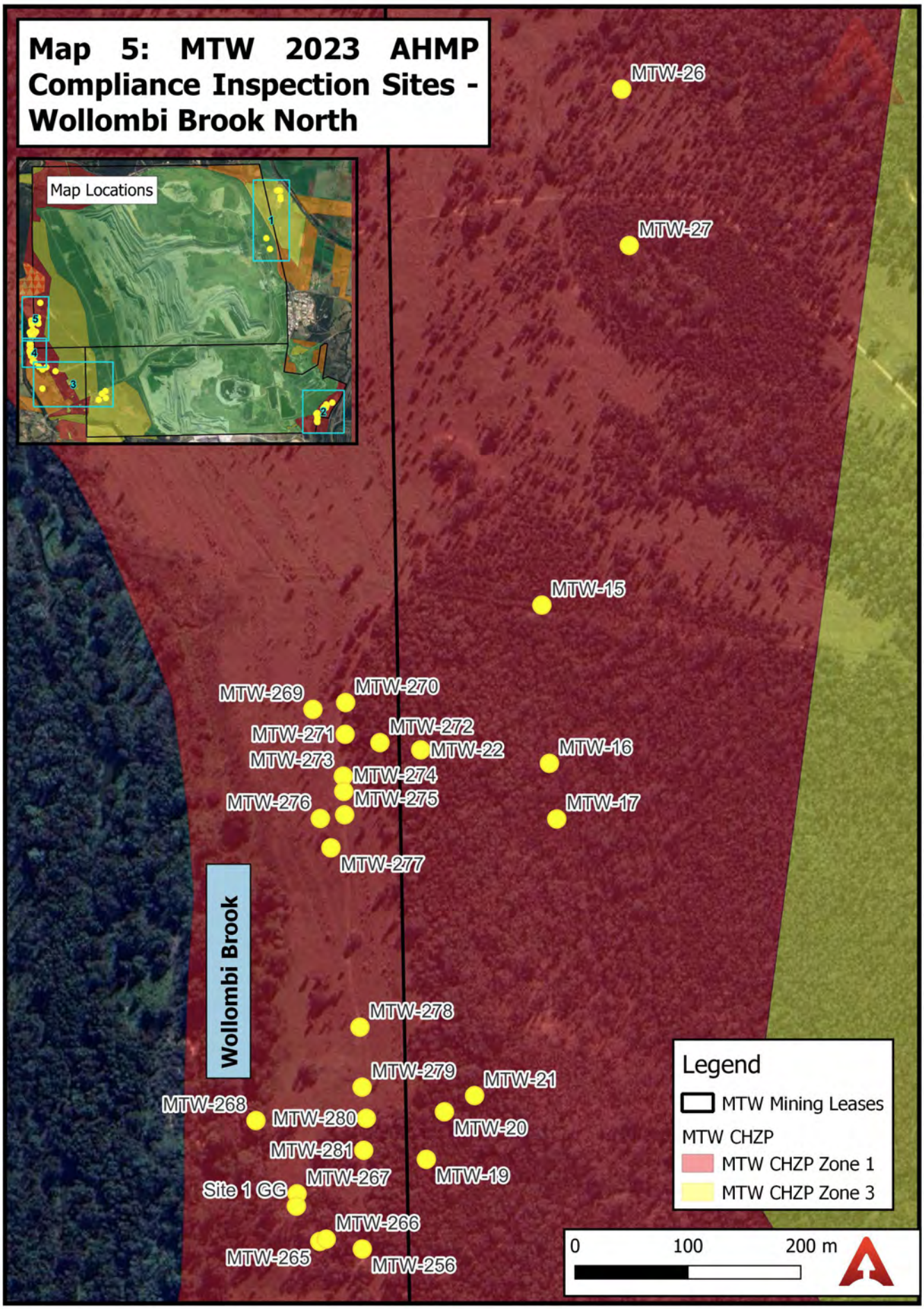
The 2023 compliance audit involved the inspection of 85 ACH sites across MTW lands. At each site an AHMP compliance inspection proforma was completed noting evidence of compliance or non-compliance with AHMP provisions, recommendations on modifications and improvements to management provisions, and recommendations on corrective actions. A photographic record was also completed for the inspected ACH sites.


Map 1: MTW 2023 AHMP Compliance Inspection Sites - Warkworth East
MTW-431
MTW-450
MTW-449
MTW-462
MTW-486
Hunter River
Golden Highway
Wark-2
Wark-1
Legend
MTW Mining Leases
MTW CHZP
MTW CHZP Zone 2
MTW CHZP Zone 3
MTW CHZP Zone 5
0
250
500 m
Map Locations


Map 2: MTW 2023 AHMP Compliance Inspection Sites - Loder Creek
MTW-618
Loder Creek
MTW-622
MTW-621
MTW-623
MTW-613
MTW-624
MTW-612
MTW-625
MTW-632
MTW-631
MTW-665
Broke Road
MTW-629
MTW-630
MTW-628
MTW-627
MTW-626
Map Locations
Legend
MTW Mining Leases
MTW CHZP
MTW CHZP Zone 1
MTW CHZP Zone 5
0
100
200 m


Map 3: MTW 2023 AHMP Compliance Inspection Sites - Putty Rd
Map Locations
MTW-233
MTW-231
MTW-230
MTW-311
RPS WB2
MTW-177
MTW-182
MTW-178
MTW-181
Putty Road
Wollombi Brook
Legend
MTW Mining Leases
MTW CHZP
MTW CHZP Zone 1
MTW CHZP Zone 2
MTW CHZP Zone 3
MTW CHZP Zone 5
0
100
200 m


Map 4: MTW 2023 AHMP Compliance Inspection Sites - Wollombi Brook South
Map Locations
MTW-264
MTW-263
MTW-262
MTW-260
MTW-258
MTW-261
MTW-242
MTW-243
MTW-247
MTW-244
MTW-248
MTW-245
MTW-249
MTW-250
MTW-246
MTW-251
MTW-241
MTW-240
MTW-238
MTW-239
MTW-237
MTW-252
MTW-254
MTW-255
MTW-253
MTW-232
Wollombi Brook
Legend
MTW Mining Leases
MTW CHZP
MTW CHZP Zone 1
0
100
200 m


Map 5: MTW 2023 AHMP Compliance Inspection Sites - Wollombi Brook North
Map Locations
1
2
3
4
5
MTW-26
MTW-27
MTW-15
MTW-16
MTW-17
MTW-269
MTW-270
MTW-271
MTW-272
MTW-273
MTW-22
MTW-274
MTW-275
MTW-276
MTW-277
Wollombi Brook
MTW-278
MTW-279
MTW-21
MTW-268
MTW-280
MTW-20
MTW-281
MTW-19
MTW-267
Site 1 GG
MTW-266
MTW-265
MTW-256
Legend
MTW Mining Leases
MTW CHZP
MTW CHZP Zone 1
MTW CHZP Zone 3
0
100
200 m

Timing & Personnel

The 2023 MTW AHMP compliance inspection program was conducted on Tuesday 5th and Wednesday 6th December 2023. The personnel involved in these inspections were:

Name	Position/Organisation
Joel Deacon	Archaeologist, Arrow Heritage Solutions
Robert Carter	Environment and Community Advisor
Luke Hickey	CHWG representative
Joshua Hickey	CHWG representative

Arrow Heritage Solutions were engaged as independent heritage consultants to conduct the AHMP compliance inspections, and Joel Deacon acted as technical advisor and author of this report. MTW Environment and Community Advisor Robert Carter arranged the compliance inspection programs and escorted the field team. CHWG representatives from Wattaka and Hunter Valley Cultural Surveying participated in the field work program.

MTW AHMP Compliance Inspection

A total of 88 ACH sites were inspected across both the Warkworth and the Mount Thorley operations (see Maps 1 through 5). The inspection areas were selected for as they were either located adjacent to current development areas, within areas subject to agricultural leasing arrangements, near to tracks that may be accessed by MTW personnel and contractors, or within conservation areas that are currently managed for the protection of ACH values.

Methodology & Results

Table 1 shows the results of the 2024 MTW compliance inspection and summarises the information recorded on the individual proforma inspection sheets. Using a mobile mapping device pre-loaded with the GIS co-ordinates for each ACH site, the field team travelled to each location and attempted to re-locate each site. Sometimes this was not possible due to poor ground surface visibility (GSV), a result which, in itself, was not overly significant as long as it was determined that the vicinity had not been disturbed. The presence and condition of barricading or fencing was noted, as well as the presence and nature of various potential site disturbing factors (e.g. erosion, animal, human). Pertinent observations of each site were made and, based on information provided for all the above factors, management recommendations were discussed and agreed by the field team for each site if necessary.

Site Name	Date	Mine	Site re-identified?	Site intact?	Site fenced/ barricaded?	Fencing/ barricading intact?	Natural erosion	Livestock damage	Human disturbance	Animal disturbance	Pests & weeds	General observations	Management recommendations
MTW-15	6/12/23	MTW	Yes	No	Yes	Yes	No	No	On edge of track	No	No		
MTW-16	6/12/23	MTW	Yes	Yes	No	-	No	No	No	No	No		
MTW-17	6/12/23	MTW	No	Yes	No	-	No	No	No	No	No	Heavy leaf litter	
MTW-19	6/12/23	MTW	Yes	Yes	No	-	No	No	No	No	No	Flaked bottle base – rare	
MTW-20	6/12/23	MTW	No	Yes	No	-	No	No	No	No	No	Heavy leaf litter	
MTW-21	6/12/23	MTW	No	Yes	No	-	No	No	No	No	No	Heavy leaf litter	
MTW-22	6/12/23	MTW	Yes	Yes	No	-	No	No	No	No	No		
MTW-26	6/12/23	MTW	Yes	Yes	No	-	No	No	No	No	No		
MTW-27	6/12/23	MTW	No	Yes	No	-	No	No	No	No	No		
MTW-28	6/12/23	MTW	No	Yes	No	-	No	No	No	No	No		
MTW-177	5/12/23	MTO	No	Yes	Yes	No	No	No	On old track	No	No		
MTW-178	5/12/23	MTO	No	Yes	Yes	Yes	No	No	On old rubbish ditch	No	No		Remove any rubbish by hand
MTW-181	5/12/23	MTO	Yes	Yes	No	-	No	No	No	No	No	Scarred tree	Install hard fence
MTW-182	5/12/23	MTO	No	Yes	Yes	Yes	No	No	No	No	No		
MTW-230	6/12/23	MTW	Yes	Yes	No	-	Wash across track	No	On old track	No	No		Barricade to re-route track
MTW-231	6/12/23	MTW	No	Yes	No	-	No	No	No	No	No		
MTW-232	6/12/23	MTW	No	Yes	Yes	No	On erosion scour	No	No	No	No	In replanting maintenance area	Re-barricade with delineation posts
MTW-233	6/12/23	MTW	Yes	Yes	Yes	No	No	No	No	No	No		
MTW-237	6/12/23	MTW	Yes	Yes	Yes	No	No	No	On old scrape	No	No		Re-barricade
MTW-238	6/12/23	MTW	No	Yes	Yes	No	No	No	On old dam	No	No		Re-barricade
MTW-239	6/12/23	MTW	No	Yes	Yes	No	No	No	No	No	No	Thick vegetation	Re-barricade
MTW-240	6/12/23	MTW	Yes	Yes	No	-	No	No	On old track	No	No	Heavy leaf litter	
MTW-241	6/12/23	MTW	No	Yes	No	-	No	No	On old track	No	No	Heavy leaf litter	
MTW-242	6/12/23	MTW	Yes	Yes	No	-	No	No	On old track	No	No		
MTW-243	6/12/23	MTW	No	Yes	No	-	No	No	On old track	No	No		
MTW-244	6/12/23	MTW	Yes	Yes	No	-	No	No	No	No	No		

Site Name	Date	Mine	Site re-identified?	Site intact?	Site fenced/ barricaded?	Fencing/ barricading intact?	Natural erosion	Livestock damage	Human disturbance	Animal disturbance	Pests & weeds	General observations	Management recommendations
MTW-245	6/12/23	MTW	No	Yes	No	-	No	No	On old track	No	No		
MTW-246	6/12/23	MTW	Yes	Yes	No	-	No	No	On old track	No	No	More found	Extend extent to 313924e 6387639n
MTW-247	6/12/23	MTW	Yes	Yes	No	-	In wash area	No	No	No	No		
MTW-248	6/12/23	MTW	No	Yes	No	-	No	No	No	Pig disturbance nearby	No		
MTW-249	6/12/23	MTW	Yes	No	No	-	No	No	No	No	No		
MTW-250	6/12/23	MTW	No	Yes	No	-	No	No	No	No	No		
MTW-251	6/12/23	MTW	No	Yes	No	-	No	No	No	No	No		
MTW-252	6/12/23	MTW	Yes	Yes	Yes	No	On erosion wash	No	No	No	No	In replanting maintenance area	Re-barricade with delineation posts
MTW-253	6/12/23	MTW	Yes	Yes	Yes	No	Some wash	No	No	No	No	In replanting maintenance area	Re-barricade with delineation posts
MTW-254	6/12/23	MTW	Yes	Yes	No	-	No	No	No	No	No	In replanting maintenance area	Re-barricade with delineation posts
MTW-255	6/12/23	MTW	No	Yes	Yes	No	Some wash	No	No	No	No	In replanting maintenance area	Re-barricade with delineation posts
MTW-256	6/12/23	MTW	Yes	Yes	Yes	Yes	No	No	On old track	No	No	Keep barricaded	
MTW-258	6/12/23	MTW	Yes	Yes	No	-	No	No	No	No	No	Likely natural scar	
MTW-260	6/12/23	MTW	Yes	Yes	No	-	No	No	No	No	No	Likely old remnant loading ramp	
MTW-261	6/12/23	MTW	Yes	Yes	No	-	No	No	On old track	No	No		
MTW-262	6/12/23	MTW	Yes	Yes	No	-	No	No	No	No	No	More found	Extend extent to 313934e 6387896n
MTW-263	6/12/23	MTW	Yes	Yes	No	-	No	No	On old track	No	No	Track being allowed to regenerate	
MTW-264	6/12/23	MTW	Yes	Yes	No	-	No	No	No	No	No	Non-cultural scars, saw marks present, potential boundary mark	
MTW-265	6/12/23	MTW	No	Yes	No	-	No	No	No	No	No	Heavy leaf litter	
MTW-266	6/12/23	MTW	Yes	Yes	No	-	No	No	No	No	No	4-5 grooves located	Clear accumulation from grooves for detailed recording
MTW-267	6/12/23	MTW	Yes	Yes	No	-	No	No	No	No	No	Grinding grooves co-recorded with ‘Site 1 GG’	Clear accumulation from grooves for detailed recording

Site Name	Date	Mine	Site re-identified?	Site intact?	Site fenced/ barricaded?	Fencing/ barricading intact?	Natural erosion	Livestock damage	Human disturbance	Animal disturbance	Pests & weeds	General observations	Management recommendations
MTW-268	6/12/23	MTW	Yes	Yes	No	-	No	No	No	No	No		Clear accumulation from grooves for detailed recording
MTW-269	6/12/23	MTW	No	Yes	No	-	No	No	No	No	No	In re-planting area	Barricade
MTW-270	6/12/23	MTW	Yes	Yes	Yes	No	No	No	On old track	No	No		Ensure old track avoided
MTW-271	6/12/23	MTW	Yes	Yes	Yes	No	No	No	On old track	No	No		Ensure old track avoided
MTW-272	6/12/23	MTW	Yes	Yes	No	Yes	No	No	No	No	No	Anvil found instead of axe	
MTW-273	6/12/23	MTW	Yes	Yes	Yes	No	No	No	On old track	No	No	Overgrown	Ensure old track avoided
MTW-274	6/12/23	MTW	Yes	Yes	Yes	No	No	No	On old track	No	No	Overgrown	Ensure old track avoided
MTW-275	6/12/23	MTW	Yes	Yes	Yes	No	No	No	On old track	No	No	Overgrown	Ensure old track avoided
MTW-276	6/12/23	MTW	Yes	Yes	Yes	No	No	No	On old track	No	No	Overgrown	Ensure old track avoided
MTW-277	6/12/23	MTW	Yes	Yes	Yes	No	No	No	On old track	No	No	Overgrown	Ensure old track avoided
MTW-278	6/12/23	MTW	Yes	Yes	Yes	No	No	No	On old track	No	No		Re-barricade
MTW-279	6/12/23	MTW	No	Yes	Yes	No	No	No	On old track	No	No		Re-barricade
MTW-280	6/12/23	MTW	Yes	Yes	Yes	No	No	No	On old track	No	No		Re-barricade
MTW-281	6/12/23	MTW	Yes	Yes	Yes	No	No	No	On old track	No	No		Re-barricade
MTW-311	6/12/23	MTW	No	Yes	No	-	No	No	On old track	No	No		Barricade location
MTW-431	5/12/23	MTW	No	Yes	No	-	No	No	In gateway	No	No	On active farmland	Ensure ACH management requirements included in lease agreement
MTW-448	5/12/23	MTW	No	Yes	No	-	No	No	On old drain	No	No	On active farmland	Ensure ACH management requirements included in lease agreement
MTW-449	5/12/23	MTW	No	Yes	No	-	No	No	On old drain	No	No	On active farmland	Ensure ACH management requirements included in lease agreement
MTW-450	5/12/23	MTW	No	Yes	No	-	No	No	On old drain	No	No	On active farmland	Ensure ACH management requirements included in lease agreement
MTW-462	5/12/23	MTW	No	Yes	No	-	No	No	On fence-line	No	No	On active farmland	Ensure ACH management requirements included in lease agreement
MTW-486	5/12/23	MTW	No	Yes	No	-	No	No	No	No	Thistle present	On active farmland	Ensure ACH management requirements included in lease agreement
MTW-612	5/12/23	MTO	Yes	Yes	Yes	Yes	No	No	No	No	No	More found	Extend extent to 323007e 6385932n
MTW-613	5/12/23	MTO	Yes	Yes	Yes	Yes	No	No	No	Pig disturbance	No	Non-artefactual	

Site Name	Date	Mine	Site re-identified?	Site intact?	Site fenced/ barricaded?	Fencing/ barricading intact?	Natural erosion	Livestock damage	Human disturbance	Animal disturbance	Pests & weeds	General observations	Management recommendations
MTW-618	5/12/23	MTO	No	Yes	Yes	Yes	Severe wash out	No	No	No	No	Artefact likely washed away	
MTW-621	5/12/23	MTO	Yes	Yes	Yes	Yes	Yes	No	No	No	No		
MTW-622	5/12/23	MTO	No	Yes	No	-	Wash on creek edge	No	No	Wombat burrows	No		
MTW-623	5/12/23	MTO	Yes	Yes	No	-	Sheet wash	No	No	No	No		
MTW-624	5/12/23	MTO	Yes	Yes	No	-	Sheet wash	No	No	No	No		
MTW-625	5/12/23	MTO	Yes	Yes	No	-	No	No	No	No	No		
MTW-626	5/12/23	MTO	Yes	Yes	Yes	Yes	No	No	On track edge	No	No	Recent work has avoided site	Extend extent to 322778e 6385526n Barricade site and cut fence and move track to east
MTW-627	5/12/23	MTO	No	Yes	Yes	Yes	No	No	No	No	No		
MTW-628	5/12/23	MTO	No	Yes	Yes	Yes	No	No	No	No	No		
MTW-629	5/12/23	MTO	Yes	Yes	No	-	No	No	No	No	No		Barricade site or track edge
MTW-630	5/12/23	MTO	Yes	Yes	No	-	No	No	No	No	No		Barricade site or track edge
MTW-631	5/12/23	MTO	Yes	Yes	No	-	Severe erosion	No	No	No	No		Look to establish erosion remedies through the LCACHCA PMIG
MTW-632	5/12/23	MTO	Yes	Yes	No	-	Severe erosion	No	No	No	No		Look to establish erosion remedies through the LCACHCA PMIG
MTW-665	5/12/23	MTO	Yes	Yes	No	-	Severe erosion	No	No	No	No		Look to establish erosion remedies through the LCACHCA PMIG
RPS WB2	6/12/23	MTW	No	Yes	Yes	No	No	No	No	No	No	Recorded and barricaded for non-MTW project	Obtain site card and update MTW ACH database
Site 1 GG	6/12/23	MTW	Yes	Yes	No	-	No	No	No	No	No	Grinding grooves co-recorded with 'MTW-267'	Clear accumulation from grooves for detailed recording
Wark-1	5/12/23	MTW	No	Yes	Yes	No	No	No	No	No	No	Heavily grassed	
Wark-2	5/12/23	MTW	No	Yes	Yes	No	No	No	No	No	No	Heavily grassed	

Table 1: Results of 2022 MTW AHMP Compliance Inspection

Aboriginal Site Management Recommendations

All ACH site locations visited during the AHMP compliance inspection were found to be intact with no recent damage or unauthorised disturbance noted, however, natural erosion processes were noted at several sites. Not all ACH sites were able to be re-identified, but this was due to poor GSV or leaf litter obscuring the ground surface rather than due to inadvertent destruction. Management recommendations were provided for many of the ACH sites visited during the 2023 compliance inspection. These recommendations are described below.

Install or reinstall/repair barricade, wire and/or signage

Sites: MTW-181, MTW-230, MTW-232, MTW-237, MTW-238, MTW-239, MTW-252, MTW-253, MTW-254, MTW-255, MTW-269, MTW-278, MTW-279, MTW-280, MTW-281, MTW-311, MTW-626, MTW-629, MTW-630

At these 19 ACH sites, it is recommended that barricading or fencing be installed or repaired in order to provide additional protection, particularly if activities and movement in the area are ongoing or likely to increase. The specific recommendations for each site are noted in Table 1 above and summarised below.

Site MTW-181 is a scarred tree located on a property that is currently being leased out. Due to the general significance of scarred trees, and to prevent potential damage by stock, it is recommended that hard fencing be installed at this site, consisting of posts, wire and ACH site signage.

Several sites are recommended for barricading (or re-barracading) to protect them from current or future activities that have the potential to cause inadvertent disturbance. Such activities include the use of existing vehicle tracks on or near to sites, and current revegetation programs. There are a number of sites located on or adjacent to a disused track within the Wollombi Brook Aboriginal Cultural Heritage Conservation Area (WBACHCA). This track should be effectively barricaded to ensure it is closed for use.

Barricading should consist of hi-vis string line and signage delineating the area as an ACH site to be avoided. There are some areas, however, where hi-vis delineation posts minus string line are an appropriate demarcation method.

Examples of barricading in need of repair (left) and newly reinstated (right)

Management of rubbish by hand

Site: MTW-178

View across previously fenced MTW-178, located over rubbish-filled ditch

This site consists of a single, very small silcrete flake located on the edge of a ditch near a vacant house. The ditch has been used as a rubbish pit in the past and prior to the site's initial recording in 2009. Although the site has been hard fenced, the artefact has been unable to be relocated during previous audits.

In order to clean up the rubbish pit and surrounding area it is recommended that rubbish removal be conducted by personnel on foot using hand tools. New ACH site signage should also be fixed to the current wire fencing.

Clear accumulation from grinding groove sites

Site: MTW-266, MTW-267, MTW-268, Site 1 GG

These are grinding grooves sites located within the WBACHCA. MTW-268 is located on the bank of a lagoon channel of Wollombi Brook, while MTW-266, MTW-267 and Site 1 GG is located above the creek bank on a grassy plain. At each site, grooves were located on sandstone boulders after the team cleared away accumulated soil and detritus.

Grooves on sandstone outcrop at MTW-267

Grooves on sandstone boulder at MTW-268

It is likely that more grooves are located in the vicinity of the grooves identified during this audit. It is recommended that each site is revisited and the soil/vegetative accumulation carefully removed from the immediate vicinity by hand and with brooms. This will aid in the preservation of the grooves by removing the possibility of moisture retention within the

accumulation atop the grooves. It would also allow for all grooves in the area to be uncovered and recorded in detail.

Ensure ACH management requirements considered on rural properties

Sites: MTW-431, MTW-448, MTW-449, MTW-450, MTW-462, MTW-486

A number of sites were assessed at Warkworth Farm, in the vicinity of a set of old yards where works are planned. Although no disturbance was noted at these sites, they were unable to be relocated due to high vegetation levels. Although no specific issues were identified that required management, during discussions regarding ACH sites located on active farming land it was suggested that it would be prudent to inform lessees of the property as to the location and extent of these sites, as well as information regarding management. In this instance, this recommendation would extend to all ACH sites located on Warkworth Farm and not just those the subject of this audit.

Look to establish erosion remediation

Sites: MTW-631, MTW-632, MTW-665

Erosion scour along Loder Creek

There are several sites recorded along a severe erosion scour on the high bank of Loder Creek within the Loder Creek Aboriginal Cultural Heritage Conservation Area (LCACHCA). It is likely that artefacts have been washed into the creek, redeposited or covered by sediment in this area. It is recommended that MTW engage in-house rehabilitation/environmental

specialists to assess the area and develop a remediation plan with members of the LCACHCA Plan of Management Implementation Group (PMIG). Any on-ground works arising should also involve the PMIG and be conducted in accordance with the LCACHCA Plan of Management and the Mount Thorley Development Consent (SSD-6465).

Obtain site card and update MTW ACH database

Sites: RPS WB2

This site is located on land bounded by Wollombi Brook, Putty Rd and the WBACHCA. Upon inspection the site was found to have been fenced in the past but as it was not recorded for MTW, its contents are unknown. The site was covered in thick ground cover and no artefacts were located during the inspection. It is recommended that the AHIMS site card be requested in order to add relevant details to the MTW ACH sites database that will better assist relocation attempts during a future audit.

View north across WB2 fenced area

Amend site extents to include new finds

Sites: MTW-246, MTW-262, MTW-612, MTW-626

At four of the sites inspected, additional artefactual material was recorded outside of these sites' current mapped extents. In all cases, the newly located artefacts were all noted as intact and not affected by any recent disturbance. They are located within ACH conservation areas and in places where leaf litter and grassy ground cover would impact ground surface visibility. Co-ordinates were recorded in all instances to aid in the remapping of new extent boundaries.

Significant Site Highlight: MTW-19

This site consists of a bottle base that has likely been flaked by humans in the past. The bottle base is a dark green-black colour and very thick. It appears to have been used as a core from which to remove flakes rather than a tool in itself.

MTW-19 bottle base core showing regular longitudinal flake scars

Definitive flaked glass artefacts are very rarely represented in Hunter Valley assemblages and the artefacts themselves are also very difficult to conclusively ascribe to human manufacturing processes as opposed to the effects of trampling or mechanical breakage. This particular

artefact likely represents a very good and very rare example of a flaked bottle base core in the Hunter Valley. It may indicate post-contact land-use and habitation by Aboriginal groups in the area within the last 200 years. If this is the case, there could also be contemporaneity with the last known ceremony held in 1852 at the Bulga Bora Ground (located c.1.5-2km north) and attended by 500-600 people, including from groups as far away as Goulburn and Mudgee.

This site was originally recorded by AECOM in 2008 and ascribed a high level of archaeological significance, which is captured within the MTW ACH database. The site is located within the WBACHCA and hence protected from any potential ground disturbing activities. No further protective recommendations are required.

Conclusions and Recommendations

The 2023 AHMP compliance inspection has been conducted as per the procedures outlined in the AHMP. No unauthorised site disturbances or AHMP non-compliances were observed during the inspection, and no issues were raised by the CHWG representatives present. A number of recommendations have been made to enhance or assist with the management of ACH at MTW, which are summarised below:

1. **Install or repair barricading, fencing or other delineation at ACH sites MTW-181, MTW-230, MTW-232, MTW-237, MTW-238, MTW-239, MTW-252, MTW-253, MTW-254, MTW-255, MTW-269, MTW-278, MTW-279, MTW-280, MTW-281, MTW-311, MTW-626, MTW-629 and MTW-630, as per specific recommendations in Table 1;**
2. **Remove rubbish by hand at ACH site MTW-178 and rejuvenate fencing/demarcation;**
3. **Clear accumulation from grinding grooves sites MTW-266, MTW-267, MTW-268 and Site 1 GG with a view to further detailed recording of these sites;**
4. **Review ACH management approach for Warkworth Farm including information to be provided to lessees;**
5. **Develop and implement a remediation strategy for the severe erosion along Loder Creek in the vicinity of ACH sites MTW-631, MTW-632 and MTW-665, and elsewhere along the creek where remediation would be appropriate;**
6. **Obtain AHIMS site card for ACH site RPS WB2 and update MTW ACH sites database with relevant details; and**
7. **Amend extents for ACH sites MTW-246, MTW-262, MTW-612 and MTW-626 to include recent additional finds.**

Appendix 4:

Historic Heritage Management Plan Compliance Inspection Report

Mount Thorley Warkworth Historic Heritage Management Plan 2023 Compliance Audit Inspection

Report prepared for

Yancoal Australia, Mount Thorley Warkworth

February 2024

Joel Deacon

ARROW HERITAGE SOLUTIONS

Introduction

Yancoal Australia (Yancoal) manage the Mount Thorley Warkworth (MTW) mining complex located in the Hunter Valley, approximately 8km south-west of Singleton. Approval for the continuation and expansion of the mine was granted on 26 November 2015 under two separate project approvals: the Warkworth Continuation Project Approval (SSD-6464) and the Mount Thorley Operations Project Approval (SSD-6465).

Pursuant to Condition 46 of the Warkworth Continuation Project Approval, Yancoal have developed an MTW Historic Heritage Management Plan (HHMP) that covers the whole MTW mining complex. The MTW HHMP was approved by the Department of Planning and Environment on 11 October 2017 and sets out the principles, processes and measures through which historic heritage will be managed within the HHMP Area. This includes the commitment (Provision 19) to conduct annual HHMP compliance inspections with members of the community through the auspices of the Community Heritage Advisory Group (CHAG). The purpose of the HHMP compliance inspections is to:

a. inspect areas and sites to assess compliance with the provisions of the HHMP and site-specific Conservation Management Plans (CMPs);
b. inspect and monitor the condition and management of various sites; and
c. review the effectiveness and performance of the HHMP provisions in the management of historic heritage at MTW.

Proposed Activity and Project Brief

The following historic sites within the MTW HHMP area (shown on the map below) were inspected to assess compliance with actions listed in the HHMP and specific CMPs. A detailed photographic record for each site was also collated to add to the previous photographic data:

- Former RAAF Base Bulga Mess Hall
- Springwood Homestead
- Mount Thorley Brick Farm House


Historic Heritage Sites Inspected
2024 MTW HHMP Compliance Audit
Springwood Homestead
Mount Thorley Red Brick House
Former RAAF Base Bulga Mess Hall
1 0 1 2 3 4 km
Legend
HHMP Audit Sites
Warkworth Continuation DC Boundary
MTW Mining Leases

Timing & Personnel

The 2023 MTW HHMP compliance inspection was conducted on Thursday 7 December. The personnel involved in this inspection were:

Name	Position/Organisation
Joel Deacon	Archaeologist, Arrow Heritage Solutions
Robert Carter	Environment and Community Advisor, MTW
Lyn MacBain	CHAG representative

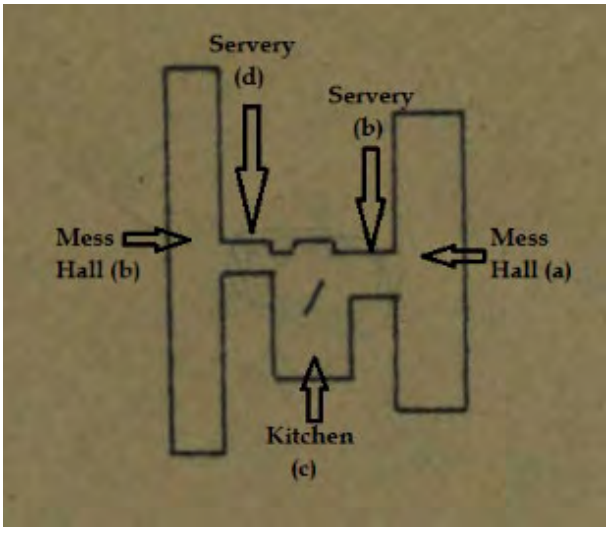
Arrow Heritage Solutions were engaged as independent heritage consultants to conduct the HHMP compliance inspection, with Joel Deacon acting as technical advisor and author of this report. Robert Carter, MTW Environment and Community Advisor, arranged the compliance inspection program and escorted the field team. Lyn MacBain participated in the inspection as a representative of the CHAG forum.

Former RAAF Base Bulga Mess Hall

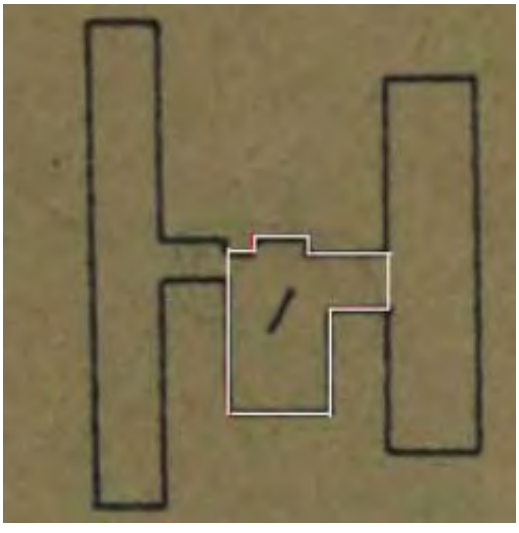
Following the Japanese attack on Pearl Harbour in December 1941, plans were approved to expand existing RAAF bases and establish new ones, including a number of sites in the Hunter Valley. Bulga was identified as a potential site for an operational base and the area was officially taken over by the RAAF on 12 June 1942 for use as a relief landing strip. By July 1943 the site was completed, including the kitchen and mess hall, however, by January 1944 the use of the site was limited due to the decreasing threat of attack. A 1946 condition report noted this building as deteriorating. In January 1953, the building was noted as missing a few sheets of iron and windows.

The building sits in the former camp area west of the north-south runway. It was originally irregular in plan comprising a central kitchen area measuring 13.4 x 8.8m, with long rectangular mess halls to the east and west, connected by a servery on either side. The remnant structure today comprises the kitchen building and the foundation of one of the serveries (see below).

The remnant building is "L" shaped in plan with brick and concrete footings. During the original assessment conducted by ERM in November 2012 (which informed the CMP) the building was noted as being in poor condition with trees physically impacting on the building fabric, and some minor settlement issues resulting in cracking and failing brickwork. The western section of the building was the most intact part, retaining the original timber frame, corrugated asbestos cement roof sheeting and walls clad with corrugated iron sheeting.



Original layout of building



Remaining structure

The building is currently structurally unsound, with a number of timber elements either missing or in a deteriorated state. Corrugated asbestos roof sheeting is also missing in some places, and damaged and in poor condition where it remains. Much of the corrugated iron sheeting

is corroded. Brickwork is also cracking in a number of locations resulting in movement outward, loss of mortar and loss of bricks along the southern and eastern elevations.

View to mess from south-east (2012)

Remnant kitchen area (2012)

As a result, a number of structural recommendations were outlined by ERM in the CMP developed for the site in 2012. These recommendations were not intended to return the building to a serviceable state, rather they sought to do the minimum required to allow safe access to the building to prevent significant damage, and also allow safe access for asbestos removal and internal inspection of the building in the short to medium term.

CMP Requirements

Short to medium term structural recommendations included:

a) **Remove fallen tree branch.** The tree branch impacting on the roof of the building should be removed, using an external mobile elevated platform or boom lift;
b) **Temporary propping.** The building should be temporarily propped and supported as per Bligh Tanner plans SK 1.0 A and SK 2.0 A (contained within the CMP) to allow for safe access into the building and more detailed inspection of the structure.
c) **Asbestos Removal.** Asbestos removal should be completed by a licensed asbestos removal specialist, include the roof sheeting, all asbestos dust and fibres, and loose fragments that are known to exist in the remaining area.
d) **Stabilise framework and replace roof.** Any structural roof members that are destabilized once the roof sheeting is removed are to be secured as required. Side walls which lose stiffness once the roof sheeting has been removed are to be propped temporarily until the new roof has been replaced.
e) **Archaeological clean-up.** Asbestos removal and clean-up should be supervised by a historical archaeologist to ensure any identified items of significance are retained.

f) **Further building inspection.** A structural engineer should complete a building inspection to identify structural repairs and stability requirements with four weeks of the building being cleaned up and decontaminated from asbestos.

Following the internal inspection of the building noted in (f) above, further advice may be provided regarding further recommendations, which, due to the lack of integrity of the building, are unlikely to be directed at restoration, but more towards retaining the remnant structure in a safe environment and reducing further deterioration. Repair drawings have been provided in the CMP to remedy any major cracking in the brickwork or where sections of brickwork have either partially collapsed or broken away from the wall.

Photographic Comparison 2012; 2018; 2020 (Mar); 2020 (Dec); 2021; 2022; 2023

During the inspection of the Former RAAF Base Bulga Mess Hall for this report, a number of photographs were taken from the same angles and of the same features as were taken during the ERM 2012 assessment and archival recording as well as during the 2018, March 2020, December 2020, 2021 and 2022 HHMP compliance inspections. These photographs provide a visual baseline condition assessment of the building, and also allow a comparative analysis of the deterioration, or maintenance, levels over the last eleven years. These photographs are set out below, along with comments pertinent to management recommendations. Where defects have been noted and/or actions have been recommended and remain outstanding, these have been presented in blue text.

2012	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**East elevation**
			**2012-18:** no discernible change – note fallen branch from tree on western side. **2018-20 (Mar):** no discernible change – fallen branch has moved. **Mar 2020 – Dec 2020:** no discernible change. **Dec 2020 – 2021:** no discernible change. **2021-2022:** no discernible change. **2022-2023:** no discernible change.

2012	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**<u>South-east elevation</u>**
			2012-18: evidence of increased bow to southern wall. **2018-20 (Mar):** bow in wall appears to have increased. **Mar 2020 – Dec 2020:** bow in wall continues to increase. **Dec 2020 – 2021:** gap in bowing has increased. **2021-2022:** no discernible change. **2022-2023:** bow in wall continues to increase.

2012	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**South elevation**
			**2012-18:** evidence of increased bow to southern wall and missing panel above entry. **2018-20 (Mar):** increased bow to southern wall. **Mar 2020 – Dec 2020:** increased bowing on southern wall. **Dec 2020-2021:** gap in bowing has increased. **2021-2022:** potential subsidence bottom right corner. **2022-2023:** increased bowing on southern wall.

2012	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**West elevation**
			**2012-18:** shows deterioration of roofing members above open kitchen area and leaning north wall, and further collapse of asbestos roof due to fallen dead tree. **2018-20 (Mar):** top of north wall now collapsed, further damage to roof with branch now fallen to ground. **Mar 2020 – Dec 2020:** no discernible change. **Dec 2020-2021:** northern wall on near side of chimney has detached from exposed western beam. **2021-2022:** no discernible change **2022-2023:** no discernible change

2012	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**North elevation**
			**2012-18:** no discernible change. **2018-20 (Mar):** top of north wall now collapsed. **Mar 2020 – Dec 2020:** no discernible change. **Dec 2020-2021:** no discernible change. **2021-2022:** no discernible change **2022-2023:** no discernible change

2012	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**<u>Concrete and brick foundation at east side of building</u>**
			**2012-18:** difficult to discern change. **2018-20 (Mar):** no discernible change. **Mar 2020 – Dec 2020:** no discernible change. **Dec 2020-2021:** difficult to discern change. **2021-2022:** no discernible change **2022-2023:** some collapse of internal timber members

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2012	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**<u>Grease trap at south end of building</u>**
			**2012-18:** shows bow to south wall. **2018-20 (Mar):** shows increased bow to south wall. **Mar 2020 – Dec 2020:** shows increasing bowing of south wall, and example of new termite monitoring system in bottom right of picture. **Dec 2020-2021:** shows increasing bowing of south wall. **2021-2022:** potential subsidence at broken brick corner. **2022-2023:** some increased movement at cracked corner

2012	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**<u>Storage area at south end of building</u>**
			2012-18: further slight collapse of storage area. **2018-20 (Mar):** shows loosening of corrugated iron wall sheeting due to bowing in wall. **Mar 2020 – Dec 2020:** no discernible change. **Dec 2020-2021:** no discernible change. **2021-2022:** no discernible change **2022-2023:** further separation of corrugated iron wall sheeting due to bowing in wall.

2012	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**Windows and entry at west elevation**
			2012-18: shows large trunk/branch portions of tree collapsed on roof, which has destroyed roof ventilator. **2018-20 (Mar):** shows majority of branches fallen from roof, leaving increased damage to sheeting. **Mar 2020 – Dec 2020:** no discernible change. **Dec 2020-2021:** no discernible change. **2021-2022:** no discernible change. **2022-2023:** no discernible change

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2012	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**<u>Timber window detail, west elevation</u>**
			**2012-18:** no discernible change. **2018-20 (Mar):** no discernible change. **Mar 2020 – Dec 2020:** no discernible change. **Dec 2020-2021:** no discernible change. **2021-2022:** no discernible change **2022-2023:** no discernible change

2012	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**<u>Showing cylindrical ventilator and damage to roof, view from west</u>**
			**2012-18:** shows significant roof damage from fallen dead tree, including to ventilator. **2018-20 (Mar):** shows increased damage to roof edge sheeting from fallen branch. **Mar 2020 – Dec 2020:** no discernible change. **Dec 2020-2021:** deterioration of left window frame. **2021-2022:** no discernible change **2022-2023:** no discernible change

2012	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**Detail of north-west elevation**
			2012-18: shows increased collapse over open kitchen area, as well as new damage to brick foundation at north-west corner. **2018-20 (Mar):** shows fallen top of north wall plus increased (animal?) damage to brick foundation at north-western corner. **Mar 2020 – Dec 2020:** no discernible change. **Dec 2020 – 2021**: detachment of north wall from western beam. **2021-2022:** no discernible change **2022-2023:** some internal timbers have fallen further.

2012	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**<u>Showing interior damage at kitchen at north end of building</u>**
			**2012-18:** shows increased collapse over and accumulation of debris within open kitchen area. Note also severe lean to north wall. Stove doors have become unhinged. **2018-20 (Mar):** shows collapsed top of north wall and collapse of remaining full crossbeam. Stove now obscured by collapsed north wall. **Mar 2020 – Dec 2020:** no discernible change. **Dec 2020 – 2021:** no discernible change. **2021-2022:** no discernible change **2022-2023:** some movement of fallen timbers

2012	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**<u>View to interior of south end of building, view from east</u>**
			**2012-18:** shows increased collapse over open kitchen area. **2018-20 (Mar):** shows further minor deterioration of asbestos panelling. **Mar 2020 – Dec 2020:** no discernible change. **Dec 2020 – 2021:** no discernible change. **2021-2022:** no discernible change **2022-2023:** some movement of fallen timbers

2012	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**<u>Showing west interior space</u>**
			**2012-18:** no discernible change. **2018-20 (Mar):** no discernible change. **Mar 2020 – Dec 2020:** no discernible change. **Dec 2020 – 2021**: no discernible change. **2021-2022:** no discernible change **2022-2023:** no discernible change

2012	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**<u>Damaged brick foundation at south-east corner (south view)</u>**
			**2012-18:** no discernible increase to cracked brick foundation. **2018-20 (Mar):** further cracking of foundation (to left of shot) and some slumping of corner bricks. **Mar 2020 – Dec 2020:** some slight potential further movement in cracked section (also note termite management system in bottom right-hand corner of photograph. **Dec 2020 – 2021**: no discernible change. **2021-2022:** subsidence noted with buckling beginning between 3rd and 4th course of bricks **2022-2023:** potential further slumping to corner

2012	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**<u>Detail of damaged brick foundation (east view)</u>**
			**2012-18:** some further collapse of concrete/cement above brick foundation. **2018-20 (Mar):** some slumping outwards of corner brick foundation. **Mar 2020 – Dec 2020:** no discernible change. **Dec 2020 – 2021**: movement and setting of internal concrete piece. **2021-2022:** increased cracking along mortar lines **2022-2023:** no discernible change

2012	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**<u>View to interior of building, looking north from south entry</u>**
			**2012-18:** no discernible change. **2018-20 (Mar):** no discernible interior change but shows collapsed north wall. **Mar 2020 – Dec 2020:** no discernible change. **Dec 2020 – 2021**: no discernible change. **2021-2022:** some movement of timbers at front of shot may suggest human interference **2022-2023:** movement of prone drum may suggest human or animal interference

2012	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**<u>Showing interior of building, viewed from north-west corner</u>**
			**2012-18:** shows collapsed roofing members above open kitchen area and accumulation of debris. **2018-20 (Mar):** shows additional collapsed roofing member. **Mar 2020 – Dec 2020:** no discernible change. **Dec 2020 – 2021**: no discernible change. **2021-2022:** no discernible change **2022-2023:** some movement of fallen timbers

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The comparative photographs above show the changes at the building over the past ten years. Although no substantial changes were noted between the current and the last inspection, other than continuing instability along the southern face, no structural maintenance has occurred either. During this time, it can be expected that the underlying causes of deterioration, such as the degeneration of wooden framework and metal panelling, and animal burrowing underneath the structure has continued. Therefore, the more significant changes and priority actions identified during the last inspection remain of importance and, if anything, their need of remediation has increased in urgency. Previous recommendations remain valid and the key issues remain:

- Damaged roof sheeting and roofing members, as well as increasing structural instability of bowing southern wall;
- Due to the complete collapse of remaining roofing members over the open kitchen area the top portion of the northern wall has now failed and fallen inside the building footprint. This northern wall has now detached from remnant roofing and west wall members;
- Deterioration of window panelling; and
- Increased damage to brick foundation in north-west corner, and new slumping of south-east foundation corner.

A termite management regime was implemented around the site prior to the 2020 annual inspection. The inspection points largely remain intact and these should continue to be monitored and any evidence of termite activity treated as soon as possible.

Recommendations

High Priority Actions

1. Engage an asbestos expert to assess and develop a clean-up and disposal plan to deal with both the broken fragments and intact asbestos sheeting;
2. Remove any remaining tree branches from the roof. In addition, to prevent similar damage in the future, serious consideration should be given to removing or lopping those trees that are located close enough to the building that they may cause damage if they fall or drop large branches.

High Priority Actions to Follow Actions 1 & 2

3. Pending the results of the asbestos assessment, the building and surrounds should be thoroughly cleaned of asbestos and other rubbish material. An archaeologist should be present to collect any items of historic importance or that relate to the original fabric of the building. This should also include the removal, repair and curation of items such

as window frames and panels before their total deterioration. All such items can be stored inside the building and potentially re-used during further stabilization programs;

4. Pending the results of the asbestos assessment, susceptible parts of the building framework, such as roofing members and walls should be stabilized and propped, using the CMP Bligh Tanner plans as a guide;
5. A structural engineer should then inspect the building before any further works are commenced to make further recommendations on stability requirements and structural repairs. These further works should aim to reduce the likelihood and extent of any further deterioration at the site rather than seek to rebuild or renovate as it is unlikely that there would be any valid or appropriate option to re-use the site; and

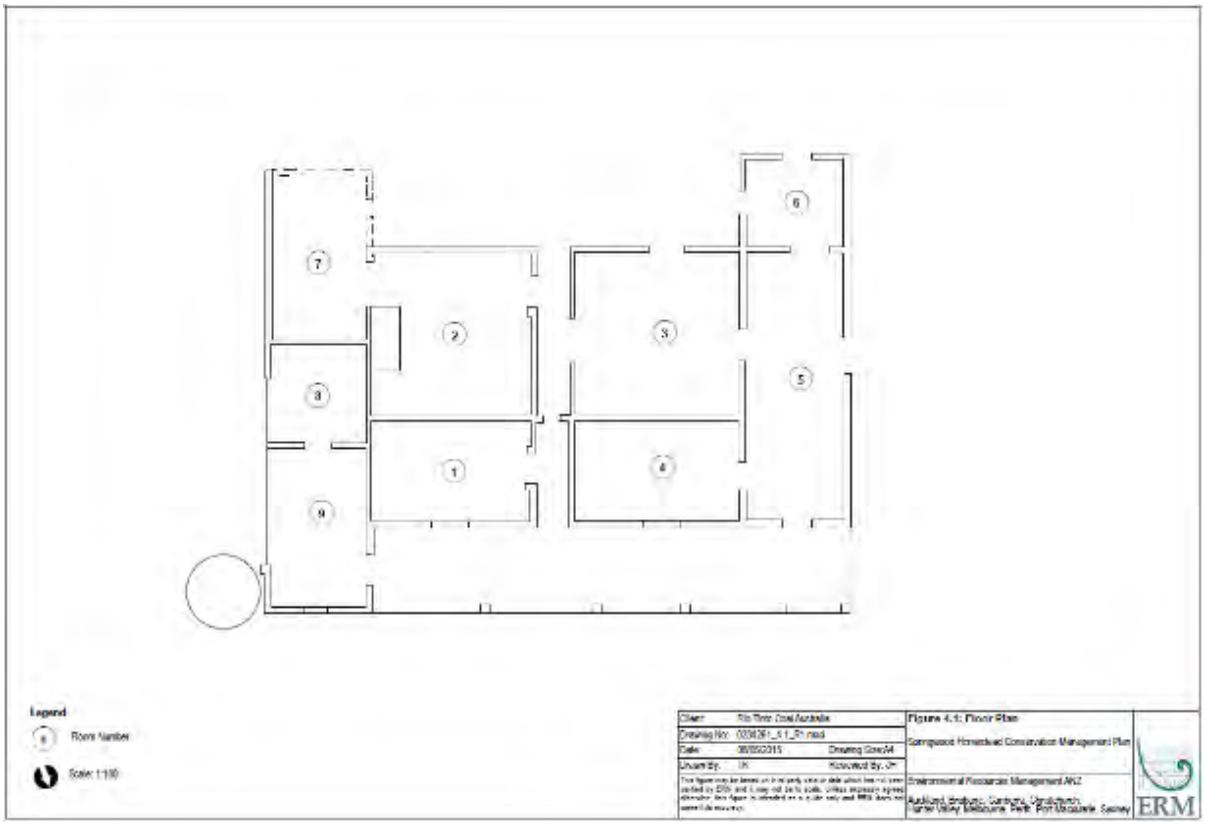
Ongoing

6. Continue with the recently implemented termite monitoring regime, including an assessment of the integrity of the existing termite inspection pits.

Springwood Homestead

Based on historical research, Springwood Homestead is likely to have been constructed c.1860 and displays many characteristics of late Old Colonial Georgian and Victorian Georgian architecture, including an original shingle broken-backed roof, fanlights or transom lights, panelled doors and under-roof verandas. The homestead is low set, constructed in vertical timber slabs and built around a four room square core, as shown in the plan below.

Given that Springwood Homestead is timber framed and in direct contact with the ground, it is remarkable that it is still standing and in a generally stable condition, with most roof rafters appearing to be still in place. Although the building fabric is generally intact there are a number of areas where the level of structural damage to the roof, wall and flooring members is high. The majority of the damage has occurred from termites and fungal decay, resulting in localised collapse of outer external walls and roof structures. Recently, vandalism has also been an issue, with many vertical timber slabs having been pilfered. Within the CMP developed for the site by ERM in 2015, a number of stabilisation measures have been recommended that will assist to reduce the extent of damage, however a return to a habitable state is not planned.



Springwood Homestead plan (taken from 2015 ERM CMP)

Springwood Homestead in 2012

CMP Recommendations

Although many recommendations are made within the CMP, the more important management measures have been incorporated within a conservation works schedule that covers the following issues:

- Drainage and weatherproofing;
- Vegetation;
- Termites and vermin;
- Building fabric; and
- Structural capacity and wind loads.

The works schedule prioritises the required conservation works and are presented with technical specifications from a structural engineer. Those measures that attend to the building's structural integrity are the focus of the schedule.

High Priority

a) Remove debris from roof using a cherry picker or similar;
b) Remove tree from eastern elevation and stabilize building in this location;
c) Remove vine from eastern wall using combination of pruning and herbicide;
d) Remove tree from south-west corner and stabilize building in this location;
e) Prune all overhanging branches and maintain regular maintenance program; and
f) Reinstate southern veranda and roof to match northern elevation.

Moderate to Low Priority

g) Place treated plywood sheeting over door openings;
h) Prune trees, spray weeds and slash grass;
i) Clean up of site surrounds, overseen by archaeologist;
j) Clean up of building interior, overseen by archaeologist;
k) Refix loose ceiling boards, retaining evidence of fabric if unable to fix;
l) Refix loose and dislodged slabs and plates; and
m) Place treated plywood sheeting over openings and undertake repairs to windows.

Photographic Comparison 2014; 2018; 2020 (Mar); 2020 (Dec); 2021; 2022; 2023

During the inspection of Springwood Homestead for this report, a number of photographs were taken from the same angles and of the same features as were taken during previous compliance inspections, and the ERM 2014 assessment that informed the 2015 CMP. These photographs provide a visual baseline condition assessment of the building, and also allow a comparative analysis of the changes over the last nine years. These photographs are set out below, along with comments pertinent to management recommendations. Where defects have been noted and/or actions have been recommended and remain outstanding, these have been presented in blue text.

2014	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**<u>Eastern elevation</u>**
			**2014-8:** no discernible change. **2018-20 (Mar):** roof slumping appears to have increased. **Mar 2020-Dec 2020:** heavy leaf litter on roof persists. Positively, vegetation clearing surrounding the house is occurring regularly. **Dec 2020–2021:** tree growth and associated leaf litter/structural impacts increasing. **2021-2022:** tree growth increasing with associated deterioration of roof integrity. 2022-2023: tree growth continues and southern section of timber wall/skillion has collapsed.

2014	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**Southern elevation**
			**2014-8:** vertical timber slabs have been removed from southern wall. **2018-20 (Mar):** possible deterioration of shingles at roof edge, and missing panels from above back door. **Mar 2020-Dec 2020:** no discernible change. **Dec 2020 – 2021:** no discernible change. **2021-2022:** uprights from chimney room wall fallen or vandalised, along with remaining wall elements. Associated roof line slumping. Chimney slumping to the east. Movement of remnant furniture/timbers evident through doorway in western room. **2022-2023:** part of door has broken off

2014	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**<u>Southern elevation doorway</u>**
			**2014-8:** door has been removed. **2018-20 (Mar):** no discernible change. **Mar 2020-Dec 2020:** no discernible change. **Dec 2020 – 2021:** no discernible change. **2021-2022:** fallen timber to right of door jamb. **2022-2023:** door timber fallen across hallway.

2014	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**South-eastern corner**
			**2014-8:** vertical slabs have been removed causing further collapse of roof. **2018-20 (Mar):** further deterioration of eastern wall. **Mar 2020-Dec 2020:** heavy leaf litter on roof persists. **Dec 2020 – 2021:** heavy leaf litter on roof persists. **2021-2022:** chimney slumping and separated from ceiling; back veranda roof also slipping. **2022-2023:** south-east wall and skillion roof collapsed. 3º - 4.5º lean to the east on chimney.

2014	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**<u>Eastern side</u>**
			**2014-8:** debris has been cleaned and stored and a weed removal program conducted. The house area has also been fenced. **2018-20 (Mar):** further deterioration of eastern wall and regrowth of weeds. **Mar 2020-Dec 2020:** no discernible change. **Dec 2020 – 2021:** no discernible change. **2021-2022:** apparent increased deformation of eastern roof line. **2022-2023:** south-east wall and skillion roof collapsed

2014	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**Room 2 interior**
			**2014-8:** increased debris caused by removal of southern wall. **2018-20 (Mar):** no discernible change. **Mar 2020-Dec 2020:** no discernible change. **Dec 2020 – 2021:** no discernible change. **2021-2022:** fallen timber upright; increased decay of chimney blocks. **2022-2023:** south-east wall and skillion roof collapsed, continued erosion of chimney sandstone blocks, movement of fallen timbers on floor suggests human or animal visitors.

2014	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**South-west corner**
			**2014-8:** shows removal of vertical slabs from southern wall. **2018-20 (Mar):** no discernible change. **Mar 2020-Dec 2020:** no discernible change. **Dec 2020 – 2021:** furniture in far room collapsed. **2021-2022:** wall/ceiling separation within white room, furniture/timber disturbance in western room. **2022-2023:** no discernible change

2014	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**Northern elevation**
			**2014-8:** further deterioration of weatherboard panelling. **2018-20 (Mar):** no discernible change, though termite activity present. **Mar 2020-Dec 2020:** grass/weed growth encroaching over veranda floor. **Dec 2020 – 2021:** increased grass encroachment. **2021-2022:** increased grass growth. **2022-2023:** no discernible change

2014	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**<u>South-east corner</u>**
			**2014-8:** shows removal of vertical slabs from southern wall, and some from eastern wall, and further collapse of roof. **2018-20 (Mar):** further roof slumping and deterioration of eastern wall. **Mar 2020-Dec 2020:** no discernible change. **Dec 2020 – 2021:** further deterioration of eastern wall. **2021-2022:** movement of roofing timbers, subsidence in chimney blocks, bottom left corner. **2022-2023:** total collapse of side wall and roof

2014	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**Eastern elevation**
			**2014-8:** possible further collapse of crossbeam and guttering. **2018-20 (Mar):** tree continues to impact eastern roof line. **Mar 2020-Dec 2020:** increased impact on roofline by tree branches. **Dec 2020 – 2021:** tree continues to impact eastern side. **2021-2022:** veranda roof now considerably buckled in middle, with separation of timber members occurring. **2022-2023:** tree continues to impact eastern side, with wall collapse shown at near left.

2014	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**Northern elevation**
			**2014-8:** slumping of veranda along edge beam. **2018-20 (Mar):** no discernible change. **Mar 2020-Dec 2020:** grass/weed growth encroaching over veranda floor. **Dec 2020 – 2021:** no discernible change. **2021-2022:** peppercorn has been pruned; termite damage is increased within veranda uprights. **2022-2023:** increased splitting to fourth verandah post from right

2014	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**<u>View of south-west corner from south</u>**
			**2014-8:** shows removal of vertical slabs from southern wall as well as some increase in vegetation growth. **2018-20 (Mar):** no discernible change but continuing vegetation impacts. **Mar 2020-Dec 2020:** apparent increased vine growth. **Dec 2020 – 2021:** continued impacts on south-west corner. **2021-2022:** vine has been chopped near ground and killed, some resultant movement of timbers. **2022-2023:** no discernible change but continuing vegetation impacts.

The comparative photographs above show the changes at the building over the past eight years. Some Significant changes were noted between the current and the last inspection, with no structural maintenance having occurred either. These main changes include:

- Total collapse of section of wall and roof in south-eastern corner
- Further structural destabilization along southern wall and roof line
- Movement to chimney evident
- Eastern roofline showing significant slumping

During this time, it can also be expected that the underlying causes of deterioration, such as the degeneration of wooden framework, impacts caused by adjacent trees and the effects of weather entering the unsealed building has continued. Therefore, the more significant changes and priority actions identified during the previous inspections remain of importance and, if anything, their need of remediation continues to increase in urgency. Previous recommendations remain valid and the key issues are:

- The removal of all of the vertical timber slabs from the southern wall continue to have a negative impact on the structural integrity of this side of the building, allowing weather and the associated adverse impacts into the building. Note more timber uprights have now fallen;
- The total collapse of the section of wall and roofline in the south-eastern corner of the house is a significant and detrimental change. The causes of this collapse are tied to the age and weathering to the materials themselves, with the structural integrity of the roofing and wall members likely further diminished by the previous collapse/removal of the southern wall of the house and associated increased weather impacts. This latest collapse will only serve to further exacerbate the impacts of weather to this section of the house, putting the integrity of the sandstone chimney at increased risk;
- The continued growth of trees also having impacts on structural stability in the south-western corner and along the eastern roof line; and
- Increasing instability to the front/northern verandah caused by severe damage to at least two supporting uprights caused by termite activity and wood rot.

Additional to the photographs above, the images below show specific damage to the northern veranda uprights and the eastern wall.

Additional northern verandah upright affected by termites and/or rot

Increased slumping along eastern wall

The verandah uprights are all severely weakened through termite activity or rot and require bolstering to aid in support of the roof. This also the case along the eastern roofline, were slumping is continuing with the absence of any vertical support along this wall line.

It should also be noted that the collapse of the south-eastern section of wall has also exposed some portions of old newspaper that had been adhered to one pieces of wood that once served as shelving in this room. The newspaper appears to be one of several layers that have been used as coverings over the years. A search of the National Library of Australia's Trove newspaper database conducted by CHAG member Lyn MacBain revealed that the paper originated from p.7 of the August 15 1908 edition of the Singleton Argus, making these fragments 115 years old. Recommendations on their care and conservation are outlined below.

Fragments of the August 15 1908 Singleton Argus recovered from the collapsed wall

Recommendations

Management recommendations have been prioritised as high or moderate importance, with high priority recommendations to be actioned as soon as possible. Due to the considerable structural deterioration that has occurred, particularly along the southern and eastern elevations, and to the northern verandah, the conservation works schedule within the CMP should be re-assessed and revised by a structural engineer prior to any other works commencing. This task should be actioned with urgency as it will inform the remaining corrective actions required to stabilise the structure.

Urgent

Engage a structural engineer, preferably with experience and exposure to historic timber buildings, to assess the current CMP conservation works schedule and associated drawings, in light of the current state of the homestead in order to provide revised stabilisation measures and advise on the current applicability of the remaining proposed priority actions.

High Priority (pending revised structural engineering report)

1. Remove the trees and vines currently impacting the building at the eastern elevation and south-west corner and treat to prevent regrowth (acknowledgment that work has begun in this regard). Coincident with this removal, acrow props should be installed where appropriate, i.e. where the trees themselves have been supporting the building structure, and as per current structural engineer's instructions at Annex B of the CMP;
2. Once vegetation has been removed, clean all debris from the roof and prune (or consider the removal of) all other trees in close vicinity of the building with potential to drop leaf/branch litter on roof;
3. Clear the surroundings of the building of rubbish, overgrowth and weeds in the accompaniment of an archaeologist to ensure any items of historical relevance are salvaged and stored within the homestead;
4. Propping of the northern, eastern and southern roof lines should occur without delay to prevent any collapse caused by removed/damaged uprights; and
5. The wooden piece containing the remnant newspaper fragments should be removed from the site as soon as possible in order to preserve the remaining fabric. The piece should be stored inside and in constant temperature conditions at low humidity and in dark conditions. It should be stored so as to be protected from vermin and pests, and personnel involved should avoid touching the fragments, especially with bare hands. Prior to removal, in situ photographs should be taken of the piece and its relationship to the other fallen timbers in order to record its contextual provenance. These

measures should be undertaken immediately and do not require the structural engineering report in order to commence.

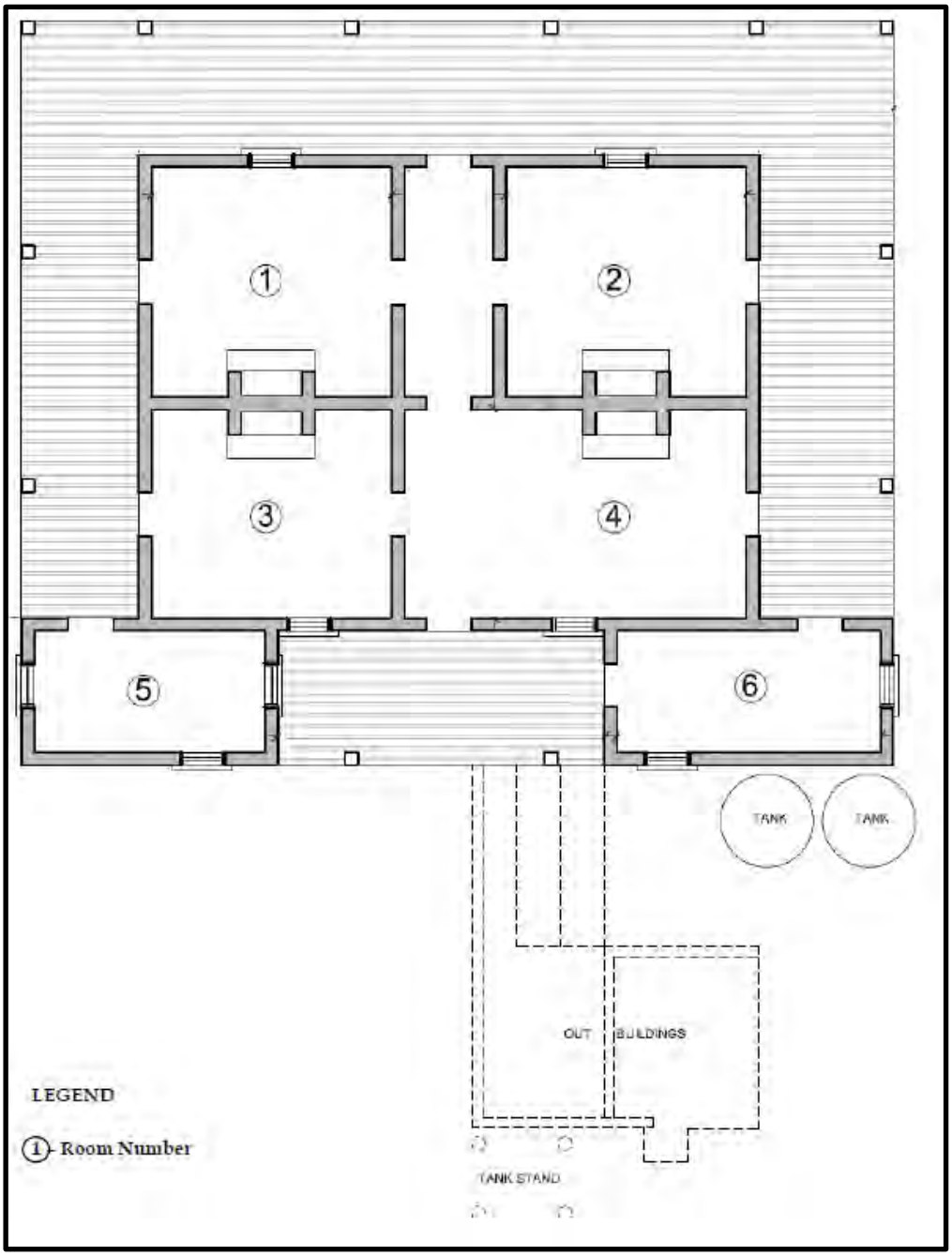
Moderate Priority (pending revised structural engineering report)

Once the high priority recommendations have been attended to, the structural engineer may recommend different or additional measures than originally put forward. Pending this report, the following moderate priority measures are recommended to attain compliance with the CMP and enhance the condition of the homestead:

1. Due to their propensity to harbour termites and transfer infestation to the building, remove all peppercorn trees from around the building, a process which has begun;
2. Maintain the regular vegetation maintenance program;
3. Pending structural engineer's advice, reinstate western, eastern and southern walls, verandah and roof to match northern elevation.
4. Pending reconstruction of southern wall, place treated plywood sheeting over door and window openings;
5. Clean up of building interior, overseen by archaeologist;
6. Pending structural engineer's advice, refix loose ceiling boards and loose and dislodged wall slabs and plates, retaining evidence of fabric if unable to fix;
7. Ensure the minor recommendations and 'policies' listed throughout Section 7 of the CMP are considered in the future management of the homestead;
8. Give consideration to an archaeological excavation and research program at the site, with possible community involvement, to explore the areas of archaeological potential identified in the CMP; and
9. Maintain the termite and pest control regime at the building.

Mount Thorley Brick Farm House

The Mount Thorley Brick Farm House is located off the Golden Highway opposite the MTW coal handling and preparation plant, c.10km south-west of Singleton. The portion of land on which the house sits was purchased by Eliza Glass in 1870 and the physical attributes of the house, which display characteristics of Victorian Georgian architecture, suggest that it was constructed during the following decade. The building is roughly square in plan, with four principal rooms flanking a central hallway.



Floor plan of Mount Thorley Brick Farm House, north up (from ERM 2015 CMP)

Mount Thorley Brick Farm House (2012)

The masonry structure of the building is sound, however, it was noted as being in poor physical condition in 2015 (when a CMP was developed for the site by ERM), with a collapsed veranda roof, missing or loose roof sheeting, missing or collapsed veranda posts, and floorboards and areas affected by termites. The conservation works schedule within the CMP considered the following issues at Mount Thorley Brick Farm House:

- Drainage and weather-proofing;
- Asbestos;
- Vegetation;
- Termites and vermin;
- Building fabric; and
- Structural capacity and wind loads.

Recommendations were made within the CMP's conservation works schedule to address the elements above, a number of which have completed by the proponent. These works included:

- Removal and safe storage of verandah;
- Initial vegetation clearing;
- Sheeting and sealing of all window and door openings;
- Clean up of scattered debris surrounding building; and

- Repair of loose roof sheeting and patching of holes.

Monitoring and maintenance of these repaired items is an ongoing requirement to ensure they provide continual protection to the building.

Photographic Comparison 2015; 2018; 2020 (Mar); 2020 (Dec); 2021; 2022; 2023

During the inspection of the Mount Thorley Brick Farm House for this report, a number of photographs were taken from the same angles and of the same features as were taken during previous HHMP compliance inspections as well as the ERM 2015 assessment that informed the CMP. These photographs provide a visual baseline condition assessment of the building, and also allow a comparative analysis of the changes over the last eight years. These photographs are set out below, along with comments pertinent to management recommendations. Where defects have been noted and/or actions have been recommended and remain outstanding, these have been presented in blue text.

2015	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**View of north-west side**
			**2015-8:** veranda removed and stored inside building, vegetation has been managed. **2018-20 (Mar):** vegetation has regrown around building**.** **Mar 2020-Dec 2020:** vegetation again under control, panel above boarded door requires refixing. **Dec 2020 – 2021:** vegetation requires management and loose boards re-affixing. **2021-2022:** panelling fixed or reinstalled on all openings; ruinous electricity board fallen; increased vandal activity at left-most door opening; grass recently mowed. **2022-2023:** recently mowed and left door barricading bolstered. Guttering deterioration and lifting of roof tin at near corner.

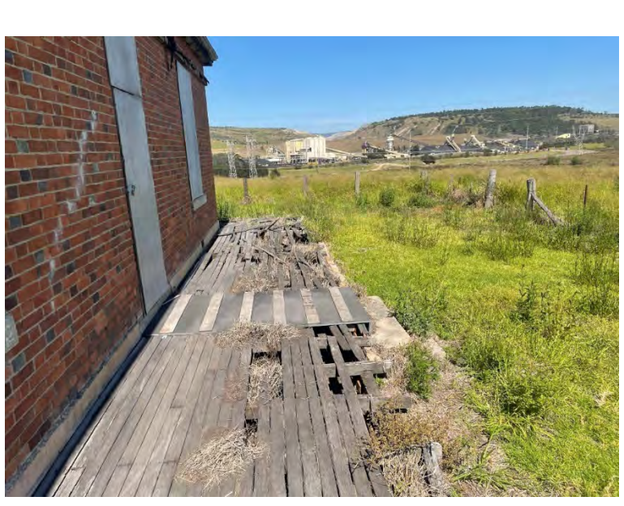
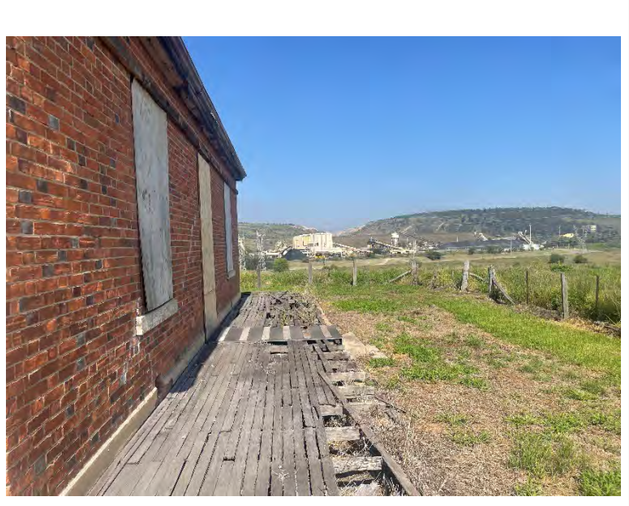
2015	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**<u>View of north-west roof corner (focus on damaged roof)</u>**
			**2015-8:** roofing sheets have been replaced and holes patched. **2018-20 (Mar):** some minor roof holes and lifted sheeting noted. **Mar 2020-Dec 2020:** some veranda flashing fallen, panel above door requires refixing. **Dec 2020 – 2021:** panel above door requires re-affixing and guttering remains in disrepair. **2021-2022:** panel above door fixed, guttering in disrepair. **2022-2023:** Deterioration of guttering and roof edge.

2015	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**View of door and window panelling**
			**2015-8:** sheeting installed on all openings, however some repair required. **2018-20 (Mar):** no discernible change. **Mar 2020-Dec 2020:** Front door panel requires reinstallation. **Dec 2020 – 2021:** front door panel remains broken. **2021-2022:** front door panel reaffixed; veranda grass poisoned. **2022-2023:** new panelling installed on front door.

2015	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**View of door and window panelling**
			**2015-8:** sheeting installed on all openings, however some repair required. **2018-20 (Mar):** some repair of panelling required. **Mar 2020-Dec 2020:** Broken panel remains unrepaired. **Dec 2020 – 2021:** broken panel remains unrepaired. **2021-2022:** door panel fixed; uprights fixed and propped to support roof. **2022-2023:** weeds sprayed, however water appears to be settling under back verandah, which may require attention.

2015	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**View of rear of building (view south)**
			**2015-8:** debris has been cleared and stacked. **2018-20 (Mar):** vegetation has regrown around building and stacked debris. **Mar 2020-Dec 2020:** vegetation cleared and debris restacked. **Dec 2020 – 2021:** vegetation management required. **2021-2022:** vegetation managed; collapsed roofing members tidied and stacked inside building; broken fascia removed but not repaired. **2022-2023:** no discernible change.

2015	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**View of rear of building (view north)**
			**2015-8:** debris has been cleared and stacked. **2018-20 (Mar):** vegetation has regrown around building and stacked debris. **Mar 2020-Dec 2020:** vegetation cleared and debris restacked. **Dec 2020 – 2021:** vegetation regrown. **2021-2022:** rear of building has been tidied and vegetation managed; building openings repanelled. **2022-2023:** guttering has fallen with lifting of roof sheeting behind.

2015	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**<u>View of eastern veranda (focus on veranda floor)</u>**
			**2015-8:** posts and sheeting removed, damaged boards remain exposed. **2018-20 (Mar):** damaged boards remain and vegetation growth throughout. **Mar 2020-Dec 2020:** damaged boards remain and vegetation growth throughout. **Dec 2020 – 2021:** veranda floor remains dilapidated and grass growth throughout. **2021-2022:** door panel fixed, vegetation managed but veranda floor remains dilapidated. **2022-2023:** no discernible change.

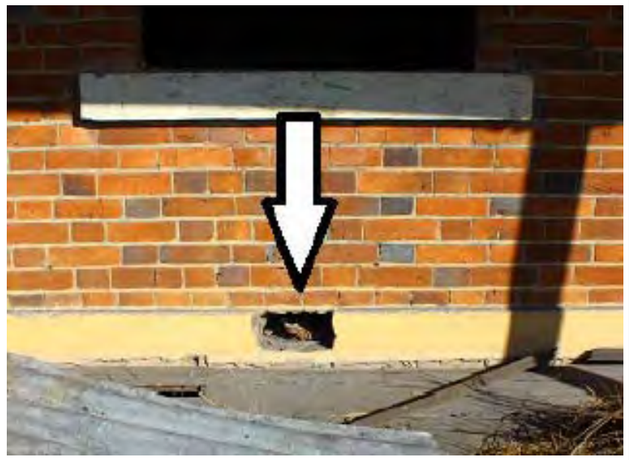
2015	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**<u>View of rear of building (focus on roof)</u>**
			**2015-8:** skillion roof, guttering and rafters have collapsed; main roof holes repaired. **2018-20 (Mar):** no discernible change. **Mar 2020-Dec 2020:** some minor holes in roofing require repair. **Dec 2020 – 2021:** minor roofing holes remain. **2021-2022:** veranda uprights propped, loose members tidied; roofing appears patched. **2022-2023:** shows fallen guttering with lifting of roof sheeting behind.

2015	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**<u>View of north-east of building</u>**
			2015-8: wall element has collapsed (bricks stacked under window); roof framing, sheeting and guttering has collapsed. **2018-20 (Mar):** no discernible change. **Mar 2020-Dec 2020:** no discernible change. **Dec 2020 – 2021:** rafter collapse from above window. **2021-2022:** redundant electrical box fallen; increased vandal activity at doorway; roof capping repaired; redundant panel can be removed. **2022-2023:** window opening cover replaced and door panel repaired.

2015	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**<u>View of north-east corner of building (focus wall below window)</u>**
			**2015-8:** bricks from roof above stacked in front of required repointing, window sheeting removed. **2018-20 (Mar):** no discernible change. **Mar 2020-Dec 2020:** repointing requirements remain. **Dec 2020 – 2021:** repointing requirements remain. **2021-2022:** collapsed roofing members stacked inside; far door panel reaffixed; redundant panel can be removed; repointing requirements remain. **2022-2023:** window panel replaced, repointing requirements remain

2015	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**View of south-east of building (focus on top of wall)**
			**2015-8:** repointing requirements remain. **2018-20 (Mar):** repointing requirements remain. **Mar 2020-Dec 2020:** repointing requirements remain. **Dec 2020 – 2021:** repointing requirements remain. **2021-2022:** repointing and fascia repair requirements remain; white paint or similar has been daubed on wall. **2022-2023:** brick fallen from chimney, some bowing to top of wall at verandah's end, repointing and fascia repair requirements remain.

2015	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**<u>View of eastern veranda (focus on dwarf wall wall)</u>**
			**2015-8:** debris cleared from veranda, no change to dwarf wall. **2018-20 (Mar):** no discernible change. **Mar 2020-Dec 2020:** cracking to wall evident. **Dec 2020 – 2021:** remains in disrepair. **2021-2022:** vegetation managed but remains in disrepair. **2022-2023:** vegetation managed but remains in disrepair.

2015	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**View of ventilation grilles**
			**2015-8:** grilles not replaced. **2018-20 (Mar):** grilles remain missing. **Mar 2020-Dec 2020:** grilles remain missing. **Dec 2020 – 2021:** grilles remain missing. **2021-2022:** grilles remain missing. **2022-2023:** grilles remain missing.

2015	2018	2020 (Mar)	2020 (Dec)
			
2021	**2022**	**2023**	**View of southern chimney**
			**2015-8:** repointing requirements remain. **2018-20 (Mar):** repointing requirements remain. **Mar 2020-Dec 2020:** repointing requirements remain. **Dec 2020 – 2021:** repointing requirements remain. **2021-2022:** repointing requirements remain. **2022-2023:** brick missing and repointing requirements remain.

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The comparative photographs above show the changes at the building over the past seven years. It is apparent that some repairs and structural maintenance have occurred between the current and the last inspection, with vegetation levels being well managed also. Although these measures are certainly beneficial, some priority actions identified within the CMP and during previous inspections remain of importance and, if anything, their need of remediation has increased in urgency. The key issues are currently:

- Considerable damage and exposure to the rear of the building;
- Veranda boards in need of repair;
- Some holes in sections of fascia;
- Gutters remaining in a state of disrepair; and
- Two sections of lifted roof sheeting require nailing down.

A section of wall at the end of the verandah where it meets Room 5 on the house's south-east corner also requires attention (see picture below). The mortar between the brick work on this wall, particularly on the southern edge, has deteriorated, with fretting on some bricks also apparent. This has created some slight bowing/deformation to the top of the southern side of this wall, which poses a risk of collapse of this section. Repointing attention is required in this area, as it is in other sections of the building.

It should be noted that the termite and vegetation management regimes have been implemented around the site, as have numerous smaller repairs, which are positive actions

and will assist in the arrest of the deterioration of the building. If recommended by a termite control specialist, nearby peppercorns should be removed due to their propensity to harbour termites. The lemon tree to the west of the building should be retained due to its connection with habitation of the house.

Recommendations

While many of the high and moderate priority recommended actions within the CMP conservation works schedule have been completed in the past, the recommendations outlined below are required as part of the ongoing maintenance of the building and to minimise the risk of further deterioration in the building structure.

High Priority

1. If any asbestos or fibrous cement sheeting remains at the property, engage an asbestos removalist to remove as required;

Moderate Priority

2. Check that all debris surrounding the house has been removed. If this has not occurred, remove all debris, ensuring an archaeologist is on hand to identify and catalogue any early architectural fittings or rare pieces of joinery that should be retained for future restoration purposes;
3. Reinstall veranda, including veranda decking and northern brick dwarf wall, re-using original material where possible, as per recommendations M5, M6 and L1 in the CMP conservation works schedule;
4. As the roof above Room 6 has collapsed, salvage any reusable masonry or timber and set aside within room. Engage a structural engineer to advise on feasibility of reconstructing the roof. (NB. Recommendation M9 in the CMP conservation works schedule erroneously refers to this room as Room 5 rather than Room 6 as shown in the floor plan);
5. Repair fascias and replace gutters around the house to match existing materials and ogee profile. Install new down-pipes and ensure they are discharging away from the building – particularly away from eastern back verandah;
6. Repoint mortar joints with lime-based mortar on brickwork below Room 6 eastern elevation window sill, on northern and western walls of room 5 and all chimneys;
7. Install new ventilation grilles to existing ground level openings; and
8. Maintain the vegetation management and termite and pest control regimes at the building.

Conclusion

Up to eleven years has now elapsed since the preparation of the CMPs for the three historic heritage buildings reviewed during this inspection. Although some important conservation measures have been implemented over the last decade, other recommended management actions remain incomplete, with the urgency surrounding their attention only increasing year on year. The following actions are considered imperative to prevent irreparable damage to the buildings and, once complete, will provide a solid foundation from which to tackle the remaining issues.

Former RAAF Base Bulga Mess Hall

- Engage an asbestos expert to assess and develop a clean-up and disposal plan to deal with both the broken fragments and intact asbestos sheeting;
- Remove any remaining tree branches from the roof. In addition, to prevent similar damage in the future, serious consideration should be given to removing or lopping those trees that are located close enough to the building that they may cause damage if they fall or drop large branches;
- Pending the results of the asbestos assessment, the building and surrounds should be thoroughly cleaned of asbestos and other rubbish material. An archaeologist should be present to collect any items of historic importance or that relate to the original fabric of the building. This should also include the removal, repair and curation of items such as window frames and panels before their total deterioration. All such items can be stored inside the building and potentially re-used during further stabilization programs;
- Pending the results of the asbestos assessment, susceptible parts of the building framework, such as roofing members and walls should be stabilized and propped, using the CMP Bligh Tanner plans as a guide; and
- A structural engineer should then inspect the building before any further works are commenced to make further recommendations on stability requirements and structural repairs. These further works should aim to reduce the likelihood and extent of any further deterioration at the site rather than seek to rebuild or renovate as it is unlikely that there would be any valid or appropriate option to re-use the site.

Springwood Homestead

- Engage a structural engineer, preferably with experience and exposure to historic timber buildings, to assess the current CMP conservation works schedule and associated drawings, in light of the current state of the homestead in order to provide

revised stabilisation measures and advise on the current applicability of the remaining proposed priority actions.

- Remove the trees and vines currently impacting the building at the eastern elevation and south-west corner and treat to prevent regrowth (acknowledgment that work has begun in this regard). Coincident with this removal, acrow props should be installed where appropriate, i.e. where the trees themselves have been supporting the building structure, and as per current structural engineer's instructions at Annex B of the CMP;
- Once vegetation has been removed, clean all debris from the roof and prune (or consider the removal of) all other trees in close vicinity of the building with potential to drop leaf/branch litter on roof;
- Clear the surroundings of the building of rubbish, overgrowth and weeds in the accompaniment of an archaeologist to ensure any items of historical relevance are salvaged and stored within the homestead; and
- Propping of the northern, eastern and southern roof lines should occur without delay to prevent any collapse caused by removed/damaged uprights.

Mount Thorley Brick Farm House

- If any asbestos or fibrous cement sheeting remains at the property, engage an asbestos removalist to remove as required.

Appendix 5:

Annual Stream Health and Stability Report

MOUNT THORLEY WARKWORTH

ANNUAL STREAM HEALTH AND CHANNEL STABILITY MONITORING REPORT 2023

Looking downstream in Loder Creek at LC12

DATA REPORT PREPARED FOR MOUNT THORLEY WARKWORTH PTY LTD

MARINE POLLUTION RESEARCH PTY LTD
FEBRUARY 2023

FIGURES

TABLES

APPENDICES

1 INTRODUCTION

Marine Pollution Research (MPR) has been commissioned by Mount Thorley Warkworth (MTW) to undertake stream health and channel stability monitoring of creekline drainages downstream of the MTW discharge point and adjacent the MTW open cut mining operations in the upper Hunter Valley, NSW, to meet the requirements outlined in Section 7.4 of the approved Water Management Plan (WMP) (Version 5.1, October 2021). This data report provides the results of the first Annual Stream Health and Channel Stability monitoring undertaken by MPR in December 2023, with former survey reports provided by SLR between 2017 and 2022 (see Reference **Section 5**).

2 MONITORING PROGRAM METHODOLOGY

The objective of the MTW Channel Stability and Stream Health Monitoring program is to monitor the channel stability and health of the riparian vegetation in the waterways downstream of the MTW discharge point and adjacent to the mine footprint, to ensure they are not affected by the existing approved MTW mine operations. Excess mine water contained in Dam 9s is released via the MTW discharge point in the upper limits of Loder Creek, an activity which is regulated under the Hunter River Salinity Trading Scheme (HRSTS). In accordance with the monitoring requirements outlined in the MTW WMP, annual Channel Stability and Stream Health monitoring is undertaken in Loder Creek and Wollombi Brook (see **Figure 1** and **Table 1** below).

Table 1 MTW Channel Stability and Stream Health Monitoring Site Program 2023

Creek	Site	E	N	Transect	Photos	RARC	CSIRO
Nine Mile Ck	MTW LDP	321966	6385819	x	x	x	x
Loders Creek	BM35	322746	6385819	x	x	x	x
Loders Creek	BM34	323779	6388119	x	x	x	x
Wollombi Brook	BM37	313709	6388933		x	x	x
Loder Creek	LC1	321974	6385382		x		x
Loder Creek	LC2	322019	6385367		x		x
Loder Creek	LC3	322087	6385446		x		x
Loder Creek	LC4	322367	6385647		x		x
Loder Creek	LC5	322484	6385655		x		x
Loder Creek	LC6	322670	6385697		x		x
Loder Creek	LC7	322759	6385778		x		x
Loder Creek	LC8	323948	6389351		x		x
Loder Creek	LC9	323996	6389540		x		x
Loder Creek	LC10	324131	6390142		x		x
Loder Creek	LC11	322881	6386043		x		x
Loder Creek	LC12	323802	6388650		x		x
Loder Creek	LC13	324160	6390408		x		x
Loder Creek	LC14	323800	6389222		x		x
Loder Creek	LC15	324150	6390239		x		x
Loder Creek	LC16	324329	6390543		x		x

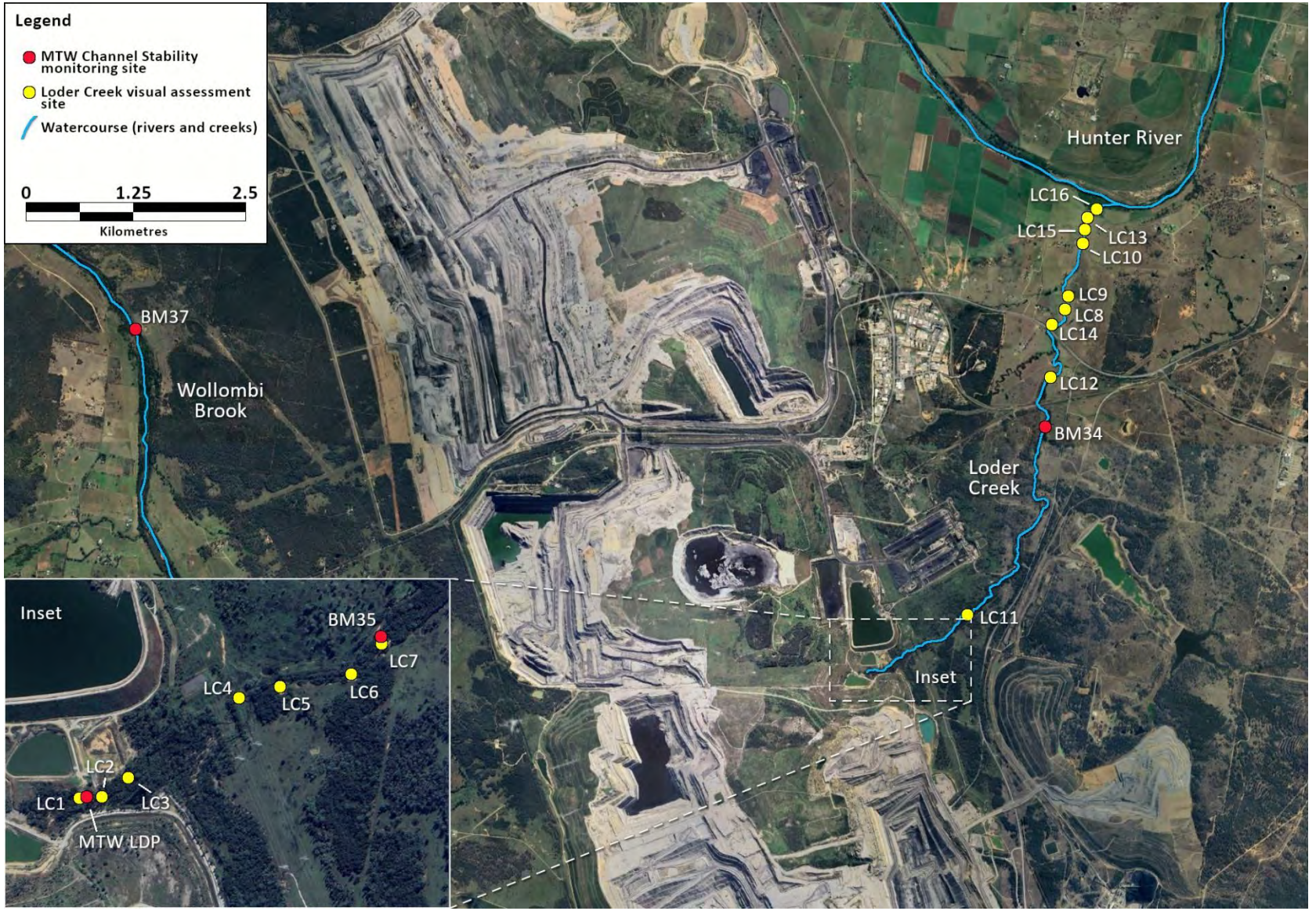


Figure 1: MTW 2023 Channel Stability Monitoring Sites

Assessment of geomorphic condition in stream health assessment is undertaken using a subjective, rapid, visual assessment methodology, with the trajectory of change assessed by comparing scores from surveys made over time. The MTW Channel Stability and Stream Health monitoring program includes the following features:

- Channel Stability rating using the CSIRO *Ephemeral Stream Assessment* (CSIRO ESA) guidelines protocol to assess the erosional state of the creek channel banks and bed,
- Stream Health rating using the Land & Water Australia Rapid Appraisal of Riparian Condition protocol (RARC), to assess the ecological condition of riparian habitats using indicators that reflect functional aspects of the physical, community and landscape features of the riparian zone,
- Cross sectional channel depth transect measurements for a comparative assessment of channel shape over time,
- Photographic monitoring points to facilitate a comparative assessment of channel stability over time,
- Documenting locations and dimensions of significant erosive or depositional features from which any subsequent changes can be evaluated.

2.1 CSIRO Ephemeral Stream Assessment

The CSIRO Ephemeral Stream Assessment method (Tongway and Ludwig 2011) was used to evaluate the condition of drainage channel features in Nine Mile Creek, Loder Creek and Wollombi Brook. There are four main classes of indicators assessed:

A. The type and condition of the vegetation present, if any,
B. The shape and profile of the drainage line and type and condition of materials on the drainage line floor.
C. The nature of the drainage line wall materials.
D. The nature of the stream bank bordering flats and/or slopes and regulation of lateral flow into drainage line.

The indicators produce an activity rating which, when converted to a percentage, ranks each location from *Very Active* through to *Very Stable* (**Table 2**). Annual monitoring results are reviewed and compared with previous surveys to assess whether stream channel degradation has occurred as a result of mine operations.

An investigation is triggered when there is a decrease in the CSIRO ESA classification over two consecutive monitoring rounds at any of the four prescribed monitoring sites (see **Table 9.3** from the MTW WMP), and **Section 9.2** of the MTW WMP outlines the response procedure in the event of a performance trigger breach.

Table 2 CSIRO ESA Activity Ratings & Classifications		
Activity Rating (%)	**Classification**	**Classification definitions**
80 +	Very Stable	Drainage line is very stable and likely to be in original form. It is able to withstand all flow velocities that have previously occurred in this area and only minimal monitoring is required, predominantly after high flow events, to ensure condition does not deteriorate.
70-80	Stable	Drainage line is stable. It is important to assess this zone in relation to the other classifications and define whether this zone is moving from potentially stabilising to a more stable form, or if it is deteriorating from a very stable form. The nature of this relationship will identify the type of monitoring required.
60-69	Potentially Stabilising	Drainage line is potentially stabilising. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.
50-59	Active	Drainage line is actively eroding and remedial actions are required. It is important to classify if erosion is caused primarily by upstream flows, lateral flows or unstable wall materials so that appropriate rehabilitation can be carried out.

2.2 Rapid Appraisal of Riparian Condition (RARC)

The Rapid Appraisal of Riparian Condition assesses the ecological condition of riparian habitats using indicators that reflect functional aspects of the physical, community and landscape features of the riparian zone (Jansen et al 2005). The RARC method includes score ratings for the following categories:

- Longitudinal continuity and width of riparian canopy vegetation and proximity to nearest patch of native vegetation,
- Vegetation cover for canopy, understorey and ground layers,
- Vegetation cover for canopy, understorey and ground layers for natives,
- Cover of standing dead trees, leaf litter, and fallen logs, and
- Presence of native vegetation regeneration, native tussock, grasses and reeds.

The scores for these five categories are tallied to provide an overall score indicating riparian health:

Table 3 RARC Classification Ratings	
RARC Score	**RARC Classification**
<25	Very Poor
25 - 30	Poor
30 - 35	Average
35 - 40	Good
>40	Excellent

Annual monitoring results are reviewed and compared with previous surveys to assess whether stream channel degradation has occurred as a result of mine operations. An investigation is triggered when there is a decrease in the RARC Stream Health Assessment classification over two consecutive monitoring rounds at any of the four prescribed monitoring sites (see **Table 9.3** from the MTW WMP), and **Section 9.2** of the MTW WMP outlines the response procedure in the event of a performance trigger breach.

2.3 Channel Profile Measurements

Stream channel depth profiles are undertaken along a fixed transect to assess temporal changes to the channel shape by fluvial processes (i.e., bank erosion or sediment deposition). Former Channel Stability and Stream Health monitoring surveys have recorded depth transect measurements by extending a tape between two fixed survey pegs, whereby a survey staff was then used to measure the vertical distance between the tape and the ground surface at approximately 0.5m increments or at points which captured any sudden changes in channel geometry (SLR 2022). It is also noted that the previous SLR results are relative to the survey peg height and not fixed to an AHD height as generally recommended.

Whilst this method is for the most part repeatable, it does not take into account tape slack, which accounts for around 150mm drop in the centre of the tape over a 15m profile. Taking this into consideration, MPR measured the creek channel profile using a dumpy level where the site channel depth measurements were recorded at 0.5m intervals relative to the fixed peg on the left-hand bank (looking downstream), and at significant channel structures or irregular forms (such as incised channel banks, steep sections, rocky outcrops), finishing at the right-hand bank peg.

The 2023 dumpy Channel Transect Profile results are shown in **Appendix Figures A-1** to **A-3** and include any water level measurements encountered during the 2023 survey (represented as blue lines).

2.4 Site Channel Visual Assessment

Additionally, visual assessments were undertaken throughout all study sites which included documenting the locations of any significant erosion or depositional sedimentary features and photographing monitoring points at representative locations. Annual monitoring results will be compared with previous monitoring events with the overall aim of detecting temporal changes in drainage channel condition.

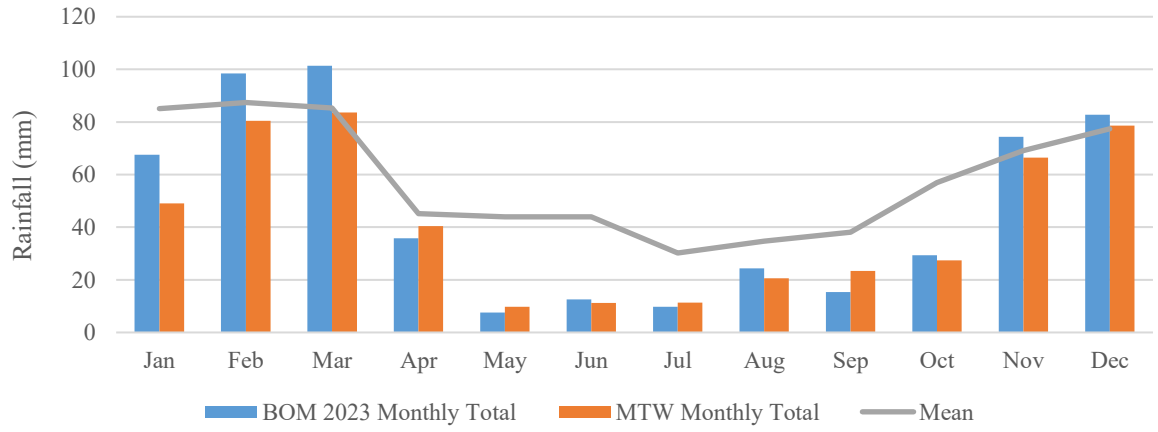
3 MTW CHANNEL STABILITY & STREAM HEALTH RESULTS

The MTW Channel Stability and Stream Health monitoring survey was undertaken between the 5th and 8th December 2023. **Section 3.1** below summarises the study area weather conditions recorded over the year to date, **Section 3.2** provides the Stream Health and Channel Stability site results and **Section 3.3** provides the Loder Creek Site Visual Assessment results. Channel transect cross sections are provided in **Appendix Figures A-1** to **A-3**, full RARC data sheets are in **Appendix B** and CSIRO ESA data sheets are in **Appendix Table C**.

3.1 Weather Leading Up to the Annual Survey

Rainfall records are recorded at Bureau of Meteorology (BOM) Bulga Down Town gauge (61143) located near BM37 and MTW mine site at Charlton Ridge. The 2023 monthly gauge totals are compared to the long-term mean monthly rainfall totals acquired since 1961, shown in **Figure 2** below.

Figure 2 Combined Gauge Rainfall 2023



Weather patterns in 2022 were characterised by close to average rainfall on a monthly basis, interrupted by intense storm events in March and July which produced the wettest year on record (1204mm), almost double the annual mean (689mm) at Bulga Down town rain gauge. Following the summer of 2022 to 2023, prevailing weather patterns shifted to dry weather conditions which have prevailed over the study area catchments since autumn 2023:

- December 2022 was dry with only 12mm rainfall; however, this was followed by more consistent rainfall activity from January through to

April (303mm combined monthly total), occurring mostly as isolated shower events.

- Historically the cooler months are the driest, however the combined rainfall over 6 months between May and October (99mm) was only 40% of the combined mean total.
- November produced slightly above average rainfall (74mm) which fell mostly later in the month, and there was 53mm recorded as consistent showers over the nine-day period leading into the commencement of the Stream Health Channel Stability Monitoring survey in early December.

3.2 Channel Stability & Stream Health Site Monitoring Results 2023

3.2.1 Loder Creek site MTW LDP

Site: MTW LDP		7/12/23	
Coordinates (MGA56):		E	N
		321966	6385379
Method	Year	Score	Rating
RARC	2022	32	Average
	2023	32	Average
CSIRO	2022	63	Potentially Stabilising
	2023	63	Potentially Stabilising

The creekline at MTW LDP accomodates a Mount Thorley Warkworth mine Licensed Discharge Point (LDP). The channel banks have been stabilised with logs and jute matting underlying a boulder and cobble embankment around the pipe outlet, and coir logs have been installed on the northern bank to contain potential sediment mobilisation from the LDP access track to the creekline (**Figures 3** and **4**).

The site channel just downstream (among rock armouring) contained ponded water however there was no surface flow throughout this location. Small fish (plague minnow *Gambusia holbrooki*) were present in surface pools which indicates that ponded surface waters have been sustained for some time. There is a break in the riparian corridor at the MTW LDP site location, with bare exposed soils of relatively low erosion risk due to the low bank profile. The coverage provided by the adjoining riparian swamp-oak (*Casuarina glauca*) corridor up and downstream is continuous and dense, on both sides of the creek, which had increased in foliage density over the previous year.

Figure 3: Looking upstream (left) and downstream (right) at Loder Creek site MTW LDP.

Figure 4: Site MTW LDP left bank (left) and right bank (right).

The understorey vegetation along the channel banks and throughout the broader riparian strip are for the most part, sparse, comprising scattered grasses (rhodes grass *Chloris gayana* and couch *Cynodon dactylon*), wattle and seedling swamp-oak trees. There were sections of bare substrates surrounding the middle of the site (bounding the LDP), however the broader riparian corridor contained variable quantities (sparse to dense coverage) of a swamp-oak needle detrital layer throughout much of the area, and fallen logs among denser swamp-oak canopy areas. The channel basin (creekline) up and downstream from the boulder embankment support dense occupation by spiny rush (*Juncus acutus*), which remains consistent in extent and density compared to the previous monitoring round, and scattered common reed (*Phragmites australis*) downstream.

A re-assessment of the nearest patch of intact native vegetation (>10 ha in area) resulted in an increase in the RARC 'Habitat' category score, owing to the continuity of the site riparian vegetation with the adjoining patch downstream (estimated at around 16 ha). Notwithstanding, there were no changes to the overall RARC rating in 2023 which remained as *Average,* nor were there changes to the CSIRO rating which remained as *Potentially Stabilising*.

3.2.2 Loder Creek site BM35

Site: BM35		7/12/23	
Coordinates (MGA56):		E	N
		322746	6385819
Method	Year	Score	Rating
RARC	2022	34	Average
	2023	32	Average
CSIRO	2022	56	Active
	2023	59	Active

Site BM35 is located just downstream of the confluence of Loder Creek and Nine Mile Creek. The channel shape is V-shaped with shallow sloping banks, supporting a shallow (0.3m to 1m deep) and meandering box shaped stream flow channel in the middle (**Figure 5**). Surface water was present as isolated pools within the channel basin (no flow present).

The Loder Creek she-oak riparian corridor canopy showed signs of increased growth since the previous monitoring round however there were no changes to the relevant RARC categories owing to previous results already being allocated the highest scores (for 'Canopy Cover' categories).

The site drainage channel floor and walls (banks) contained a generally continuous coverage of swamp-oak needle layer and the ground cover vegetation (mostly couch and spiny rush) had also flourished, likely in response to recent rain events. Whereas there was a slight increase in the distribution of common reed among the broader channel basin (**Figure 5**), the composition and extent of weed species (curled dock (*Rumex crispus*), purple top (*Verbena bonariensis*) and lantana) were unchanged in 2023.

Figure 5: Loder Creek site BM35 looking upstream (left) and downstream (right).

Figure 6: Site BM35 left bank (left) and right bank (right).

Figure 7: Erosion scar along the upper right-hand bank.

The animal track that crosses the site at BM35 (**Figure 6**) remains exposed and an active source of fine clayey silt to the creekline, as does the erosion scar along the upper right-hand bank (**Figure 7**). Couch grasses were noted to have colonised colluvial sediments at the base of the channel walls.

There were no changes to the CSIRO ESA method rating which remained as *Active*. While there were minor increases in RARC category scores for 'Natives' due to increased frequency of sparse coverage ground cover (grasses), there were decreased category scores recorded for 'Cover' owing to re-assessment of the groundcover estimates (which were moderate to sparse among transects), and for 'Features' due to decreases in the estimates of tussock grasses and reeds. Furthermore, a re-assessment of the transect riparian width and nearest patch of intact native vegetation (<10 ha in area) resulted in an increase in 'Habitat' score, and reduced observations of logs for one of the RARC transects resulted in a minor score reduction for 'Fallen logs'. As a result, the overall RARC score decreased slightly between 2022 (33.8) to 2023 (32.3) there were no changes to the RARC rating which remained as *Average.*

3.2.3 Loder Creek site BM34

Site: BM34		6/12/23	
Coordinates (MGA56):		E	N
		323779	6388119
Method	Year	Score	Rating
RARC	2022	30	Average
	2023	37	Good
CSIRO	2022	78	Stable
	2023	78	Stable

Downstream Loder Creek monitoring site BM34 is located around 3km downstream from the junction of Loder Creek and Nine Mile Creek. The site consists of a straight drainage channel with minimal sinuosity, with V-shaped profile formed from moderately sloped banks. Surface water was continuous in 2023 with sluggish flow downstream.

When compared to the previous survey in 2022, the instream and bank edge spiny rush and common reed stands at BM34 had proliferated in 2023 (**Figures 8 and 9**), however there was no change to the 'Vegetation on drainage line floor' category was already assigned to the highest category score. The channel pools supported other macrophytes (sago pondweed (*Stuckenia pectinata*), rushes *Juncus usitatus*), charophytes and regular occurrences of fat hen (*Chenopodium album*) along the waters edge.

The riparian corridor comprises a continuous, thin band of swamp-oak with generally dense understorey comprising native shrubs, grasses and weeds (**Figure 10**). The overall distribution and density of weeds among the riparian corridor was consistent with the former survey, and included fireweed (*Senecio madagascariensis*), mallow (*Modiola caroliniana*), purple top, blue heliotrope (*Heliotrope amplexicaule*), farmers friend (*Bidens pilosa*), African boxthorn and lantana, however purple top and St Johns Wort (*Hypericum gramineum*) were abundant throughout the adjoining paddocks beyond the immedaite riparian corridor.

A re-assessment of the canopy vegetation width among transects resulted in an increase in the overall 'Habitat' score, and there was an increase in groundcover vegetation estimates resulting in an increased category score for 'Cover'. There were also increases to the 'Debris' category due to the increased coverage provided by leaf litter (swamp-oak detritus) and

as a result, the BM34 RARC score increased between 2022 to 2023, changing the overall RARC rating from *Average* to *Good.* There were no changes to the overall site CSIRO ESA rating in 2023 (*Stable*).

Figure 8: Loder Creek site BM34 looking upstream (left) and downstream (right) in 2022.

Figure 9: Looking upstream in site BM34 (left) and downstream (right) in 2023. Note the increase in macrophyte growth when compared to 2022 (**Figure 8**).

Figure 10: Site BM34 left bank (left) and right bank (right) in 2023.

3.2.4 Wollombi Brook site BM37

Site: BM37		4/12/23	
Coordinates (MGA56):		E	N
		313709	6388933
Method	Year	Score	Rating
RARC	2022	32	Average
	2023	35	Average
CSIRO	2022	69	Potentially Stabilising
	2023	72	Stable

Site BM37 is the only site located on Wollombi Brook, on the western side of MTW mining operations (**Figure 1**). The drainage basin comprises a broad channel (20 to 35m width) with steep, high banks along the eastern edge and flat floodplain banks along the western edge (**Figures 11** and **12**). Waters were much lower than the previous survey, clear with a sluggish flow throughout the site length.

There are dense stands of common reed along the instream and stream edge banks, with smaller quantities of other macrophyte species, including river clubrush (*Schoenoplectus validus*) and tall clubrush (*Bolboschoenus fluviatilis*) and knotweed (*Persicaria decipens*) confined to the waters edge. Occurrences of river oak (*Casuarina cunninghamiana*) dominate the canopy forming species along with less frequently occurring willows (*Salix sp*) and eucalypts, forming a thin corridor along the drainage channel which is bordered by cleared pasture lands beyond the riparian zone. A layer of river-oak needles was blanketing much of the riparian corridor along the channel edge banks, supporting grass growth (couch, panic veldtgrass *Ehrharta erecta*) and for the most part, there was no groundcover vegetation growing amongst river-oak needle detritus.

Figure 11: Wollombi Brook site BM3 looking upstream (left) and downstream (right) in 2023.

Figure 12: Site BM37 left bank (left) and right bank (right).

The upper channel bank walls and entry points for lateral runoff maintain some active erosional features (gully erosion, undercutting- see **Figure 12** right hand side), however many of the points are likely historical (from cattle access prior to fencing) or exacerbated from flood event scouring.

There were improved category scores for 'Features' due to the presence of river-oak seedlings observed among transects 1 and 3, for 'Debris', for increased frequency of fallen logs and river-oak needle coverage across all transects. While this increased the overall RARC score between 2022 (32) to 2023 (35), it remains within the RARC band rating of *Average.* Site BM37 recorded an improved category score for 'Vegetation on drainage line floor' owing to the presence of reeds and macrophytes in the location, which improved the overall ratings band from the upper limits of *Potentially Stabilising* to the lower limits of *Stable*, which is consistent with former survey results in 2018.

3.3 Loder Creek Site Visual Assessments 2023

3.3.1 Loder Creek site LC1

Site: LC1		7/12/23	
Coordinates (MGA56):		E	N
		321974	6385382
CSIRO	Year	Score	Rating
	2022	72	Stable
	2023	72	Stable

The creekline at LC1 accomodates a Mount Thorley Warkworth mine Licensed Discharge Point (LDP) immediately downstream and the channel banks have been stabilised with logs and jute matting underlying a boulder and cobble embankment (**Figures 13** and **14**).

Figure 13: Site LC1 looking upstream (left) and downstream (right).

Figure 14: Site LC1 left bank (left) and right bank (right).

There was no surface water observed in the channel upstream from the rock embankment, however there was ponded water around the LDP (see **Section 3.2.1** above). The channel upstream is densely occupied almost exclusively by spiny rush (**Figure 13**) bordered by a dense and continuous swamp-oak riparian corridor with scattered eucalypts. The site does contain some exposed soils along the drainage walls however for the most part, they are contained on low profile banks with grass coverage and coir logs had been installed on the

northern bank to contain potential sediment mobilisation from the LDP access track to the creek at LC1.

The general site conditions were unchanged from the previous monitoring round and this was reflected in the unchanged CSIRO ESA category scores, which maintained a *Stable* rating in 2023.

3.3.2 Loder Creek site LC2

Site: LC2		7/12/23	
Coordinates (MGA56):		E	N
		322019	6385367
CSIRO	Year	Score	Rating
	2022	56	Active
	2023	66	Potentially Stabilising

Site LC2 is contained within a narrow section of drainage channel with steep banks spanning the southern channel perimeter (**Figures 15** and **16**). Surface water within the site was contained in isolated puddles separated by dry channel areas.

An erosion scar exists along the upper right-hand bank with a void created by a fallen tree stump (**Figure 17**). The scar remains exposed and active however there appears to be minimal contribution of channel wall sediments to the creek, and in 2023 there were new swamp-oak saplings that were noted to have colonised the void. Swamp-oak needles and other detrital reservoirs had accumulated along the drainage floor and walls which suggests that there had been no scouring flow events for some time.

The composition of the vegetation growing on the drainage line walls resulted in an improved category score. There was also an improved category score for 'Particle size of materials on the drainage floor' owing to the presence of gravels in the channel basin, and re-assessment of the 'Shape of drainage line cross-section' resulted in an improved category score. Overall, there was an improvement in the CSIRO ESA score and rating which shifted from *Active* to *Potentially stable*.

Figure 15: Site LC2 looking upstream (left) and looking downstream (right).

Figure 16: Site LC2 left bank (left) and right bank (right).

Figure 17: Upper right-hand bank erosion exacerbated by a fallen tree.

3.3.3 Loder Creek site LC3

Site: LC3		7/12/23	
Coordinates (MGA56):		E	N
		322087	6385446
CSIRO	Year	Score	Rating
	2022	41	Very Active
	2023	50	Active

Loder Creek site is situated in a narrow section of drainage channel with moderately steep banks along both sides of the drainage channel (**Figures 18** and **19**). A small tributary drainage swale that enters the channel from the left-hand bank (north) contains some localised erosive features (gully erosion and bank undercutting) however the catchment area for the swale is small. Most of the site channel was dry, with surface water restricted to infrequently occurring shallow pools that supported filamentous green alga.

As noted for LC2, a swamp-oak needle detrital layer had accumulated throughout the drainage channel floor, walls and tributary swale, indicating a period of stability (in terms of potential recent scouring flow impacts). Spiny rushes growing on the drainage channel floor and edge banks showed signs of regrowth.

There was an improved category score recorded for 'Particle size of materials on the drainage floor' owing to the presence of gravels in the channel basin, and re-assessment of the 'Shape of drainage line cross-section' and 'Longitudinal morphology' resulted in an improved category score. Overall, the was an improvement in the CSIRO ESA score between 2022 and 2023 which shifted the band rating from *Very Active* to *Active*.

Figure 18: Site LC3 looking upstream (left) and looking downstream (right).

Figure 19: Site LC3 left hand bank (left) and right-hand bank (right).

3.3.4 Loder Creek site LC4

Site: LC4		7/12/23	
Coordinates (MGA56):		E	N
		322367	6385647
CSIRO	Year	Score	Rating
	2022	66	Potentially Stabilising
	2023	66	Potentially Stabilising

The LC4 site channel is relatively broad and flat-bottomed with a localised break in the riparian canopy corridor due to the powerline easement (**Figure 20**). The drainage channel is bordered by a near vertical, stepped bank along the left-hand side and shallow sloped bank along the right-hand side (**Figure 21**). For the 2023 survey, site LC4 was mostly dry with surface water present among a few isolated, shallow pools.

Figure 20: Site LC4 looking upstream (left) and looking downstream (right).

Figure 21: Site LC4 left bank (left) and right bank (right).

For the most part, a continuous assortment of groundcover species (grasses, shrubs and weeds) provide stabilisation for the channel floor and walls from stream flows or runoff. An exposed animal track traverses the channel from the left-hand bank which presents a localised source of erosion, which is bordered by an active erosion scar at the upper crest of the bank (**Figure 21** left-hand side).

The condition of both potential erosion sources appeared stable with groundcover having grown around their exposure perimeter, and throughout the broader channel area in general. The channel weeds (mainly spiny rush, fleabane and purple top), grasses (couch and slender bamboo grass) had showed signs of recent growth, likely in response to recent rainfall events, and there were new cumbungi plants shooting in the channel floor. The occurrences of thistle (*Cirsium vulgare*) had declined since the previous survey.

There were no changes to the LC4 site CSIRO ESA rating in 2023 which remained as *Potentially Stabilising*, reflective of the consistency in channel and riparian vegetation conditions between surveys.

3.3.5 Loder Creek site LC5

Site: LC5		7/12/23	
Coordinates (MGA56):		E	N
		322484	6385655
CSIRO	Year	Score	Rating
	2022	59	Active
	2023	69	Potentially Stabilising

The channel basin at LC5 comprises a V-shaped channel with mostly shallow sloped banks. The riparian corridor at the location is fragmented, bordered by continuous and dense stands of swamp-oak upstream, however the understorey and ground cover vegetation are dense (**Figure 22**). For the 2023 survey surface water was contained among isolated refuge pools and there were no surface flows observed.

The upper right-hand bank contains an active erosion scar with rilling around its upper limits (**Figure 23**). While extent and condition of the exposure is consistent with the previous monitoring round, the accumulation of soft, fine sediments at the base of the slope and its colonisation by grasses and rushes does indicate that it's an active source of erosive material during wet weather events (**Figure 24**). There were some new swamp-oak saplings observed along the channel bank walls, and the instream and edge bank vegetation (grasses and rushes) had showed signs of minor growth since 2022.

There was an improved category score recorded for ‘Nature of drainage line wall materials’ owing to reduced estimate of exposed soils along drainage line walls, and re-assessment of the ‘Shape of drainage line cross-section’ and ‘Longitudinal morphology’ resulted in an improved scores their respective categories, resulting in an improved CSIRO rating of *Potentially Stabilising* in 2023.

Figure 22: Looking upstream (left) and downstream (right) at LC5.

Figure 23: Site LC5 left bank (left) and erosion scar (right).

Figure 24: Couch grass colonising colluvial deposits (fine clayey sand) at the base of the right-hand bank, sourced from the erosion scar shown in **Figure 23**.

3.3.6 Loder Creek site LC6

Site: LC6		7/12/23	
Coordinates (MGA56):		E	N
		322670	6385697
CSIRO	Year	Score	Rating
	2022	53	Active
	2023	50	Active

Site LC6 is situated in Loder Creek just upstream from the Nine Mile Creek confluence, in a V-shaped channel with moderately sloped channel walls and incised, box shaped channel. Surface waters were mostly clear and continuous throughout the section with no surface flows observed (**Figure 25**), with charophytes and plague minnow present in pool habitats.

The swamp-oak riparian corridor is generally narrow, relatively dense and continuous and throughout the width of the channel with cleared pastures and rehabilitated mining land beyond the riparian strip (**Figure 26**). The upper right-hand bank contains a considerable erosion scar which remains an active source of fine sediment to the creekline (**Figure 27**). As noted at LC5, accumulated fine sediments at the base of the slopes have been colonised by couch grass which show signs of recent growth, as had spiny rushes which occupy the channel floor, however there are still bare patches with no vegetation (only swamp-oak needles) occupying much of the channel area, which limit the category score for 'Vegetation on drainage line floor' to 2, and resulted in a decrease in the overall CSIRO ESA score from 53 in 2022 to 50 in 2023.

Notwithstanding, there were no changes to the LC6 site CSIRO ESA rating which remained as *Active* in 2023.

Figure 25: Looking upstream at site LC6 (left) and looking downstream (right).

Figure 26: Site LC6 left bank (left) and right bank (right).

Figure 27: Bank erosion along upper right-hand bank at LC6.

3.3.7 Loder Creek site LC7

Site: LC7		7/12/23	
Coordinates (MGA56):		E	N
		322759	6385778
CSIRO	Year	Score	Rating
	2022	53	Active
	2023	59	Active

Site LC7 is located downstream of the confluence of Loder Creek and Nine Mile Creek. The channel is incised and box-shaped, meandering through a broader V-shaped valley containing some moderately sloped banks on both sides (**Figures 28** and **29**). Although there was no surface flow encountered at LC7 in 2023, surface water was present throughout most of the section, with charophytes and plague minnow present among pool habitats.

Figure 28: Looking upstream in LC7 (left) and looking downstream (right).

Figure 29: Site LC7 left bank (left) and right bank (right).

While there were minor changes in vegetation condition noted for the 2023 survey, for the most part the overall condition of the LC7 site riparian and channel environments were unchanged for the 2023 survey.

The main source of erosion in LC7 is from animal tracks which traverse the drainage channel width, and fine silt sediments accumulated at the base of the tracks had been colonised by both couch grasses and spiny rushes with signs of recent growth, however there was no change to category score for 'Vegetation on drainage line floor' as the existing score was already the highest.

A re-evaluation of the category scores for 'Vegetation growing on the drainage line walls', and 'Nature of lateral flow regulation into drainage line' resulted in and overall improved CSIRO ESA site score, however the overall band rating remained as *Active*.

3.3.8 Loder Creek site LC11

Site: LC11		7/12/23	
Coordinates (MGA56):		E	N
		322881	6386043
CSIRO	Year	Score	Rating
	2022	N/A	N/A
	2023	66	Potentially Stabilising

Compared to sites upstream in Loder Creek, the LC11 stream channel consists of a broad and flat-bottomed meandering channel, with intermittently occurring stepped bank edges intersected by shallow sloped (curved) banks (**Figures 30** and **31**). Note that the site was not surveyed in 2022 due to wildlife hazards.

Surface waters were continuous with filamentous green alga abundant throughout the length. The vegetation along the drainage channel floor contains some bare patches covered in a layer of swamp-oak detritus and generally sparse occurrences of common reed and spiny rush, with new grass growth on instream sediment banks (as represented by the bright green area shown in **Figure 30** right-hand side) likely facilitated by recent rain events.

The riparian corridor comprises a continuous strip of swamp-oaks with scattered eucalypt in the overstorey and dense understorey, where lantana has proliferated since the previous survey in 2021 (**Figure 31**). The CSIRO ESA rating indicated that the site was *Potentially Stabilising* in 2023.

Figure 30: Looking upstream in LC7 (left) and looking downstream (right).

Figure 31: Site LC11 left bank (left) and right bank (right).

3.3.9 Loder Creek site LC12

Site: LC12		8/12/23	
Coordinates (MGA56):		E	N
		323802	6388650
CSIRO	Year	Score	Rating
	2022	63	Potentially Stabilising
	2023	59	Active

The channel at LC12 comprises a flat-bottomed meandering channel with moderate incision into the surrounding valley floor, which is bordered by moderately sloping and higher left-hand bank and shallow sloped bank along the right-hand side (**Figures 32** and **33**). At the time of survey surface waters were clear with visible trickling through the shallow constricted pool sections.

The previous monitoring round in 2022 noted that spiny rushes and common reeds at LC12 had died back, and while there was no indication of recovery for the 2023 survey, the reduction was insufficient to warrant reducing the category score for 'Vegetation on drainage line floor'. Couch grasses and streaked arrow grass (*Triglochin striatum*) showed signs of localised renewed growth, however much of the drainage line floor and walls comprised bare ground smothered in a layer of swamp-oak needles during the 2023 survey (**Figures 32** and **33**). Cattle access the creekline at LC12 contributes to exposure of soil profiles through trampling, and there was a reduction in category score for 'Nature of drainage line wall materials' owing to an increase in the estimate of exposed soils along drainage line walls, and as a result, the LC12 CSIRO ESA score declined, and the overall site rating shifted from the lower limits of *Potentially Stabilising* to the upper limits of *Active* in 2023.

Figure 32: Looking upstream at LC12 (left) and looking downstream (right).

Figure 33: Site LC12 left bank (left) and right bank (right) in 2023.

3.3.13 Loder Creek site LC14

Site: LC14		8/12/23	
Coordinates (MGA56):		E	N
		323800	6389222
CSIRO	Year	Score	Rating
	2022	59	Active
	2023	59	Active

The Loder Creek channel at LC14 comprises a flat-bottomed meandering channel with variable incision into the surrounding valley floor, with a steep bank bordering the stream along the left-hand side and shallow profile bank to the right (**Figures 34** and **35**). Surface waters were clear with visible trickling through the shallow riffle section.

The channel floor and bank edges support pockets of dense swamp-oak stands surrounded by moderate quantities of groundcover and understorey vegetation, comprising grasses, sedges (spiny rush), common reed stands, fat hen and some weeds (thistle, fleabane, annual beard grass).

A livestock access track through the middle of the site has created areas of exposed soils and active erosion scars which occur along the upper left-hand bank, and further downstream on the creek bend contains some significant exposed soil profiles where bank undercutting occurs in response to creek flow events.

Overall, the site drainage channel condition appears consistent with the previous monitoring round and there were no changes to the CSIRO ESA rating, maintaining its rating within the upper limits of *Active* in 2023.

Figure 34: Looking upstream at LC14 (left) and looking downstream (right) in 2023.

Figure 35: Site LC14 left bank (left) and right bank (right).

3.3.10 Loder Creek site LC8

Site: LC8		6/12/23	
Coordinates (MGA56):		E	N
		323948	6389351
CSIRO	Year	Score	Rating
	2022	69	Potentially Stabilising
	2023	66	Potentially Stabilising

The drainage channel at LC8 comprises a steep, vertical bank along the western side and shallower sloped, stepped bank to the east, and both edges support a thin and continuous strip of riparian swamp-oak trees which are undercut in parts (**Figures 36** and **37**). Surface waters were clear wand flowing through the site length for the 2023 survey.

The left-hand bank is steep and undercut however the mature riparian swamp-oaks provide sufficient stability to limit soil dispersal to minor localised losses on a year-to-year basis despite ongoing livestock access.

Figure 36: Looking upstream at LC8 (left) and looking downstream (right).

Figure 37: Site LC8 left bank (left) and right bank (right).

There was a reduction in category score for 'Vegetation on drainage line walls' as the condition of vegetation was more fitting of the rating 2 description, which contributed the reduction in overall CSIRO site score, however the rating remained as *Potentially Stabilising* in 2023.

3.3.11 Loder Creek site LC9

Site: LC9		6/12/23	
Coordinates (MGA56):		E	N
		323996	6389540
CSIRO	Year	Score	Rating
	2022	66	Potentially Stabilising
	2023	69	Potentially Stabilising

Loder Creek site LC9 stream channel is generally straight with low profile banks with a dense and thin strip of swamp-oak riparian corridor up and downstream of the open channel area surrounding the middle of the site (**Figures 38** and **39**).

The creek waters were clear and flowing throughout the site length for the 2023 survey. The instream and edge bank couch grasses, common reed and spiny rush growths showed signs of minor growth since the 2022 survey, and the erosion points along the right-hand bank appeared more vegetated (with pasture grasses) despite signs of recent cattle usage of the area (tracks, scats). The left-hand bank riparian corridor remains in good condition with a dense coverage of small to medium sized swamp-oaks and saplings (<1m height). There were no changes to the LC9 site CSIRO ESA rating which has remained within the upper half of *Potentially Stabilising* since 2018.

Figure 38: Looking upstream (left) and downstream (right) at LC9.

Figure 39: Site LC9 left bank (left) and right bank (right).

3.3.12 Loder Creek site LC10

Site: LC10		5/12/23	
Coordinates (MGA56):		E	N
		324131	6390142
CSIRO	Year	Score	Rating
	2022	59	Active
	2023	63	Potentially Stabilising

Site LC10 is located in the lower limits of Loder Creek at a concrete causeway with a narrow 100mm piped culvert (**Figures 40** and **41**). The channel is incised into the surrounding valley floor, and moderately steep V-shaped banks along both sides of the creek (reaching 5 to 8m above the channel floor), with bank undercutting prevalent throughout the section. With the exception of the narrow and fragmented band of riparian swamp-oak trees, pasture grasses provide the only source of sediment stabilisation in the riparian zone.

Surface waters were clear for the 2023 survey and flow was continuous throughout the site length. The condition of the riparian bank vegetation and erosional features (mostly restricted to flow induced bank undercutting and stepped bank profiles from livestock access) remained unchanged from the previous survey. There was an increase in category score for 'Particle size of materials on drainage line floor' due to observations made of coarser materials on the substrates up and downstream of the causeway. As a result, the overall LC10 CSIRO ESA rating increased from *Active* to *Potentially Stabilising* for the 2023 survey.

Figure 40: Site LC10 looking upstream from causeway (left) and looking downstream (right).

Figure 41: LC10 left bank (left) and right bank (right).

3.3.13 Loder Creek site LC15

Site: LC15		5/12/23	
Coordinates (MGA56):		E	N
		324150	6390239
CSIRO	Year	Score	Rating
	2022	53	Active
	2023	53	Active

The creek channel at LC15 is incised into the surrounding valley floor at depths of 8 to 10m. The creekline contains moderately steep to near vertical sections of bank along both sides with bank undercutting and stepped bank walls prevalent throughout the section as a result of livestock access and fluvial processes (**Figures 42** and **43**). Surface waters were generally clear with low flow through the site, and filamentous green alga was abundant in the creek pools.

The narrow and fragmented band of mature swamp-oak riparian trees and pasture grasses provide the only source of sediment stabilisation in the riparian zone. The eastern (right-hand) bank contains an extensive active erosion face along its upper edge whereas, the left-hand bank contains vegetated stepped banks with localised, exposed soil profiles.

Despite the groundcover vegetation (pasture grasses and weeds) showing a recovery from the degraded condition encountered in 2022, the 'Vegetation on drainage line' category score was reduced for the 2023 survey (from 3 to 2), as the 2023 condition was more suited to the relevant category description. A re-assessment of the 'Shape of drainage line cross-section' resulted in an improved category score, which resulted in and unchanged overall CSIRO ESA score and rating which remained as *Stable* in 2023.

Figure 42: Site LC15 looking upstream (left) and looking downstream (right).

Figure 43: LC15 left bank (left) and right bank (right).

3.3.13 Loder Creek site LC13

Site: LC13		5/12/23	
Coordinates (MGA56):		E	N
		324160	6390408
CSIRO	Year	Score	Rating
	2022	63	Potentially Stabilising
	2023	63	Potentially Stabilising

The channel form at LC13 is similar to that noted for LC10, and consists of a V-shaped channel, deeply incised (7 to 10m) into the surrounding catchment area with fragmented riparian corridor consisting of mature she-oak and eucalypts (**Figures 44** and **45**). Surface waters were turbid and continuous through the site, and carp (*Cyprinus carpio*) were observed.

Figure 44: Looking upstream (left) and downstream (right) at site LC13 in 2023.

Figure 45: Looking along the left-hand bank at LC13 (left) and right bank (right).

The sloped drainage channel walls show signs of frequent usage by livestock with minor stepped banks however for the most part, the only areas of active erosion are limited to isolated patches along the upper left-hand bank and along the waters edge. There were slight increases in groundcover vegetation (pasture grasses, thistle, fleabane) along both banks compared to the previous survey however it was insufficient to warrant an increase to the highest category score for 'Vegetation on drainage line walls'. The LC13 site CSIRO ESA rating remained unchanged in 2023 (*Potentially Stabilising*).

3.3.13 Loder Creek site LC16

Site: LC16		5/12/23	
Coordinates (MGA56):		E	N
		324329	6390543
CSIRO	Year	Score	Rating
	2022	50	Active
	2023	53	Active

Site LC16 is located in the lower limits of Loder Creek, around 150m upstream from the confluence of the Hunter River. The channel banks are moderately sloped with very sparse occurrences of trees (gaps of 50m or more) (**Figures 44** and **45**). Waters were clear with sluggish flow at the time of survey.

The drainage channel walls showed signs of recovery from the 2022 survey where flood impacts removed or smothered the groundcover vegetation, and significant mud was deposited in the channel basin throughout the lower limits of Loder Creek (see SLR 2022).

Figure 44: Looking upstream (left) and downstream (right) at site LC16 in 2023.

Figure 45: Looking along the left-hand bank at LC16 (left) and right-hand bank (right).

Whilst the mud deposits remain throughout the site length channel basin, groundcover vegetation along the channel walls was very dense, comprising pasture grasses and weed growth, including thistle (*Cirsium vulgare*), sowthistle (*Sonchus oleraceus*), thistle, green cestrum (*Cestrum parqui*), purple top, dock (*Rumex sp*), Buchan weed (*Hirschfeldia incana*). Along the lower bank walls, emergent macrophytes were continuous at the water's edge (common reed, tall spikerush and slender knotweed).

Mass failure occurs along the upper right-hand bank with an exposed soil profile and active erosional features (most likely a scour hole left from a tree root mass), and the left bank contains stepped banks with infrequent undercutting isolated to heights of less than 1m. A re-evaluation of the 'Shape of drainage line cross-section' resulted in an improved category score and overall CSIRO ESA score in 2023, however the CSIRO rating within the limits of *Active* in 2023.

4 SUMMARY

In 2023 Marine Pollution Research (MPR) was engaged by MTW to undertake stream health and channel stability monitoring of creekline drainages adjacent the MTW open cut mining operations in the upper Hunter Valley, NSW, to meet the requirements outlined in Section 7.4 of the approved WMP (Version 5.1, October 2021). This report provides the results for the 2023 Annual Stream health and Channel Stability monitoring survey undertaken in December 2023.

Following on from the previous years' record rainfall, 2023 saw a shift in weather patterns with an intensification of dry weather conditions, particularly during the winter months which historically are the driest. The annual total in 2023 (560mm) was less than half the total in 2022 (1204mm), almost half of which fell in the first quarter (267mm). There were no major flood events in 2023 and stream flows logged by the WaterNSW Wollombi Brook gauging station (210028) indicate moderate and fluctuating flows on a monthly basis between January and March followed by a gradual decline from April to December.

Despite the dry conditions throughout much of the year, there was consistent, almost daily rainfall totalling 53mm over the nine-day period leading into the 2023 Stream Health Channel Stability Monitoring survey in early December, that replenished creekline aquifers in Loder Creek and stimulated riparian and channel vegetation growth.

Table 4 below provides a summary comparison of the RARC and CSIRO results over the previous three years. Whilst some of the changes to CSIRO and RARC category ratings were owing to re-evaluation of the category scores recorded for the previous survey (and subsequent shifting of band ratings), the majority of individual category scores were unchanged. Loder Creek site CSIRO ratings ranged between *Active* and *Stable*, and the most influential sources of poor condition assessment relate to existing exposed soil profiles and erosion scars, lack of vegetation and associated ongoing impacts from rainfall events. The 2023 survey indicates that sources of fine silt to the creekline occur from exposed and active erosion scars along the upper bank Loder Creek bank edges, from slumped trees or from tracks formed by ongoing animal use (kangaroos, livestock or wild pigs), and with mobilisation of sediments occurring via lateral inflows to the creek or from longitudinally scouring flow events within the main creek channel.

At several locations in upper Loder Creek (between LC4 and LC7), fine colluvial sediments accumulated at the bases of the bank slopes have become colonised by vegetation (mostly couch grasses and spiny rushes), which had showed renewed growth in 2023, presumably from recent rainfall events.

The 2023 Stream Health Monitoring RARC results have showed consistency over the consecutive post-drought surveys since 2021 (**Table 4**). The MTW site RARC results ranged between *Average* (MTW LDP, Loder Creek site BM35 and Wollombi Brook site BM37) and *Good* (Loder Creek site BM34).

The continuity and complexity of the stream health site riparian corridors influence many of the RARC category features. Both river-oak and swamp-oak dominant riparian canopy forming species contribute to the presence of debris (detritus, fallen logs, hollows), which in turn limit the potential complexity of the understorey and groundcover species, including weeds. Additionally, Loder Creek site BM35 banks are relatively steep, containing consolidated soils which are susceptible to erosion and inhibit the establishment of understorey and groundcover vegetation, as indicated by poor category scores returned for 'Natives' and 'Features' (native species vegetation cover and regeneration of understorey and groundcover communities).

The land surrounding site BM34 comprise cleared pasture land where livestock have been excluded, and whilst insufficient to change the overall site band rating, a recent increase in riparian canopy vegetation width results at BM34 reflect the gradual succession in riparian condition. Other factors which influence the poor RARC category scores on a site-by-site basis include competition from weed and disturbance from animals (wild pigs) and with ongoing controls in place the overall riparian and channel condition among Loder Creek and Wollombi Brook sites should continue to improve over time.

It is recommended that the MTW LDP stream health channel stability monitoring site be relocated for future monitoring events. To date, channel transect measurements have been undertaken across the width of the channel at the discharge pipe outlet, and the results have been highly variable owing to the inter-survey variation in placements of the measurement staff on boulders, which is limited in its ability to inform whether or not there has been any potential erosion or deposition occurring as a result of the LDP. It is therefore recommended that the transect profile site be moved to the channel area just downstream of the boulder embankment for a more effective monitoring point that is capable of detecting potential depositional or erosive events.

Table 4 MTW RARC and CSIRO Summary Results 2021 to 2023						
	RARC			CSIRO		
Site	Nov-21	Nov-22	Dec-23	Nov-21	Nov-22	Dec-23
MTW LDP	Average	Average	Average	Potentially Stabilising	Potentially Stabilising	Potentially Stabilising
BM34	Average	Average	Good	Stable	Stable	Stable
BM35	Poor	Average	Average	Active	Active	Active
BM37	Poor	Average	Average	Potentially Stabilising	Potentially Stabilising	Stable
LC1	NA	NA	NA	Stable	Stable	Stable
LC2	NA	NA	NA	Active	Active	Potentially Stabilising
LC3	NA	NA	NA	Very Active	Very Active	Active
LC4	NA	NA	NA	Potentially Stabilising	Potentially Stabilising	Potentially Stabilising
LC5	NA	NA	NA	Active	Active	Potentially Stabilising
LC6	NA	NA	NA	Active	Active	Active
LC7	NA	NA	NA	Active	Active	Active
LC8	NA	NA	NA	Potentially Stabilising	Potentially Stabilising	Potentially Stabilising
LC9	NA	NA	NA	Potentially Stabilising	Potentially Stabilising	Potentially Stabilising
LC10	NA	NA	NA	Active	Active	Potentially Stabilising
LC11	NA	NA	NA	Active	N.A.	Potentially Stabilising
LC12	NA	NA	NA	Potentially Stabilising	Potentially Stabilising	Active
LC13	NA	NA	NA	Potentially Stabilising	Potentially Stabilising	Active
LC14	NA	NA	NA	Active	Active	Active
LC15	NA	NA	NA	NA	Active	Active
LC16	NA	NA	NA	NA	Active	Active

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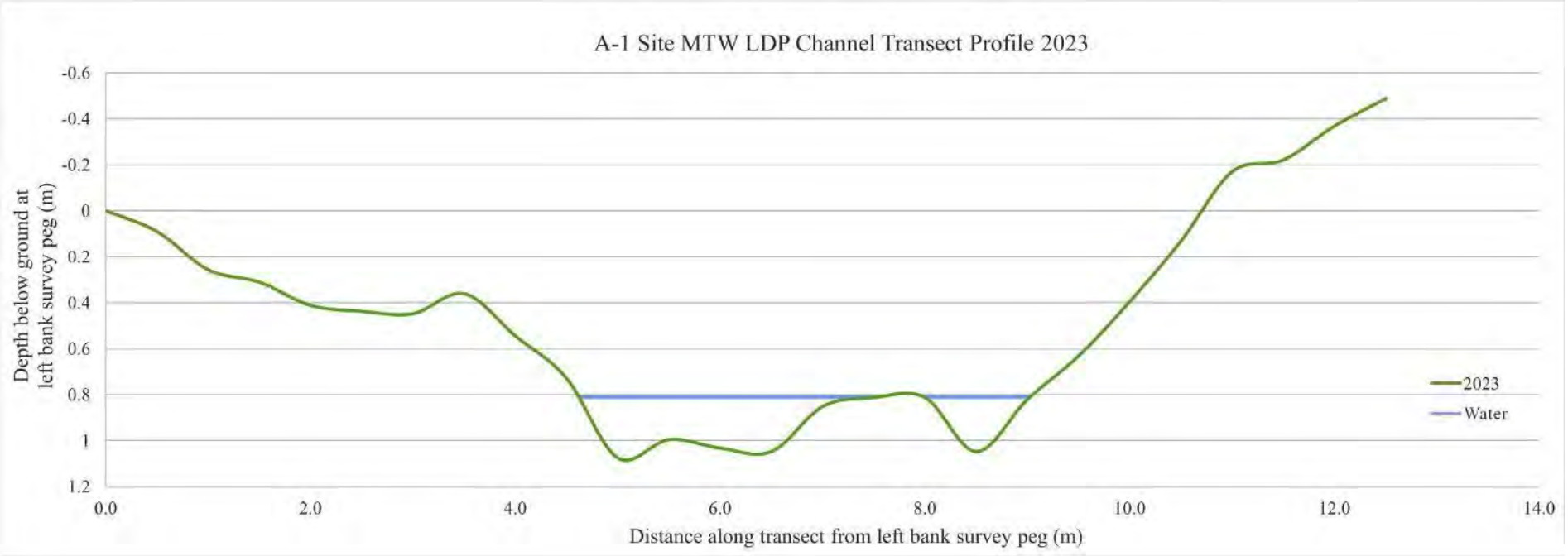
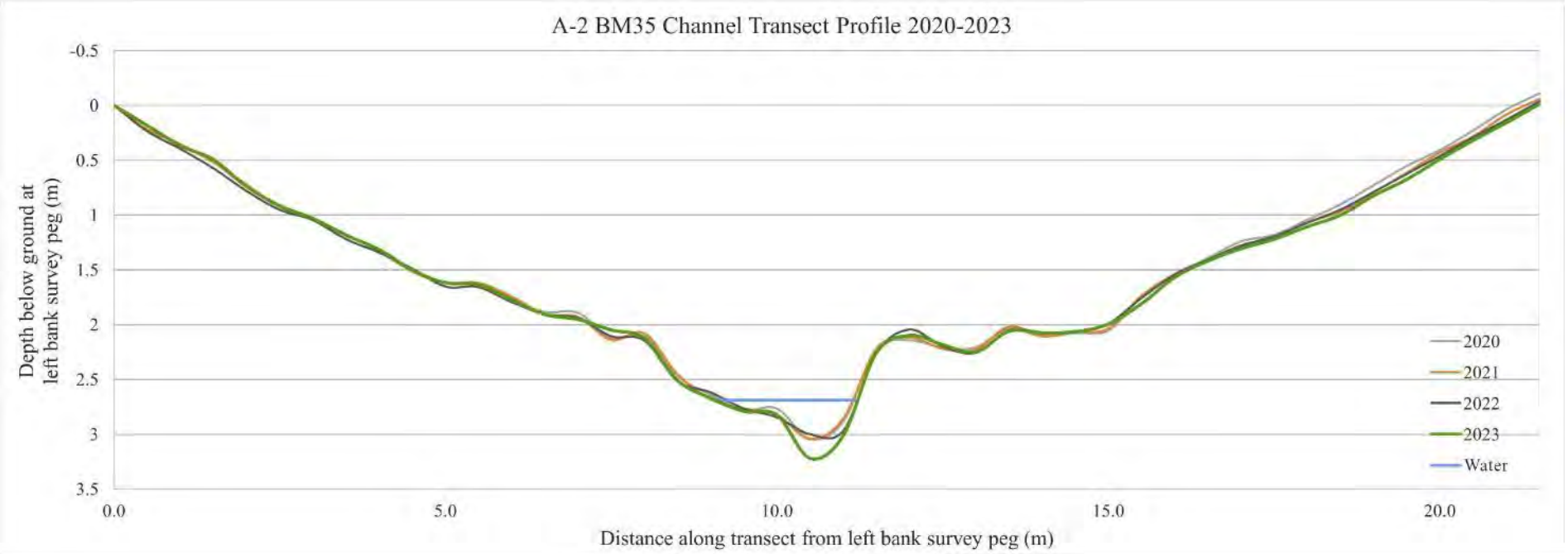
APPENDIX A

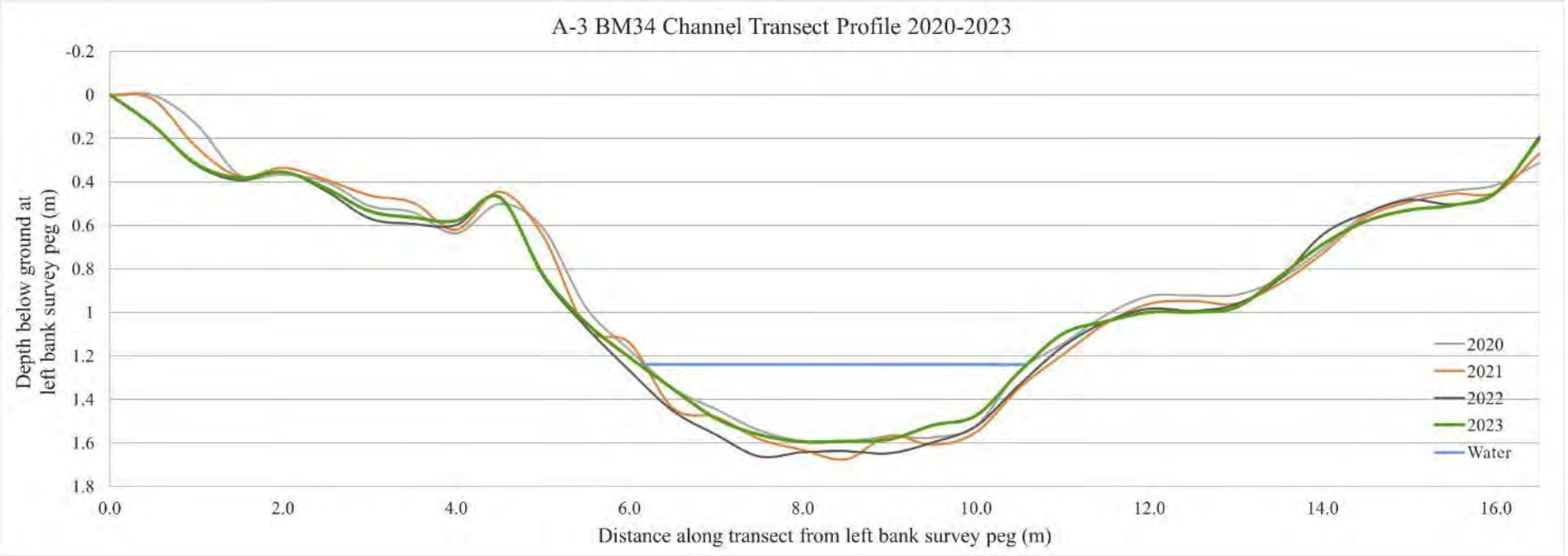
STREAM HEALTH & STABILITY

MONITORING SITE

CHANNEL TRANSECTS


A-1 Site MTW LDP Channel Transect Profile 2023
Depth below ground at left bank survey peg (m)
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
Distance along transect from left bank survey peg (m)
2023
Water


A-2 BM35 Channel Transect Profile 2020-2023
Depth below ground at left bank survey peg (m)
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
0.0
5.0
10.0
15.0
20.0
Distance along transect from left bank survey peg (m)
2020
2021
2022
2023
Water


A-3 BM34 Channel Transect Profile 2020-2023
Depth below ground at left bank survey peg (m)
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
Distance along transect from left bank survey peg (m)
2020
2021
2022
2023
Water

APPENDIX B

STREAM HEALTH & STABILITY

MONITORING SITE

RARC FIELDSHEET DATA

Rapid Appraisal of Riparian Condition

Site:	**Loder Creek**			**Site Number**	**MTW LDP**
Date:	**07/12/23**	**Observer:**	**JB+AG**		

Longitudinal continuity of riparian canopy vegetation (>5m wide)

Map	Score
	3

0 = <50%, 1 = 50-64%, 2 = 65-79%, 3 = 80-94%, 4 = ≥95% vegetated bank; with ½ point subtracted for each significant discontinuity (>50m long)

Width of riparian canopy vegetation

Transect	Channel Width (CW)	Vegetation Width (VW)	Score
1	4	48	4
2	6	20	3
3	5	40	4
4	5	35	3
Average			3.5

Channel ≤10m wide: 0 = VW <5m, 1 = VW 5-9m , 2 = VW 10-19m, 3 = VW 20-39m, 4 = VW ≥40m

Channel >10m wide: 0 = VW/CW <0.5, 1 = VW/CW 0.5-0.9, 2 = VW/CW 1-1.9, 3 = VW/CW 2-3.9, 4 = VW/CW ≥4

Proximity

Score
2

Nearest patch of native vegetation >10ha:

0 = >1km, 1 = 200m-1km, 2 = contiguous,

3 = contiguous with patch >50ha

Vegetation cover: Canopy >5m, Understorey 1-5m, Ground cover <1m

Transect	Canopy	Native canopy	Understorey	Native understorey	Ground cover	Native ground cover	# layers
1	3	3	2	1	1	1	3
2	2	2	2	1	2	1	3
3	2	2	1	1	2	1	3
4	3	3	1	1	1	1	3
Average	2.5	2.5	1.5	1	1.5	1	3

Canopy and ground cover: 0 = none, 1 = 1-30%, 2 = 31-60%, 3 = >60%

Understorey cover: 0 = none, 1 = 1-5%, 2 = 6-30%, 3 = >30%

Debris

Transect	Leaf litter	Native leaf litter	Standing dead trees	Hollow-bearing trees	Fallen logs
1	3	3	0	0	2
2	3	3	1	0	1
3	3	3	1	0	1
4	3	3	0	0	2
Average	3	3	0.5	0	1.5

Leaf litter & native leaf litter cover: 0 = none, 1 = 1-30%, 2 = 31-60%, 3 = >60%

Standing dead trees (>20cm dbh) & hollow-bearing trees: 0 = absent, 1 = present

Fallen logs (>10cm diameter): 0 = none, 1 = small quantities, 2 = abundant

Features

Transect	species regeneration	Native understorey regeneration	Large native tussock grasses	Reeds
1	1	0	1	0
2	1	0	1	0
3	1	0	1	0
4	1	0	1	0
Average	1	0	1	0

Regeneration <1m tall: 0 = none, 1 = scattered, and 2 = abundant, with ½ point subtracted for grazing damage

Reeds & large tussock grasses: 0 = none, 1 = scattered, and 2 = abundant

Calculation of scores

Site:	MTW LDP

Longitudinal continuity of riparian canopy vegetation

Score
3

Width of riparian canopy vegetation

Average	3.5

Proximity

Score
2

Vegetation cover

	Canopy	Native canopy	Understorey	Native understorey	Ground cover	Native ground cover	# layers
Average	2.5	2.5	1.5	1	1.5	1	3

Debris

	Leaf litter	Native leaf litter	Standing dead trees	Hollow-bearing trees	Fallen logs
Average	3	3	0.5	0	1.5

Features

	species regeneration	Native understorey regeneration	Large native tussock grasses	Reeds
Average	1	0	1	0

TOTALS

Site:	Habitat	Cover	Natives	Debris	Features	**Total**
(out of)	11	12	9	10	8	50
	8.5	8.5	4.5	8	2	31.5

Rapid Appraisal of Riparian Condition

Creek:	Loder Creek			Site:	BM34
Date:	06/12/23	Observer:	JB+AG		

Longitudinal continuity of riparian canopy vegetation (>5m wide)

Map	Score
	4

0 = <50%, 1 = 50-64%, 2 = 65-79%, 3 = 80-94%, 4 = ≥95% vegetated bank; with ½ point subtracted for each significant discontinuity (>50m long)

Width of riparian canopy vegetation

Transect	Channel Width (CW)	Vegetation Width (VW)	Score
1	5	40	4
2	5	25	3
3	5	30	3
4	5	35	3
Average			3.25

Channel ≤10m wide: 0 = VW <5m, 1 = VW 5-9m , 2 = VW 10-19m, 3 = VW 20-39m, 4 = VW ≥40m

Channel >10m wide: 0 = VW/CW <0.5, 1 = VW/CW 0.5-0.9, 2 = VW/CW 1-1.9, 3 = VW/CW 2-3.9, 4 = VW/CW ≥4

Proximity

Score
2

Nearest patch of native vegetation >10ha:
0 = >1km, 1 = 200m-1km, 2 = contiguous,
3 = contiguous with patch >50ha

Vegetation cover: Canopy >5m, Understorey 1-5m, Ground cover <1m

Transect	Canopy	Native canopy	Understorey	Native understorey	Ground cover	Native ground cover	# layers
1	3	3	3	2	2	2	3
2	3	3	3	1	3	2	3
3	3	3	2	1	3	2	3
4	3	3	3	1	3	2	3
Average	3	3	2.75	1.25	2.75	2	3

Canopy and ground cover: 0 = none, 1 = 1-30%, 2 = 31-60%, 3 = >60%

Understorey cover: 0 = none, 1 = 1-5%, 2 = 6-30%, 3 = >30%

Debris

Transect	Leaf litter	Native leaf litter	Standing dead trees	Hollow-bearing trees	Fallen logs
1	2	2	1	0	1
2	2	2	0	0	1
3	2	2	0	0	1
4	2	2	0	0	0
Average	2	2	0.25	0	0.75

Leaf litter & native leaf litter cover: 0 = none, 1 = 1-30%, 2 = 31-60%, 3 = >60%

Standing dead trees (>20cm dbh) & hollow-bearing trees: 0 = absent, 1 = present

Fallen logs (>10cm diameter): 0 = none, 1 = small quantities, 2 = abundant

Features

Transect	species regeneration	Native understorey regeneration	Large native tussock grasses	Reeds
1	1	1	1	1
2	1	1	1	2
3	1	1	1	2
4	1	1	1	2
Average	1	1	1	1.75

Regeneration <1m tall: 0 = none, 1 = scattered, and 2 = abundant, with ½ point subtracted for grazing damage

Reeds & large tussock grasses: 0 = none, 1 = scattered, and 2 = abundant

Calculation of scores

Site:	BM34

Longitudinal continuity of riparian canopy vegetation

Score
4

Width of riparian canopy vegetation

Average	3.25

Proximity

Score
2

Vegetation cover

	Canopy	Native canopy	Understorey	Native understorey	Ground cover	Native ground cover	# layers
Average	3	3	2.75	1.25	2.75	2	3

Debris

	Leaf litter	Native leaf litter	Standing dead trees	Hollow-bearing trees	Fallen logs
Average	2	2	0.25	0	0.75

Features

	species regeneration	Native understorey regeneration	Large native tussock grasses	Reeds
Average	1	1	1	1.75

TOTALS

Site:	Habitat	Cover	Natives	Debris	Features	**Total**
(out of)	11	12	9	10	8	50
	9.25	11.5	6.25	5	4.75	36.75

Rapid Appraisal of Riparian Condition

Site:	Loder Creek			Site:	BM35
Date:		Observer:	JB+AG		

Longitudinal continuity of riparian canopy vegetation (>5m wide)

Map	Score
	3

0 = <50%, 1 = 50-64%, 2 = 65-79%, 3 = 80-94%, 4 = ≥95% vegetated bank; with ½ point subtracted for each significant discontinuity (>50m long)

Width of riparian canopy vegetation

Transect	Channel Width (CW)	Vegetation Width (VW)	Score
1	5	50	4
2	3	20	3
3	6	20	3
4	5	55	4
Average			3.5

Channel ≤10m wide: 0 = VW <5m, 1 = VW 5-9m , 2 = VW 10-19m, 3 = VW 20-39m, 4 = VW ≥40m

Channel >10m wide: 0 = VW/CW <0.5, 1 = VW/CW 0.5-0.9, 2 = VW/CW 1-1.9, 3 = VW/CW 2-3.9, 4 = VW/CW ≥4

Proximity

Score
2

Nearest patch of native vegetation >10ha:
0 = >1km, 1 = 200m-1km, 2 = contiguous,
3 = contiguous with patch >50ha

Vegetation cover: Canopy >5m, Understorey 1-5m, Ground cover <1m

Transect	Canopy	Native canopy	Understorey	Native understorey	Ground cover	Native ground cover	# layers
1	3	2	2	1	2	1	3
2	3	3	1	0	1	0	3
3	3	3	2	1	1	1	3
4	3	3	2	0	2	1	3
Average	3	2.75	1.75	0.5	1.5	0.75	3

Canopy and ground cover: 0 = none, 1 = 1-30%, 2 = 31-60%, 3 = >60%

Understorey cover: 0 = none, 1 = 1-5%, 2 = 6-30%, 3 = >30%

Debris

Transect	Leaf litter	Native leaf litter	Standing dead trees	Hollow-bearing trees	Fallen logs
1	3	3	1	0	1
2	3	3	0	0	0
3	3	3	0	0	1
4	3	3	1	0	1
Average	3	3	0.5	0	0.75

Leaf litter & native leaf litter cover: 0 = none, 1 = 1-30%, 2 = 31-60%, 3 = >60%

Standing dead trees (>20cm dbh) & hollow-bearing trees: 0 = absent, 1 = present

Fallen logs (>10cm diameter): 0 = none, 1 = small quantities, 2 = abundant

Features

Transect	species regeneration	Native understorey regeneration	Large native tussock grasses	Reeds
1	1	0	1	2
2	1	0	0	0
3	1	0	1	2
4	1	1	1	1
Average	1	0.25	0.75	1.25

Regeneration <1m tall: 0 = none, 1 = scattered, and 2 = abundant, with ½ point subtracted for grazing damage

Reeds & large tussock grasses: 0 = none, 1 = scattered, and 2 = abundant

Calculation of scores

Site:	BM35

Longitudinal continuity of riparian canopy vegetation

Score
3

Width of riparian canopy vegetation

Average	3.5

Proximity

Score
2

Vegetation cover

	Canopy	Native canopy	Understorey	Native understorey	Ground cover	Native ground cover	# layers
Average	3	2.75	1.75	0.5	1.5	0.75	3

Debris

	Leaf litter	Native leaf litter	Standing dead trees	Hollow-bearing trees	Fallen logs
Average	3	3	0.5	0	0.75

Features

	species regeneration	Native understorey regeneration	Large native tussock grasses	Reeds
Average	1	0.25	0.75	1.25

TOTALS

Site:	Habitat	Cover	Natives	Debris	Features	**Total**
(out of)	11	12	9	10	8	50
	8.5	9.25	4	7.25	3.25	32.25

Rapid Appraisal of Riparian Condition

Site:	Wollombi Brook			Site:	BM37
Date:	07/12/23	Observer:	JB+AG		

Longitudinal continuity of riparian canopy vegetation (>5m wide)

Map	Score
	3

0 = <50%, 1 = 50-64%, 2 = 65-79%, 3 = 80-94%, 4 = ≥95% vegetated bank; with ½ point subtracted for each significant discontinuity (>50m long)

Width of riparian canopy vegetation

Transect	Channel Width (CW)	Vegetation Width (VW)	Score
1	12	20	2
2	16	26	2
3	8	20	3
4	10	35	3
Average			2.5

Channel ≤10m wide: 0 = VW <5m, 1 = VW 5-9m , 2 = VW 10-19m, 3 = VW 20-39m, 4 = VW ≥40m

Channel >10m wide: 0 = VW/CW <0.5, 1 = VW/CW 0.5-0.9, 2 = VW/CW 1-1.9, 3 = VW/CW 2-3.9, 4 = VW/CW ≥4

Proximity

Score
2

Nearest patch of native vegetation >10ha:
0 = >1km, 1 = 200m-1km, 2 = contiguous,
3 = contiguous with patch >50ha

Vegetation cover: Canopy >5m, Understorey 1-5m, Ground cover <1m

Transect	Canopy	Native canopy	Understorey	Native understorey	Ground cover	Native ground cover	# layers
1	2	2	2	1	2	2	3
2	2	2	2	1	2	2	3
3	3	3	2	1	2	2	3
4	2	2	2	2	2	2	3
Average	2.25	2.25	2	1.25	2	2	3

Canopy and ground cover: 0 = none, 1 = 1-30%, 2 = 31-60%, 3 = >60%

Understorey cover: 0 = none, 1 = 1-5%, 2 = 6-30%, 3 = >30%

Debris

Transect	Leaf litter	Native leaf litter	Standing dead trees	Hollow-bearing trees	Fallen logs
1	3	3	0	0	2
2	3	3	1	0	2
3	3	3	1	0	2
4	3	3	1	0	2
Average	3	3	0.75	0	2

Leaf litter & native leaf litter cover: 0 = none, 1 = 1-30%, 2 = 31-60%, 3 = >60%

Standing dead trees (>20cm dbh) & hollow-bearing trees: 0 = absent, 1 = present

Fallen logs (>10cm diameter): 0 = none, 1 = small quantities, 2 = abundant

Features

Transect	species regeneration	Native understorey regeneration	Large native tussock grasses	Reeds
1	1	0	1	2
2	0	0	1	2
3	1	0	1	2
4	0	1	0	2
Average	0.5	0.25	0.75	2

Regeneration <1m tall: 0 = none, 1 = scattered, and 2 = abundant, with ½ point subtracted for grazing damage

Reeds & large tussock grasses: 0 = none, 1 = scattered, and 2 = abundant

Calculation of scores

Site:	BM37

Longitudinal continuity of riparian canopy vegetation

Score
3

Width of riparian canopy vegetation

Average	2.5

Proximity

Score
2

Vegetation cover

	Canopy	Native canopy	Understorey	Native understorey	Ground cover	Native ground cover	# layers
Average	2.25	2.25	2	1.25	2	2	3

Debris

	Leaf litter	Native leaf litter	Standing dead trees	Hollow-bearing trees	Fallen logs
Average	3	3	0.75	0	2

Features

	species regeneration	Native understorey regeneration	Large native tussock grasses	Reeds
Average	0.5	0.25	0.75	2

TOTALS

Site:	Habitat	Cover	Natives	Debris	Features	**Total**
(out of)	11	12	9	10	8	50
	7.5	9.25	5.5	8.75	3.5	34.5

APPENDIX C

STREAM HEALTH & STABILITY

MONITORING SITE

CSIRO ESA FIELDSHEET DATA

BSO CSIRO Ephemeral Stream Assessment					
Site	**Date of Monitoring**		**Nov-21**	**Nov-22**	**Dec-23**
	Category Description	**Rating Range**	SLR	SLR	MPR
LC1	Vegetation on D/L floor	1-3	3	3	3
	Vegetation on D/L walls	1-3	3	3	3
	Shape & aspect ratio of D/L cross-section	1-5	3	3	3
	Longitudinal morphology of D/L	1-4	3	3	3
	Particle size of materials on foor	1-3	1	1	1
	Nature of D/L wall materials	1-4	3	3	3
	Shape of stream bordering flats/ slopes	1-5	4	4	4
	Nature of lateral flow regulation into D/L	1-5	3	3	3
	Sum of Scores		**23**	**23**	**23**
	Activity Score		**72**	**72**	**72**
	Classification		**Stable**	**Stable**	**Stable**
LC2	Vegetation on D/L floor	1-3	3	3	3
	Vegetation on D/L walls	1-3	1	1	2
	Shape & aspect ratio of D/L cross-section	1-5	2	2	3
	Longitudinal morphology of D/L	1-4	2	2	2
	Particle size of materials on foor	1-3	1	1	2
	Nature of D/L wall materials	1-4	1	1	1
	Shape of stream bordering flats/ slopes	1-5	4	4	4
	Nature of lateral flow regulation into D/L	1-5	4	4	4
	Sum of Scores		**18**	**18**	**21**
	Activity Score		**56**	**56**	**66**
	Classification		**Active**	**Active**	**Potentially Stabilising**

BSO CSIRO Ephemeral Stream Assessment					
Site	**Date of Monitoring**		**Nov-21**	**Nov-22**	**Dec-23**
	Category Description	**Rating Range**	SLR	SLR	MPR
LC3	Vegetation on D/L floor	1-3	3	3	3
	Vegetation on D/L walls	1-3	1	1	1
	Shape & aspect ratio of D/L cross-section	1-5	1	1	2
	Longitudinal morphology of D/L	1-4	1	1	2
	Particle size of materials on foor	1-3	1	1	2
	Nature of D/L wall materials	1-4	1	1	1
	Shape of stream bordering flats/ slopes	1-5	3	3	3
	Nature of lateral flow regulation into D/L	1-5	2	2	2
	Sum of Scores		**13**	**13**	**16**
	Activity Score		**41**	**41**	**50**
	Classification		**Very Active**	**Very Active**	**Active**
LC4	Vegetation on D/L floor	1-3	3	3	3
	Vegetation on D/L walls	1-3	3	3	3
	Shape & aspect ratio of D/L cross-section	1-5	2	2	2
	Longitudinal morphology of D/L	1-4	3	3	3
	Particle size of materials on foor	1-3	1	1	1
	Nature of D/L wall materials	1-4	1	1	1
	Shape of stream bordering flats/ slopes	1-5	4	4	4
	Nature of lateral flow regulation into D/L	1-5	4	4	4
	Sum of Scores		**21**	**21**	**21**
	Activity Score		**66**	**66**	**66**
	Classification		**Potentially Stabilising**	**Potentially Stabilising**	**Potentially Stabilising**

BSO CSIRO Ephemeral Stream Assessment					
Site	**Date of Monitoring**		**Nov-21**	**Nov-22**	**Dec-23**
	Category Description	**Rating Range**	SLR	SLR	MPR
LC5	Vegetation on D/L floor	1-3	3	3	3
	Vegetation on D/L walls	1-3	2	2	2
	Shape & aspect ratio of D/L cross-section	1-5	2	2	3
	Longitudinal morphology of D/L	1-4	2	2	3
	Particle size of materials on foor	1-3	1	1	1
	Nature of D/L wall materials	1-4	2	2	3
	Shape of stream bordering flats/ slopes	1-5	3	3	3
	Nature of lateral flow regulation into D/L	1-5	4	4	4
	Sum of Scores		**19**	**19**	**22**
	Activity Score		**59**	**59**	**69**
	Classification		**Active**	**Active**	**Potentially Stabilising**
LC6	Vegetation on D/L floor	1-3	3	3	2
	Vegetation on D/L walls	1-3	2	2	2
	Shape & aspect ratio of D/L cross-section	1-5	2	2	2
	Longitudinal morphology of D/L	1-4	2	2	2
	Particle size of materials on foor	1-3	1	1	1
	Nature of D/L wall materials	1-4	1	1	1
	Shape of stream bordering flats/ slopes	1-5	3	3	3
	Nature of lateral flow regulation into D/L	1-5	3	3	3
	Sum of Scores		**17**	**17**	**16**
	Activity Score		**53**	**53**	**50**
	Classification		**Active**	**Active**	**Active**

BSO CSIRO Ephemeral Stream Assessment					
Site	**Date of Monitoring**		**Nov-21**	**Nov-22**	**Dec-23**
	Assessor		SLR	SLR	MPR
LC7	Vegetation on D/L floor	1-3	3	3	3
	Vegetation on D/L walls	1-3	1	1	2
	Shape & aspect ratio of D/L cross-section	1-5	2	2	2
	Longitudinal morphology of D/L	1-4	2	2	2
	Particle size of materials on foor	1-3	1	1	1
	Nature of D/L wall materials	1-4	2	2	2
	Shape of stream bordering flats/ slopes	1-5	4	4	4
	Nature of lateral flow regulation into D/L	1-5	2	2	3
	Sum of Scores		**17**	**17**	**19**
	Activity Score		**53**	**53**	**59**
	Classification		**Active**	**Active**	**Active**
LC8	Vegetation on D/L floor	1-3	2	2	2
	Vegetation on D/L walls	1-3	3	3	2
	Shape & aspect ratio of D/L cross-section	1-5	3	3	3
	Longitudinal morphology of D/L	1-4	3	3	3
	Particle size of materials on foor	1-3	1	1	1
	Nature of D/L wall materials	1-4	2	2	2
	Shape of stream bordering flats/ slopes	1-5	4	4	4
	Nature of lateral flow regulation into D/L	1-5	4	4	4
	Sum of Scores		**22**	**22**	**21**
	Activity Score		**69**	**69**	**66**
	Classification		**Potentially Stabilising**	**Potentially Stabilising**	**Potentially Stabilising**

BSO CSIRO Ephemeral Stream Assessment					
Site	**Date of Monitoring**		**Nov-21**	**Nov-22**	**Dec-23**
	Category Description	**Rating Range**	SLR	SLR	MPR
LC9	Vegetation on D/L floor	1-3	3	3	3
	Vegetation on D/L walls	1-3	3	3	3
	Shape & aspect ratio of D/L cross-section	1-5	3	3	3
	Longitudinal morphology of D/L	1-4	2	2	2
	Particle size of materials on foor	1-3	1	1	1
	Nature of D/L wall materials	1-4	2	2	2
	Shape of stream bordering flats/ slopes	1-5	3	3	4
	Nature of lateral flow regulation into D/L	1-5	4	4	4
	Sum of Scores		**21**	**21**	**22**
	Activity Score		**66**	**66**	**69**
	Classification		**Potentially Stabilising**	**Potentially Stabilising**	**Potentially Stabilising**
LC10	Vegetation on D/L floor	1-3	1	1	1
	Vegetation on D/L walls	1-3	1	1	1
	Shape & aspect ratio of D/L cross-section	1-5	2	2	2
	Longitudinal morphology of D/L	1-4	2	2	2
	Particle size of materials on foor	1-3	1	1	2
	Nature of D/L wall materials	1-4	4	4	4
	Shape of stream bordering flats/ slopes	1-5	4	4	4
	Nature of lateral flow regulation into D/L	1-5	4	4	4
	Sum of Ratings		**19**	**19**	**20**
	Activity Rating		**59**	**59**	**63**
	Classification		**Active**	**Active**	**Potentially Stabilising**

BSO CSIRO Ephemeral Stream Assessment					
Site	**Date of Monitoring**		**Nov-21**	**Nov-22**	**Dec-23**
	Category Description	**Rating Range**	SLR	SLR	MPR
LC11	Vegetation on D/L floor	1-3	2	N.A.	2
	Vegetation on D/L walls	1-3	2	N.A.	3
	Shape & aspect ratio of D/L cross-section	1-5	3	N.A.	3
	Longitudinal morphology of D/L	1-4	2	N.A.	3
	Particle size of materials on foor	1-3	1	N.A.	1
	Nature of D/L wall materials	1-4	2	N.A.	2
	Shape of stream bordering flats/ slopes	1-5	3	N.A.	3
	Nature of lateral flow regulation into D/L	1-5	4	N.A.	4
	Sum of Scores		**19**	N.A.	**21**
	Activity Score		**59**	N.A.	**66**
	Classification		**Active**	N.A.	**Potentially Stabilising**
LC12	Vegetation on D/L floor	1-3	2	2	2
	Vegetation on D/L walls	1-3	3	3	2
	Shape & aspect ratio of D/L cross-section	1-5	3	3	3
	Longitudinal morphology of D/L	1-4	2	2	3
	Particle size of materials on foor	1-3	1	1	1
	Nature of D/L wall materials	1-4	2	2	1
	Shape of stream bordering flats/ slopes	1-5	3	3	3
	Nature of lateral flow regulation into D/L	1-5	4	4	4
	Sum of Scores		**20**	**20**	**19**
	Activity Score		**63**	**63**	**59**
	Classification		**Potentially Stabilising**	**Potentially Stabilising**	**Active**

BSO CSIRO Ephemeral Stream Assessment					
Site	**Date of Monitoring**		**Nov-21**	**Nov-22**	**Dec-23**
	Category Description	**Rating Range**	SLR	SLR	MPR
LC13	Vegetation on D/L floor	1-3	1	1	1
	Vegetation on D/L walls	1-3	2	2	2
	Shape & aspect ratio of D/L cross-section	1-3	3	3	3
	Longitudinal morphology of D/L	1-3	2	2	3
	Particle size of materials on foor	1-3	1	1	1
	Nature of D/L wall materials	1-3	3	3	2
	Shape of stream bordering flats/ slopes	1-3	4	4	4
	Nature of lateral flow regulation into D/L	1-3	4	4	4
	Sum of Scores		**20**	**20**	**20**
	Activity Score		**63**	**63**	**63**
	Classification		**Potentially Stabilising**	**Potentially Stabilising**	**Potentially Stabilising**
LC14	Vegetation on D/L floor	1-3	2	2	2
	Vegetation on D/L walls	1-3	3	3	3
	Shape & aspect ratio of D/L cross-section	1-3	2	2	2
	Longitudinal morphology of D/L	1-3	2	2	2
	Particle size of materials on foor	1-3	1	1	1
	Nature of D/L wall materials	1-3	1	1	1
	Shape of stream bordering flats/ slopes	1-3	4	4	4
	Nature of lateral flow regulation into D/L	1-3	4	4	4
	Sum of Scores		**19**	**19**	**19**
	Activity Score		**59**	**59**	**59**
	Classification		**Active**	**Active**	**Active**

BSO CSIRO Ephemeral Stream Assessment					
Site	**Date of Monitoring**		**Nov-21**	**Nov-22**	**Dec-23**
	Category Description	**Rating Range**	SLR	SLR	MPR
LC15	Vegetation on D/L floor	1-3		1	1
	Vegetation on D/L walls	1-3		3	2
	Shape & aspect ratio of D/L cross-section	1-3		1	2
	Longitudinal morphology of D/L	1-3		2	2
	Particle size of materials on foor	1-3		1	1
	Nature of D/L wall materials	1-3		1	1
	Shape of stream bordering flats/ slopes	1-3		4	4
	Nature of lateral flow regulation into D/L	1-3		4	4
	Sum of Scores			**17**	**17**
	Activity Score			**53**	**53**
	Classification			**Active**	**Active**
LC16	Vegetation on D/L floor	1-3		1	1
	Vegetation on D/L walls	1-3		2	2
	Shape & aspect ratio of D/L cross-section	1-3		1	2
	Longitudinal morphology of D/L	1-3		2	2
	Particle size of materials on foor	1-3		1	1
	Nature of D/L wall materials	1-3		1	1
	Shape of stream bordering flats/ slopes	1-3		4	4
	Nature of lateral flow regulation into D/L	1-3		4	4
	Sum of Scores			**16**	**17**
	Activity Score			**50**	**53**
	Classification			**Active**	**Active**

BSO CSIRO Ephemeral Stream Assessment					
Site	**Date of Monitoring**		**Nov-21**	**Nov-22**	**Dec-23**
	Category Description	**Rating Range**	SLR	SLR	MPR
MTW LDP	Vegetation on D/L floor	1-3	1	1	1
	Vegetation on D/L walls	1-3	2	2	2
	Shape & aspect ratio of D/L cross-section	1-3	3	3	3
	Longitudinal morphology of D/L	1-3	2	2	2
	Particle size of materials on foor	1-3	3	3	3
	Nature of D/L wall materials	1-3	3	3	3
	Shape of stream bordering flats/ slopes	1-3	4	4	4
	Nature of lateral flow regulation into D/L	1-3	2	2	2
	Sum of Scores		**20**	**20**	**20**
	Activity Score		**63**	**63**	**63**
	Classification		**Potentially Stabilising**	**Potentially Stabilising**	**Potentially Stabilising**
BM34	Vegetation on D/L floor	1-3	3	3	3
	Vegetation on D/L walls	1-3	3	3	3
	Shape & aspect ratio of D/L cross-section	1-5	5	5	5
	Longitudinal morphology of D/L	1-4	3	3	3
	Particle size of materials on foor	1-3	1	1	1
	Nature of D/L wall materials	1-4	3	3	3
	Shape of stream bordering flats/ slopes	1-5	3	3	3
	Nature of lateral flow regulation into D/L	1-5	4	4	4
	Sum of Scores		**25**	**25**	**25**
	Activity Score		**78**	**78**	**78**
	Classification		**Stable**	**Stable**	**Stable**

BSO CSIRO Ephemeral Stream Assessment					
Site	**Date of Monitoring**		**Nov-21**	**Nov-22**	**Dec-23**
	Category Description	**Rating Range**	SLR	SLR	MPR
BM35	Vegetation on D/L floor	1-3	3	3	3
	Vegetation on D/L walls	1-3	2	2	2
	Shape & aspect ratio of D/L cross-section	1-5	2	2	2
	Longitudinal morphology of D/L	1-4	2	2	2
	Particle size of materials on foor	1-3	1	1	2
	Nature of D/L wall materials	1-4	2	2	2
	Shape of stream bordering flats/ slopes	1-5	3	3	3
	Nature of lateral flow regulation into D/L	1-5	3	3	3
	Sum of Scores		**18**	**18**	**19**
	Activity Score		**56**	**56**	**59**
	Classification		**Active**	**Active**	**Active**
BM37	Vegetation on D/L floor	1-3	1	1	2
	Vegetation on D/L walls	1-3	3	3	3
	Shape & aspect ratio of D/L cross-section	1-3	3	3	3
	Longitudinal morphology of D/L	1-3	4	4	4
	Particle size of materials on foor	1-3	1	1	1
	Nature of D/L wall materials	1-3	2	2	2
	Shape of stream bordering flats/ slopes	1-3	4	4	4
	Nature of lateral flow regulation into D/L	1-3	4	4	4
	Sum of Scores		**22**	**24**	**23**
	Activity Score		**69**	**73**	**72**
	Classification		**Potentially Stabilising**	**Stable**	**Stable**

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Appendix 6:

Annual Ground Water Review Report

Australasian Groundwater & Environmental Consultants

Report on

Mount Thorley Warkworth Annual Groundwater Monitoring Review 2023

Prepared for
Mount Thorley Warkworth

Project No. MTW5008.001
March 2024

ageconsultants.com.au

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Mount Thorley Warkworth
Annual Groundwater Monitoring Review 2023

1 Introduction

Yancoal Australia Ltd (Yancoal) operate the Mount Thorley and Warkworth Mines (MTW) as an amalgamated complex known as MTW, which is located 15 km south-west of Singleton in the Hunter Valley Region of NSW. The mine consists of two separate open cut mining pits operated and owned by Yancoal, accessing a series of coal seams within the Permian Wittingham Coal Measures.

Whilst MTW is operated in an amalgamated manner, the Mount Thorley and Warkworth Mines currently have separate conditions of approval issued by the NSW Department of Planning, Industry and Environment. The Development Consents for both mines (Warkworth: SSD-6464; Mount Thorley: SSD-6465) include conditions that require environmental monitoring data to be collected at each mine, with this data being reviewed and reported in an Annual Review document.

Yancoal have commissioned Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) to review groundwater monitoring data collected at MTW during 2023 and provide the results in an Annual Review.

1.1 Scope

This report is a review of groundwater monitoring data collected during the one-year monitoring period 1 January 2023 to 31 December 2023. Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) were commissioned by MTW to undertake the following scope of work:

- review alluvial and rock aquifer groundwater levels and quality;
- update relevant groundwater monitoring hydrographs;
- discuss how groundwater levels respond to rainfall and mining over the reporting period;
- discuss groundwater chemistry trend analyses;
- identify any changes/observations made during the past 12 months;
- identify exceedances of trigger criteria outlined in the approved the Water Management Plan (WMP; Water Management Plan Mount Thorley Warkworth version 5.1, dated 15 November 2021);
- assess the adequacy of the existing monitoring bore network and monitoring program; and
- provide recommendations if necessary.

2 Physical setting

2.1 Climate and rainfall

Long-term rainfall data covering the period 2007 – 2023 were obtained from MTWs Charlton Ridge weather station and are summarised in Table 2.1.

The total annual rainfall recorded at MTW for 2023 was 502.2 mm. March was the wettest month, with 83.6 mm of recorded rain, and May was the driest with 9.8 mm of rain recorded (Table 2.1). A comparison of the total annual 2023 rainfall (502.2 mm) at MTW with the longer-term 2007 to 2023 average (681.8 mm) illustrates a below-average rainfall trend for the year.

Table 2.1 2023 rainfall data

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MTW monthly Total Rainfall (mm) 2023	49.0	80.4	83.6	40.4	9.8	11.2	11.4	20.6	23.4	27.4	66.4	78.6	502.2
MTW long-term monthly Total Rainfall (mm) 2007-2023	69.7	85.5	98.7	46.1	27.3	58.1	32.6	28.8	36.0	46.6	77.8	74.5	681.8

Historical rainfall was contextualised using the Cumulative Rainfall Departure (CRD) method (Figure 2.1). This method is a summation of the monthly departure of rainfall from the long-term average monthly rainfall. A rising trend in the CRD plot indicates periods of above average rainfall, whilst a falling slope indicates periods when rainfall is below average.

The CRD (Figure 2.1) displayed an increasing trend throughout 2020, 2021 and 2022, following drought conditions from early 2017 to late 2019. However, the CRD displayed a decreasing trend throughout 2023, reflective of the typically below-average rainfall experienced throughout the year (Table 2.1; Figure 2.1).

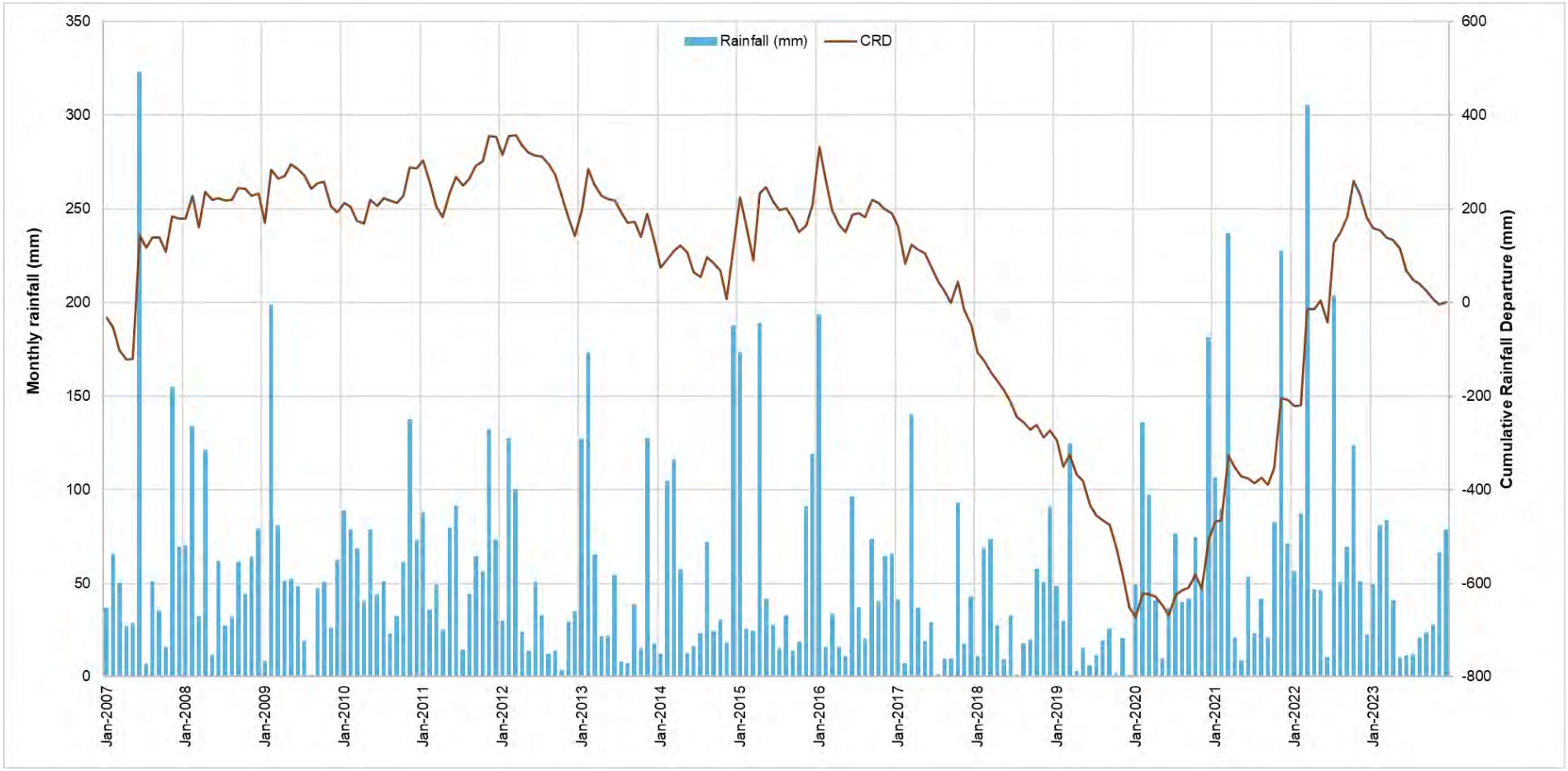


Figure 2.1 Cumulative rainfall departure (2007 to 2023) for MTW Charlton Ridge weather station

2.2 Surface water

MTW is bound by Wollombi Brook to the east and Hunter River to the north and north-east. Real time stream flow data was collected from Wollombi Brook at Warkworth (210004), Hunter River at Maison Dieu (210128) and Hunter River at Long Point (210134) from January 2016 to December 2023 (Figure 2.2).

Excepting short term fluctuations following heavy rainfall events, surface water levels decreased by approximately 0.5 m at Wollombi Brook and Hunter River at Maison Dieu and decreased by approximately 1 m at Hunter River at Long Point during 2023. Hunter River is regulated at Glenbawn Dam with daily releases to maintain flow and environmental quality. Wollombi Brook has held water since January 2020, following an extended period with no flow (period with no data on chart; Figure 2.2). Decreased flow in Wollombi Brook aligns with a decline in the CRD recorded since late 2022.

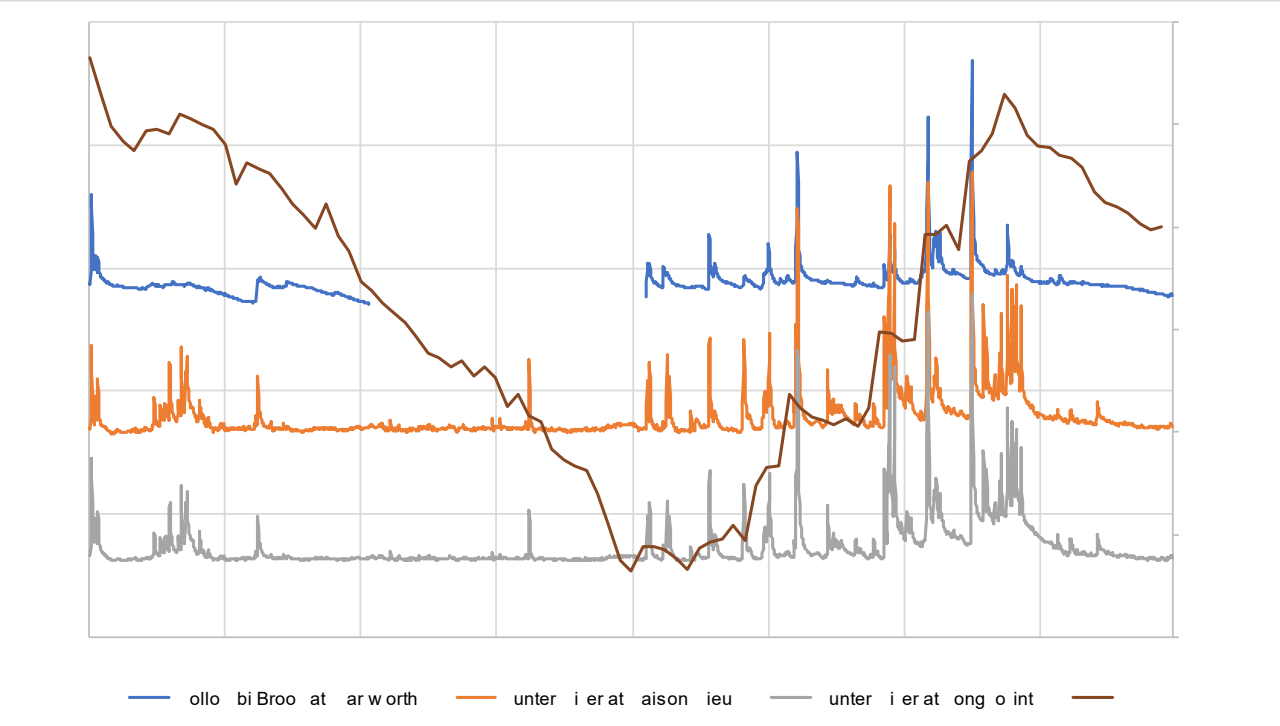


Figure 2.2 Surface water levels

2.3 Geology

MTW is located within the Hunter Coalfield in the Sydney Basin; a Permian-Triassic age sedimentary basin situated in the southern section of the Sydney-Gunnedah-Bowen Basin. The Sydney Basin's north-eastern extents are constrained by the New England Fold Belt and constrained by the Lachlan Fold Belt towards the south and west. The New England Fold Belt's periphery is distinguished by the Hunter-Mooki Thrust, defined by a progression of reverse faults alternated by mid-carboniferous rocks and Permian Sydney Basin strata.

The main stratigraphic units (Figure 2.3) occurring in the vicinity of the Project Area and the dominant lithology within each are:

- Quaternary alluvium– unconsolidated clays, silts, sands, and gravels mainly associated with Wollombi Brook to the west and Hunter River to the east of MTW;
- Warkworth sands – aeolian sand dunes unconformably overlying the Wittingham Coal Measures towards the northeast of the Project area; and
- Permian age Wittingham Coal Measures including the Jerry Plains and Vane sub-groups comprising multiple coal seams with intervening claystones, siltstones, sandstones, and conglomerates.

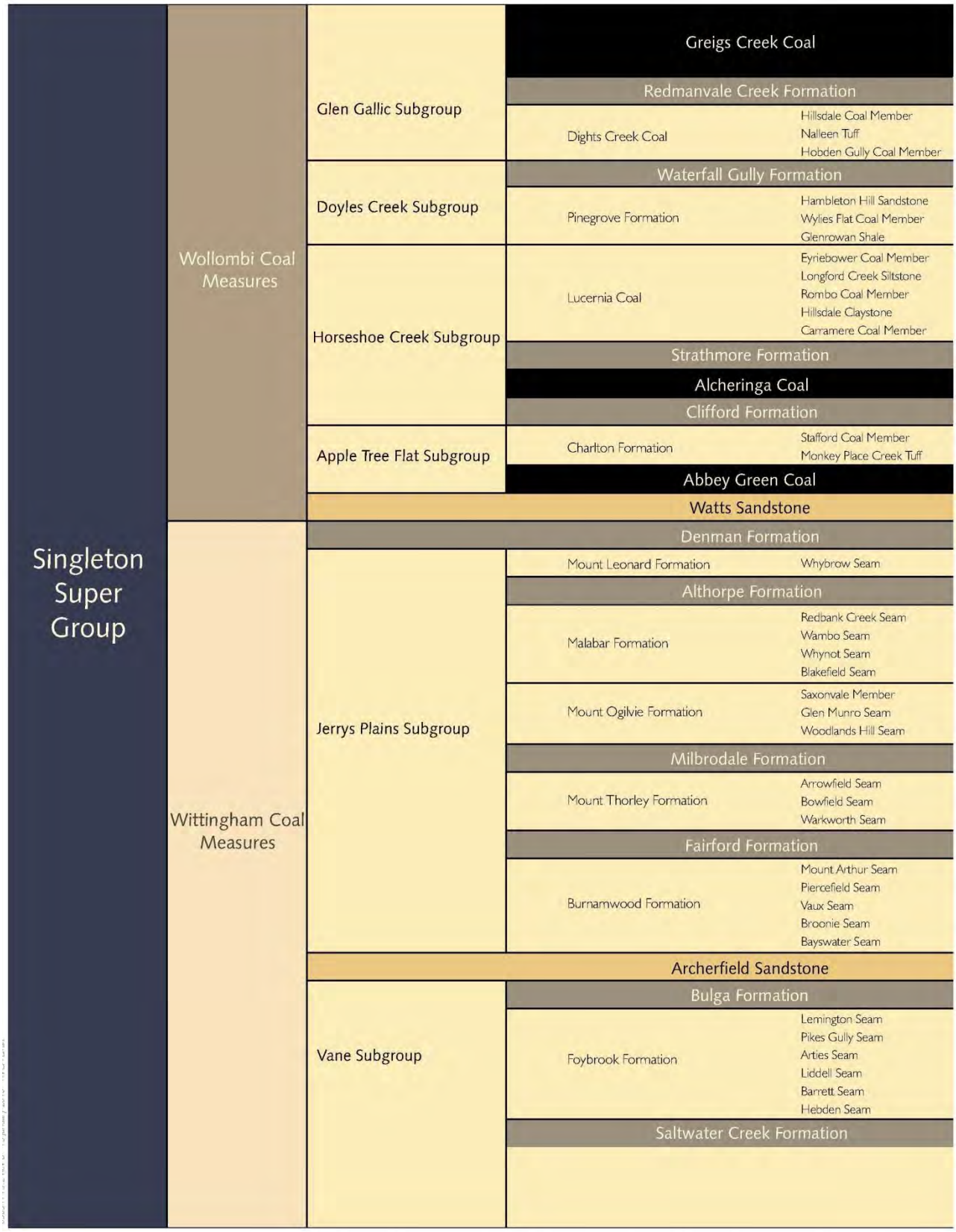


Figure 2.3 Stratigraphic column

3 Groundwater monitoring network

An updated WMP, for MTW, received approval 15 November 2021 (Yancoal 2021). The WMP contains a Groundwater Management Plan (Section 8 of the WMP), which outlines the groundwater monitoring network (Figure 3.1) and water quality triggers (Table 3.2).

The groundwater monitoring network comprises a total of 70 monitoring sites with 60 monitoring bores and 10 Vibrating Wire Piezometer (VWP) installations which require quarterly groundwater level, pH and Electrical Conductivity (EC) monitoring, and comprehensive annual lab analyses. Appendix A contains a list of the known details for each monitoring sites, as well as the monitoring plan reproduced from the WMP. The bores target alluvial aquifers (Wollombi Brook and Hunter River) as well as coal seams and interburden units within the Permian coal measures sequence. The coal seams currently mined at Warkworth Mine include the Redbank Creek, Wambo, Whynot, Blakefield, Glen Munro, Woodlands Hill, Arrowfield, Bowfield, Warkworth, and Mt Arthur Seams. Currently approved mining at Mt Thorley targets seams down to the Woodlands Hill.

VWP installations comprise pressure sensors grouted within each borehole and are used for monitoring of piezometric head.

Three bores were decommissioned during 2023: WOH2139A, MTD616P, and WD622P. A further five bores had blockages or access issues, these are detailed in Table 3.1 below.

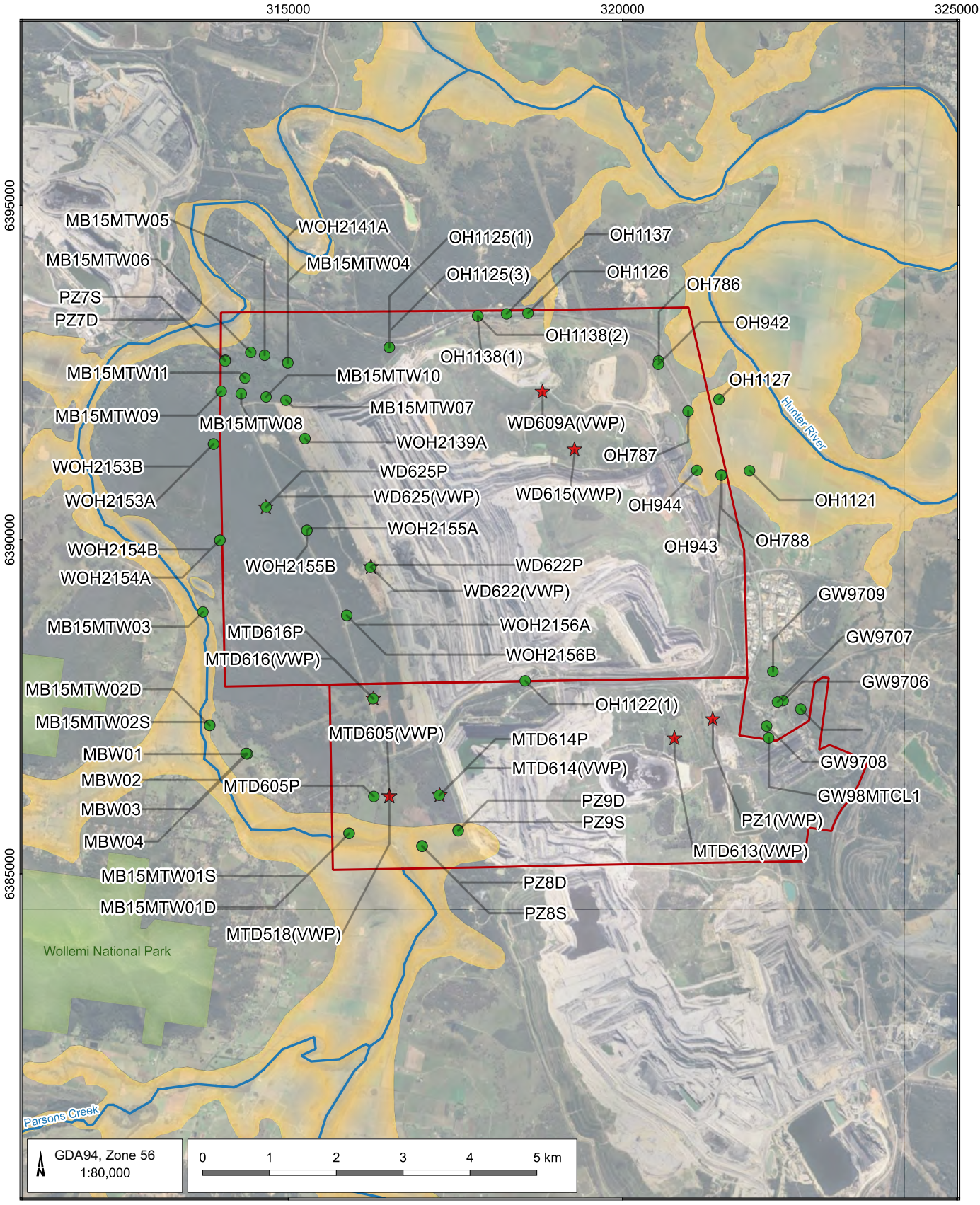
Table 3.1 Bore condition report – 2023

Bore ID	Comment(s) from field sheets[1]	Current status
OH1127	Blocked by pump stuck in bore	Blocked (Dec 2023)
OH1122(1)	Obstruction at 50 m	Cleared (Sep 2023)
OH1126	March field notes indicate the bore lid could not be removed. The bore lid was successfully opened following March monitoring. Obstruction / blockage at 1m.	Blockage (Dec 2023)
OH1137	Obstruction at 6 m	Cleared (Dec 2023)
MB15MTW11	Bore broken / collapsed	Broken / Collapsed (Nov 2023)

Note: [1]AECOM Groundwater quality monitoring field sheets – 2023

At each monitoring bore site, groundwater levels, EC and pH are measured in the field on a quarterly basis. A groundwater sample is also collected from each monitoring bore annually and analysed by an offsite laboratory for:

- total dissolved solids (TDS);
- major ions – Ca, Mg, Na, K, Cl, SO_4(or S);
- total alkalinity, bicarbonate alkalinity, carbonate alkalinity, hydroxide alkalinity; and
- trace elements - Al, As, B, Cd, Cu, Hg, Ni, Pb, Se, Zn (plus Mo, V and Cr for selected bores).



LEGEND

- Monitoring bore
- VWP
- MTW Leases
- Major water courses

MTW Annual groundwater monitoring review 2023 (MTW5008.001)

Groundwater monitoring network

AGE

DATE 16/01/2024

FIGURE No: **3.1**

Source: LiDAR DEM - © Department Finance, Services and Innovation.; GEODATA TOPO 250K Series 3 - © Commonwealth of Australia (Geoscience Australia) 2006.;
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3.1 Trigger values

The WMP outlines trigger values for groundwater EC and pH in Hunter River Alluvium, Wollombi Brook Alluvium, Aeolian Warkworth Sands, shallow overburden, and various coal seams. Trigger limits are applied to bores with a sufficient baseline dataset. The triggers apply and are calculated for groups of bores installed within the same geological unit and utilise percentiles of the available data to trigger further investigation. Three consecutive measurements falling outside the 5th and 95th percentile for pH triggers further investigation, whilst three consecutive results above the 95th percentile for EC require investigation. Groundwater quality triggers are summarised in Table 3.2.

The WMP provides a methodology to investigate samples that exceed the triggers for pH and EC. The WMP requires that '*in the event that a water quality measurement exceeds a predetermined trigger value, exceedances will be recorded and MTW will initiate a site-specific investigation if*':

- *professional judgement determines that the single deviation or a developing trend could result in environmental harm; or*
- *three consecutive measurements of EC or pH exceed trigger values.*

The investigation will:

- *determine the source and risk of impact on downstream water quality.*
- *determine the need for and extent of contingency measures.*
- *communicate outcomes to senior management.*
- *be reported in the Annual Review.*

Whilst the WMP does not specify a trigger for groundwater levels it does require an annual review of '*depressurisation of coal measures and alluvium by a suitably qualified hydrogeologist*.'

Table 3.2 Groundwater quality trigger levels

Sample Point	Target Seam	Electrical Conductivity (µS/cm)	pH	
		95th	5th	95th
OH786	Hunter River Alluvium	1,551	6.9	7.7
OH787	Hunter River Alluvium	19,351	7.2	7.7
OH942	Hunter River Alluvium	25,400	6.5	6.8
OH943	Hunter River Alluvium	8,395	7.1	7.6
OH788	Hunter River Alluvium	13,480	6.9	7.9
PZ8S	Wollombi Brook Alluvium	15,190	6.5	7.0
PZ9S	Wollombi Brook Alluvium	16,197	6.8	7.0
PZ7S	Aeolian Warkworth Sands	1,747	6.7	7.5
GW9706 GW9707 GW9708 GW9709 GW98MTCL1 GW98MTCL2 OH1127	Bayswater	22,982	6.6	7.5
OH1125(3)	Bowfield Seam	14,600	6.6	6.9
OH1122(1) WOH2139A	Blakefield	14,825	6.6	8.0

Sample Point	Target Seam	Electrical Conductivity (µS/cm)	pH	
		95th	5th	95th
OH1125(1)				
WOH2153A WOH2154A WOH2155A WOH2156A	Redbank	15,482	7.0	7.9
MTD614P MTD616P MTD605P PZ7D MBW02 MB15MTW01D MB15MTW02D MB15MTW03 PZ8D PZ9D	Shallow Overburden	17,516	6.7	8.0
OH1137 OH1126 OH1121	Vaux	17,740	6.7	7.2
WD622P WOH2153B WOH2154B WOH2155B MBW04 WOH2156B	Wambo	14,114	6.9	7.8
WD625P	Woodlands Hill	12,483	6.9	7.3
OH1138(2) OH1138(1)	Warkworth	19,872	5.9	6.9
WOH2141A	Whynot	10,689	7.5	7.8

3.2 Sampling methods

The states that groundwater onitoring will be underta en "*in accordance with AS 5667.1:-1998, Guidance on the Design of Sampling Programs, Sampling Techniques and the Preservation and Handling of Samples and AS 5667.11-1998, Guidance on Sampling of Groundwaters*".

A review of field sheet data indicate that quarterly groundwater samples were collected as grab samples or following purging in all bores. Limited information on purged volumes was made available, with three volumes of water purged prior to sampling where possible.

4 Water licensing

Groundwater licenses held for MTW are outlined in Table 4.1.

Table 4.1 Summary of licences held by MTW

Licence No.	DWE Reference	Share Component (ML)	Location/Purpose
10543	20AL201239	1009	Zone 2B: Hunter River from Wollombi Brook junction to Oakhampton Rail Bridge
963	20AL201242	243	Warkworth farm - Hunter River pump (Zone 2B)
971	20AL201258	270	Warkworth farm - Hunter River pump (Zone 2B)
1008	20AL201341	243	Warkworth farm - Hunter River pump (Zone 2B)
995	20AL201302	243	Anndale farm – Hunter River pump (Zone 2B)
1009	20AL201343	435	Anndale farm – Hunter River pump (Zone 2B)
19022	20AL209903	60	Sandy Hollow Creek (Unregulated river – Singleton Water Source)
18558	20AL208627	50	Lower Wollombi Brook Water Source
18469	20AL20858	245	Lower Wollombi Brook Water Source
40464	20AL218784	180	Mt Thorley Excavation; North Coast Fractured and Porous Rock Groundwater Sources
40465	20AL218785	750	Warkworth Excavation; North Coast Fractured and Porous Rock Groundwater Sources

Note: Water licence details obtained from the approved WMP (15 November 2021).

5 Groundwater monitoring results

Groundwater level measurements provided by Yancoal were used to prepare hydrographs for each monitoring point. The groundwater levels were also plotted along with the CRD to determine if trends in water levels were related to climatic factors or other influences. The CRD shows monthly rainfall trends compared with long term averages. An increase trend in the CRD indicates periods of above average rainfall, whilst a declining trend indicates below average rainfall. Where recharge occurs from rainfall, groundwater levels are often correlated with the . T his co parison can be used to 'screen out' cli a tic trends and deter i ne where other factors such as mining are influencing groundwater levels.

Appendix C contains the hydrographs generated for each bore and compared to modelled predictions. The hydrographs include long term data preceding the 2023 reporting year to ensure long term trends are identified and considered. Appendix B contains groundwater level hydrographs with the bores grouped according to geological unit. These figures also show the pH and EC measured for each bore (with a trigger applied) to allow water levels and water quality trends to be compared and determine if they are interrelated.

The groundwater level trends observed within the monitoring network depend on the location and geological units screened and long-term trends can therefore be grouped into:

- Western down-dip depressurisation zone – monitoring bores in Permian coal measures to the west and 'down-dip' of the i ning area that are recording depressurisation due to mining operations, as predicted by groundwater modelling.
- Eastern up-dip coal measures and alluvium – bores to the east of the mining area within Hunter River allu iu and Bayswater coal sea that are 'up-dip' of i ning and are responding only to climatic influences.
- Wollombi Brook alluvium – bores within the Wollombi Brook alluvium that have a varied response, suggesting localised impact where mining is close to the flood plain and no impact where mining is more distant.
- Warkworth Sands – bores within the perched aquifer of the Warkworth Sands, which is located in elevated areas, generally do not respond to mining.

The sections below discuss water level and quality trends within each of these zones. Samples collected that exceeded the nominated triggers values are also discussed.

5.1 Western down-dip depressurisation zone

A number of numerical models to simulate groundwater flow at MTW have been developed (within EIS reports from 2002, 2009 and 2014). The most recent update to the model was conducted by AGE (2015) which updated the model developed for the 2014 EIS. All numerical models developed have consistently predicted mining will depressurise groundwater within the coal measures down-dip and west of the mining area. The models predict the zone of depressurised Permian bedrock will extend under the Wollombi Brook alluvium, but the alluvium water level will be largely unaffected. Groundwater monitoring generally confirms this conclusion with a general loss of water pressure and level occurring in many of the monitoring sites installed within Permian bedrock to the west of the mining area.

The measured decline in water levels is not as uniform as predicted by groundwater modelling due to heterogeneities within the groundwater systems. The sections below discuss the water level and quality data collected from the bores grouped together for trigger levels. Water level and quality graphs for each group of bores are included within Appendix B.

5.1.1 Redbank Creek coal seam bores

There are four bores (WOH2153A, WOH2154A, WOH2155A and WOH2156A) within this group located west and down-dip of the mine (Figure B 1). The data for these bores indicate:

- a long-term declining trend in groundwater levels as predicted by groundwater modelling;
- groundwater levels steadily declined at all bores throughout 2023. The WOH2153A and WOH2154A water level and water quality readings from May 2023 appear to have been swapped.
- groundwater pH was typically stable in Redbank Creek coal seam bores during the 2023 monitoring period. Values for pH in WOH2155A (August and November) and WOH2156A (February and May) were recorded on the lower prescribed trigger threshold. The Quarter 2 (May 2023) pH value from WOH2155A was marginally smaller (6.9) than the trigger level (7.0), indicating an exceedance had occurred; however, subsequent values were equal to the minimum pH trigger level. Values for pH should continue to be monitored closely to ensure any exceedances of the trigger criteria are recorded; and
- groundwater EC values, recorded in Redbank Creek coal seams bores, decreased slightly at WOH2155A and WOH2156A and remained steady at WOH2153A and WOH2154A, during the 2023 monitoring period. All EC values were below the established trigger criteria during the monitoring period.

5.1.2 Wambo coal seam bores

There are six bores (WD622P, WOH2153B, WOH2154B, WOH2155B, WOH2156B and MBW04) within the Wambo coal seam group, west and down-dip of the mine (Figure B 2). The data for these bores indicate:

- a long-term declining trend in groundwater levels in WD622P. The remaining Wambo coal seam bores are relatively stable;
- bore WD622P was decommissioned in early 2023; therefore, no data is available from this bore as of February 2023;
- excepting WD622P, at which groundwater levels decreased, groundwater levels in Wambo coal seam bores were typically stable throughout 2023. Following a rapid increase in groundwater level at WOH2156B due to high rainfall during mid-2022, groundwater levels remained relatively stable at the higher elevation of approximately 72 mAHD throughout early to mid-2023. However, groundwater level at WOH2156B started to decline in Quarter 4. No groundwater level (or water quality) data were recorded in WD622P (since February) due to the bore having been decommissioned;
- groundwater pH in Wambo coal seam monitoring bores fluctuated within the trigger range throughout the 2023 monitoring period. No pH trigger exceedances were recorded in Wambo coal seam monitoring bores during the 2023 monitoring period, with fluctuations attributed to natural variation; and
- excepting MBW04, groundwater EC values recorded in Wambo coal seam bores in 2023 were relatively stable. Groundwater EC in MBW04 increased throughout 2023, indicating EC values are recovering after an influx of fresh rainwater during 2022. No EC exceedance in Wambo coal seam bores were recorded during the monitoring period.

5.1.3 Blakefield coal seam bores

There are three bores (OH1122(1), OH1125(1) and WOH2139A) within this group, downdip of the Warkworth mining area (Figure B 3). The data indicate:

- no data is available from WOH2139A due to the bore having been decommissioned in late-2022 or early-2023. Monitoring bore OH1122(1) was obstructed during Q1 and Q2 of 2023, then the bore went dry. Therefore, no 2023 water level or quality data are available for these bores;
- In recent years, groundwater levels in the Blakefield coal seam bores are relatively stable. A slight decreasing trend was observed at OH1122(1), until the bore went dry in September 2023 (Q3). Following a pronounced rainfall event in mid-2022, groundwater levels at OH1125(1) rose rapidly, then declined throughout late-2022 and into early-2023. Following the decline in groundwater level at OH1125(1), levels have reached equilibrium at approximately 50 mAHD and remained stable throughout the last two quarters of 2023;

- groundwater pH in OH1125(1) fluctuated within the trigger range throughout the 2023 monitoring period. No pH trigger exceedances were recorded during the 2023 monitoring period, with fluctuations attributed to natural variation; and
- groundwater EC in OH1125(1) was relatively stable throughout 2023. There were no EC exceedances recorded in Blakefield coal seam monitoring bores during the 2023 monitoring period.

5.1.4 Bowfield coal seam bores

There is one bore (OH1125(3)) installed within this group to the north of Warkworth mine (Figure B 4). The data for this bore indicate:

- long-term groundwater levels in OH1125(3) indicate a declining trend in groundwater level; and
- OH1125(3) was consistently dry throughout 2023, excepting readings taken in January and July, when a small amount of water was detected. For this reason, there are no water quality data available for the 2023 period.

5.1.5 Whynot coal seam bores

There is one monitoring bore (WOH2141A) installed within this group to the north of Warkworth mine (Figure B 5). The data for this bore indicate:

- long-term data show a declining groundwater level in WOH2141A. This decline in groundwater level aligns with modelled predictions;
- groundwater levels in Whynot coal seam bore WOH2141A were relatively stable during the 2023 monitoring period. There was a small decline in groundwater level observed during August, however levels returned to approximately 46 mAHD in November;
- groundwater pH in WOH2141A fluctuated within the trigger range throughout the 2023 monitoring period. No pH trigger exceedances were recorded during the 2023 monitoring period, with fluctuations attributed to natural variation; and
- excepting an increase in August, groundwater EC values in WOH2141A had no discernible trend throughout 2023. Excepting in August where EC exceeded the trigger criteria, no other exceedances were recorded in 2023.

5.1.6 Woodlands Hill coal seam bore

There is one monitoring bore (WD625P) installed within the Woodlands Hill coal seam to the west of MTW (Figure B 6). The data for this bore indicate:

- long-term gradually declining trend in groundwater level;
- groundwater level remained relatively stable throughout 2023 following an initial increase of 0.2 m from May to August;
- groundwater pH values were typically stable (7.1) with a slight increase (7.2) observed in November. No pH trigger exceedances were recorded throughout the year; and
- groundwater EC in WD625P increased during the May and August monitoring periods, before decreasing in November. No EC exceedances were recorded in WD625P during 2023.

5.1.7 Shallow overburden underlying Wollombi Brook alluvium bores

There are six bores installed within shallow overburden material underlying the Wollombi Brook alluvium (PZ8D, PZ9D, MB15MTW01D, MB15MTW02D and MB15MTW03) and Warkworth Sands (PZ7D) to the west of the Warkworth and Mt Thorley mines (Figure B 7 and Figure B 8). The bores are paired with shallow bores monitoring the overlying alluvial and aeolian sediments. The data for these bores indicate:

- access was restricted to monitoring bore PZ7D, due to boggy conditions during Q1 and Q2; therefore, no water level or quality data are available for early 2023;
- long-term groundwater level data indicate that shallow overburden monitoring bores underlying Wollombi Brook alluvium and Warkworth Sands exhibit a delayed response to rainfall recharge;

- groundwater level in shallow overburden monitoring bores underlying the Wollombi Brook alluvium and Warkworth Sands decreased during the 2023 monitoring period. The initial water level measurement for monitoring bore PZ8D taken in 2023 appears erroneous, the level taken in March is almost nine metres lower than the previous water level reading (December). This is supported by the relatively stable water quality data observed at PZ8D during the same period. Minimal interaction between the Wollombi Brook alluvium and the shallow overburden is evident as no significant groundwater level changes occur during periods of increased rainfall in the region which can be correlated with increased groundwater levels in the alluvium;
- pH values in monitoring bores underlying the Wollombi Brook alluvium and Warkworth Sands were generally stable in 2023. Several bores recorded slight increases or decreases during the May or August monitoring rounds. MB15MTW01D pH has been consistently observed below the 5th percentile trigger criteria since November 2018. Continued pH exceedances MB15MTW01D were investigated by AGE (2022) and concluded that inappropriate trigger values were the likely cause of the exceedances. No other pH exceedances were recorded during 2023; and
- excepting MB15MTW02D in which EC increased, groundwater EC in shallow overburden monitoring bores underlying Wollombi Brook alluvium and Warkworth Sands were typically stable during the 2023 monitoring period. No EC exceedances were recorded during 2023.

5.1.8 Shallow overburden bores

There are four bores (MBW02, MTD614P, MTD605P and MTD616P) installed within the shallow overburden to the west of MTW, and east of the Wollombi Brook alluvium (Figure B 7 and Figure B 8). The data for these bores indicate:

- MTD616P was decommissioned between February and May; therefore, data is only available for Q1 of 2023;
- long-term groundwater level data indicate stable groundwater levels in shallow overburden monitoring bores east of the Wollombi Brook alluvium;
- groundwater levels in shallow overburden bores east of Wollombi Brook alluvium were typically stable during the 2023 monitoring period;
- pH in shallow overburden monitoring were typically stable during the 2023 monitoring period. All bores, except MTD616P (decommissioned) recorded slight increases or decreases during the May or August monitoring rounds. No pH exceedances were recorded in 2023; and
- EC in shallow overburden bores were generally stable during the monitoring period. EC observed at monitoring bore MTD605P was similar (17,170 µS/cm) to the trigger level (17,516 µS/cm) in May and marginally exceeded (17, 660 µS/cm) the trigger level in August. Historically, EC at MTD605P has been observed at values higher than the EC trigger value, with the most recent exceedance occurring in November 2022. Therefore, the single EC exceedance recorded for the monitoring period is considered to be due to fluctuations caused by natural variation.

5.2 Eastern up-dip coal measures and alluvium

A network of monitoring bores is present to the east of the MTW mining area. This network includes bores screened within the Hunter River alluvium and also bores screened within the Bayswater seam underlying the alluvium. The sections below discuss the monitoring results for each of these bores.

5.2.1 Hunter River alluvium bores

There are six bores (OH786, OH787, OH788, OH942, OH943 and OH944) located to the east of the Warkworth mining area screened within the Hunter River alluvium (Figure B 9 through Figure B 14). The monitoring data for these bores indicate:

- OH787 was not accessible during Q1 and Q2 of 2023; therefore, water level and quality data for this bore are only available for Q3 and Q4;
- excepting OH786 in which groundwater level has fluctuated, long-term groundwater levels in Hunter River alluvial monitoring bores have been stable;

- groundwater levels in Hunter River alluvial bores were stable or decreased slightly during the 2023 monitoring period; the exception being OH786 which recorded fluctuating groundwater levels. Monitoring bore OH944 was dry or effectively dry (insufficient water to sample) throughout the monitoring period. Therefore, limited groundwater level, and no water quality, data was recorded throughout 2023 for OH944;
- groundwater pH observed at OH786 and OH788 increased, and decreased at OH787, pH values in remaining Hunter River alluvial monitoring bores remained relatively stable during 2023. Groundwater pH at OH786 increased during the May and August monitoring rounds, before decreasing thereafter. Observed pH at OH788 increased during the August and November monitoring rounds. Trigger exceedances for pH were recorded in OH786 (December) and OH787 (September); and
- groundwater EC in Hunter River alluvial bores varied during the 2023 monitoring period. EC in OH786 was typically stable (approximately 600 µS/cm) throughout 2023, with a minor increase (1,000 µS/cm) during the August monitoring round. EC in OH787 increased rapidly between the August and November sampling rounds. Groundwater EC observed in OH788 increased slightly between Q1 and Q2, before decreasing rapidly in Q3 (August; approximately 10,000 µS/cm), where it remained in November. EC in OH942 remained stable throughout 2023, with a small decrease during the August sampling round. OH943 increased during the 2023 monitoring period. No EC exceedances were recorded during 2023.

5.2.2 Bayswater coal seam bores

The Bayswater sea is the basal coal sea within the Jerry's lains subgroup. i ning at T does not re o e the Bayswater sea , and therefore it is representati e of the 'under-burden' bedroc sequence within the pit floor. There are seven bores (GW9706, GW9707, GW9708, GW9709, GW98MTCL1, GW98MTCL2 and OH1127) within the Bayswater group (Figure B 15), with the monitoring data indicating:

- OH1127 was blocked throughout the monitoring period and therefore has no water level (or quality) data for the 2023 period;
- long-term groundwater levels are stable within Bayswater coal seam monitoring bores;
- groundwater levels in Bayswater coal seam monitoring bores were typically stable during the 2023 monitoring period. Groundwater levels marginally declined at GW9706 and GW98MTCL1 throughout the monitoring period and were observed to in the last quarter (November) at GW9707;
- groundwater pH values varied in Bayswater coal seam monitoring bores during the monitoring period. GW98MTCL2 consistently exceeded the lower pH trigger level throughout 2023. Historically, pH at GW98MTCL2 has been observed continuously below the lower pH trigger level (2020-2021), indicating groundwater at this site is typically lower than other Bayswater coal seam bores. Therefore, the exceedances observed are considered to be within expected natural variation for this bore. No other pH exceedances were recorded in Bayswater coal seam monitoring bores during 2023; and
- groundwater EC values in Bayswater coal seam bores showed varied trends in 2023. GW9706 showed a slightly declining trend throughout 2023. Bores GW9707, GW9708, and GW9709 showed a generally inclining trend; and remaining bores (GW98MTCL1 and GW98MTCL2) had typically stable EC during the monitoring period. No groundwater EC exceedances were recorded in 2023.

5.2.3 Warkworth coal seam bores

There are two nested bores (OH1138(1) and OH1138(2)) within this group located to the north of Warkworth Mine (Figure B 16). The data for these bores indicate:

- long-term groundwater levels in Warkworth coal seam bores correlate to the CRD trend, indicating a lagged response to rainfall;
- groundwater levels in Warkworth coal seam monitoring bores varied throughout the 2023 monitoring period. Groundwater levels marginally declined (approximately 0.7 m) at OH1138(1) and marginally increased (approximately 0.2 m) at OH1138(2);

- groundwater pH values declined in Warkworth coal seam bores throughout the 2023 monitoring period. Values for pH in OH1138(1) were relatively stable (6.4) from February to April, before a slight increase in May (6.5), then pH declined until July (6.1), where it remained relatively stable (slight oscillations) thereafter. Values of pH observed in OH1138(2) declined throughout 2023 from 6.7 in February to 6.5 in November. No groundwater pH exceedances were recorded in Warkworth coal seam monitoring bores in 2023. Fluctuations in pH values are attributed to natural variation where they do not exceed the trigger criteria; and
- groundwater EC values in Warkworth coal seam monitoring bores varied in 2023. EC decreased in monitoring bore OH1138(2) throughout the year, whilst EC in OH1138(1) increased. No groundwater EC exceedances were recorded in the 2023 monitoring period.

5.2.4 Vaux coal seam bores

There are three bores (OH1121, OH1126 and OH1137) installed within the Vaux seam group that surround the Warkworth Mine to the north and east (Figure B 17). The data for these bores indicate:

- bore OH1126 was not accessible due to damaged bore lid; therefore, no 2023 water level (or quality) data is available. OH1121 was not accessible during the March (Q1) sampling round due to boggy conditions. OH1137 had an obstruction at 6 m during the June (Q2) sampling round and therefore has no water level (or quality) data for this quarter available;
- groundwater levels in Vaux coal seam monitoring bores varied throughout the 2023 monitoring period. Water levels at OH1121 marginally increased throughout the monitoring period. Groundwater levels at OH1137 steadily declined (1.6 m) over the reporting period, which is consistent with the understanding that long-term groundwater levels in OH1137 correlate with the CRD;
- groundwater pH in Vaux coal seam monitoring bores remained typically stable throughout the 2023 monitoring period. No groundwater pH exceedances were recorded during the 2023 period; and
- groundwater EC values in Vaux coal seam monitoring bores varied in 2023. groundwater EC values in OH1121 were stable during Q2 (June) and Q3 (August) before decreasing in Q4 (November). Groundwater EC values in OH1137 increased between Q1 (March) and Q3 (August), remaining stable thereafter. No groundwater EC exceedances were recorded.

5.3 Wollombi Brook alluvium bores

Two bores (PZ8S and PZ9S) are installed within the Wollombi Brook alluvium. The bores are in proximity to the Mt Thorley Mine Loders Pit, where the Wollombi Brook alluvium encroaches on this location (Figure B 18 and Figure B 19). The data for these bores indicate:

- long-term trends indicate that Wollombi Brook alluvial groundwater levels strongly correlate with climatic trends;
- groundwater levels in the Wollombi Brook alluvium declined throughout the 2023 monitoring period, correlating strongly with the CRD trend;
- groundwater pH in PZ8S increased between Q1 (March) and Q2 (June), then remained stable thereafter. Groundwater pH values observed in PZ9S remained relatively stable throughout 2023, excepting a small rise between Q2 (June) and Q3 (September) when pH increased to the upper pH trigger level. No groundwater pH exceedances were recorded during the 2023 period; and
- groundwater EC in PZ8S remained relatively stable (approximately 13,200 µS/cm) throughout the 2023 monitoring period. EC in PZ9S remained stable from Q4 2022 (no Q1 EC or pH data) to Q3 (September) before decreasing in Q4 (November). No EC exceedances were recorded in Wollombi Brook Alluvium bores during the 2023 monitoring period.

5.4 Warkworth Sands bore

A single monitoring bore (PZ7S) is installed at the foot-slopes of the Warkworth Sands Woodland (Figure B 20). The dataset for this bore indicate:

- PZ7S could not be accessed during Q1 (February) and Q2 (May) due to boggy conditions and therefore no water level (or quality) data is available for these 2023 quarters;
- long-term groundwater level data indicate PZ7S is weakly correlated with climatic conditions;

- groundwater level in PZ7S decreased during the 2023 monitoring period;
- groundwater pH decreased slightly in PZ7S during the year. No pH exceedances were recorded during the 2023 period; and
- groundwater EC in PZ7S increased during the 2023 monitoring period. No groundwater EC exceedances were recorded in 2023.

5.5 Additional bores

Groundwater level, pH and EC trends in monitoring bores outlined in the WMP but without water quality trigger values are outlined in this section.

5.5.1 Wollombi Brook alluvium bores

Three additional monitoring bores (MB15MTW01S, MB15MTW02S and MBW01) are installed into the Wollombi Brook alluvium (Figure B 21). Data in these bores has been collected since August 2017. No trigger values are established for these bores. The data indicate:

- long-term groundwater levels correlate with the CRD trend;
- groundwater levels at Wollombi Brook alluvium monitoring bores decreased during the 2023 monitoring period. This decrease can be attributed to below-average rainfall in the region during the year evident by a declining CRD trend;
- groundwater pH in Wollombi Brook alluvial monitoring bores varied throughout the 2023 monitoring period. Groundwater pH at MBW01 increased during Q1 (February) and Q2 (May) then remained stable throughout Q3 (August) and Q4 (November). MB15MTW01S exhibited stable pH from Q1 through Q3, before decreasing slighting in Q4. MB15MTW02S had stable pH during Q1 and Q2, increased slightly in Q3, before decreasing in Q4; and
- excepting MB15MTW01S, which decreased from Q1 to Q3, before increasing in Q4, groundwater EC values in Wollombi Brook alluvial monitoring bores initially increased then stabilised during the 2023 monitoring period.

5.5.2 Warkworth Sands bores

Eight additional monitoring bores (MB15MTW04, MB15MTW05, MB15MTW06, MB15MTW07, MB15MTW08, MB15MTW09, MB15MTW10 and MB15MTW11) are installed into the Warkworth Sands (Figure B 22). No bore survey or construction details were made available. Therefore, groundwater level is shown as mTOC (top of casing) not water level mAHD. The dataset for these bores indicate:

- Warkworth Sands monitoring bores MB15MTW04, MB15MTW05, MB15MTW07, MB15MTW09, and MB15MTW10 were dry throughout 2023 and therefore have no water level (or quality) data available. Bore MB15MTW11 was described as having insufficient water in Q3 (August) and being broken/collapsed in Q4 (November); therefore, this bore has no water level (or quality) data for the last two quarters of 2023. Bore MB15MTW08 was dry during Q4 (November);
- groundwater levels in MB15MTW06, MB15MTW08, and MB15MTW11 decreased throughout 2023. MB15MTW09 was dry throughout 2023, except in Q2 (May) when some water (approximately 1 m) was present;
- groundwater pH in Warkworth Sands monitoring bores varied throughout the 2023 monitoring period. groundwater pH in MB15MTW06 increased during the 2023 monitoring period. pH in MB15MTW08 was relatively stable throughout 2023 and pH in MB15MTW11 declined during the first quarters (no data for Q3 and Q4); and
- groundwater EC values varied in Warkworth Sands bores during the 2023 monitoring period. EC in MB15MTW06 and MB15MTW09 increased slightly, whilst MB15MTW08 increased significantly between Q2 and Q3, and MB15MTW11 marginally decreased between Q1 and Q2 (no Q3 and Q4 data). EC recorded in MB15MTW06 and MB15MTW09 were below 200 µS/c , indicating the groundwater is extremely fresh.

5.5.3 Whybrow coal seam bores

A single monitoring bore (MBW03) is installed in the Whybrow coal seam (Figure B 23). No groundwater quality triggers are assigned to this bore. The dataset indicate the following:

- long-term groundwater levels appear to correlate with climatic conditions.
- groundwater level in MBW03 decreased sharply in 2022 and remained at this low elevation into Q1 2023 (-4.9 mAHD) before sharply increasing to pre-2022 levels (approximately 55 mAHD) during Q2. Water levels have remained stable at approximately 55 mAHD to date. The sharp decrease in groundwater level during mid-2022 was investigated (AGE, 2023) and determined to be the result of one, or a combination, of the following factors: 1) erroneous data/human error, this is considered unlikely due to the number of bores in the Wollombi Brook area that exhibited a similar decline in water level; 2) purging of monitoring bores prior to recording the water level; and/or 3) pumping from nearby private bores. The major conclusions from the investigation were that no environmental impact or harm is excepted due to the rapid decline in water level and the decline in groundwater level is not associated with mining activities;
- groundwater pH values in MBW03 initially declined (6.7) before increasing between Q2 and Q3, where it remained (7.3); and
- groundwater EC values were initially very low (approximately 220 µS/cm) before sharply increasing between Q2 and Q3 (approximately 6,700 µS/cm), where it remained relatively stable for the remining months of 2023.

5.5.4 MBW6A

No survey coordinates or bore construction details are available for MBW6A (Figure B 24). Groundwater level and EC data has been recorded consistently since September 2017. The dataset indicate:

- long-term groundwater level trend decreased until November 2019, increasing gradually thereafter;
- groundwater levels declined during the 2023 monitoring period;
- groundwater pH in MBW6A was slightly variable during the 2023 monitoring period; and
- groundwater EC increased during the 2023 monitoring period.

5.6 VWP pressure heads

VWP pressure head data collected during the 2023 monitoring period was graphed with historic data. VWP figures are presented graphically in Appendix D. The following observations can be noted for 2023:

- VWP pressure head in WD609A sensor at 110 m (spoil) (Figure D 1) decreased steadily during the 2023 monitoring period;
- VWP data for WD615 has been unavailable since January 2022 (Figure D 2). Historically, pressure head in the sensor at 133 m (Piercefield) has been stable since 2019 and pressure head in the sensor at 255 m, installed into the Baywater coal seam, has been increasing gradually since September 2018, following a declining trend since 2013. Pressure head in the deeper Bayswater seam was initially higher than the shallower Piercefield seam indicating that an upward hydraulic gradient was present in the Bayswater seam before depressurisation due to mining;
- excepting in the sensor at 217 m (Woodlands Hill), VWP pressure heads in WD625 (Figure D 3) declined throughout the 2023 monitoring period. The sensor ath 217 m was relatively stable throughout the reporting period, fluctuating around 30 mAHD;
- no data was available for VWP WD622 (Figure D 4). Historically, pressure heads at each of the five sensors at WD622 have been relatively stable;
- no data was available for VWP MTD616 (Figure D 5). Historically, pressure heads have typically decreased at all sensors; except the sensor at 42 m (Whybrow), at which pressure head has typically increased;
- pressure head in MTD613 sensor at 384 m (Broonie/Bayswater) (Figure D 6) initially declined between January and May, before increasing to date;

- excepting the sensors at 149 m (Interburden), 368 m (Mt Arthur), and 502 m (Bayswater), which decreased, pressure heads in MTD605 (Figure D 7) remained typically stable throughout 2023. VWP sensor 502 m (Bayswater) has a higher pressure head than the shallower sensors at 215 m (Blakefield) and 368 m (Mt Arthur). This indicates an upward hydraulic gradient in the deeper seam. No data has been available for the Vaux seam sensor since 2019. An inspection should be conducted on the VWP cable wire/connections to ensure a loose wire isn't the cause of data loss;
- pressure heads in sensors at 64 m (Whybrow) and 191 m (Glen Munro) in MTD614 (Figure D 8) declined during the 2023 monitoring period. No data, or erroneous data, has been recorded in the sensor at 383 m (Vaux) since June 2016. Data from sensors at 342 m (Mt Arthur) and 453 m (Bowfield) have been erroneous since they were installed. This is likely due to the sensors being damaged during the installation process. Periodically, data is recorded in these sensors, however, the pressure readings fluctuate significantly between each reading;
- pressure heads in VWP MTD518 (Figure D 9) varied during the 2023 monitoring period. Data from sensors at 142.5 m (Mt Arthur) and 226.5 m (Blakefields/Woodlands Hill) was only available for the months of September through October 2023. Data from the sensor at 358 m (Wambo) was highly erroneous, indicating the sensor had failed; and
- Z calibration factors weren't a ailable. a libration factors should be located so that Z can be reviewed in the next Annual Review.

6 Model verification

Observed groundwater level data and numerical groundwater model predictions (AGE, 2015) have been graphed in Appendix C. Review of the data indicate that observed groundwater level trends generally correlate with 2023 modelled predictions. However, at multiple monitoring locations observed and modelled groundwater le els don't align, these are discussed below:

- observed groundwater levels in Redbank seam monitoring bores have trended downward since 2011. The observed downward trend is more rapid than model predictions, particularly in WOH2153A and WOH2154A in which modelled groundwater levels are generally stable;
- observed groundwater levels in Wambo seam monitoring bores are slightly lower than predictions. The exception being WOH2156B in which observed data indicate relatively stable groundwater levels in recent years, with the model predicting a sightly declining groundwater level trend;
- observed groundwater levels in WOH2139A (Blakefield seam) have been trending downward since 2011, correlating closely with modelled predictions. Predicted groundwater level in the remaining Blakefield coal seam bores are significantly lower than observed levels. This is especially evident in OH1122(1) in which observed groundwater levels are >35 m higher than model predictions;
- a weak correlation between observed and predicted groundwater level trends in Bowfield monitoring bore OH1125(3) is evident. Observed data show a fluctuating groundwater level, whilst modelled predictions indicate a gradually declining groundwater level from 2015 to 2022, after which groundwater level stabilises;
- observed level data in Warkworth seam bore OH1138(1) strongly correlated with model predictions until 2023. Predicted groundwater levels continue to decline throughout 2023; however, observed OH1138(1) data increased initially (in response to 2022 rainfall), before stabilising. Observed groundwater levels in OH1138(2) are higher than predicted levels;
- excepting OH1121, in which observed groundwater levels have consistently been below modelled predictions, observed groundwater levels in Vaux seam monitoring bores are above predictions. OH1126 has recorded decreasing groundwater levels from 2016 to 2021, stabilising during 2022 before increasing throughout 2023; predicted levels are stable during this time;
- observed groundwater level in shallow overburden monitoring bores correlate strongly with predictions, excepting PZ8D and PZ9D. PZ8D correlated with predicted levels strongly up to late 2022, when observed levels remained relatively stable throughout 2023 in contrast to decreasing predicted levels. PZ9D has remained relatively stable since 2016, despite modelled levels gradually declining.
- like modelled predictions, groundwater level in Hunter River alluvial bores have remained stable in recent years. However, observed levels are typically lower than predictions;
- observed groundwater levels in Bayswater coal seam bores generally align with predicted levels. The exceptions are GW9709, in which observed groundwater levels are below predictions; GW98MTCL2, in which observed groundwater levels are higher than model predictions (>10 m); or OH1127, in which observed groundwater levels are below prediction (approximately 10 m);
- groundwater levels in Wollombi Brook alluvium monitoring bores, except PZ9S, strongly correlate with predictions. Observed groundwater levels at PZ9S were typically stable throughout 2022 and 2023; however, modelled groundwater levels gradually declined during this period;
- observed groundwater levels in Warkworth Sands bore PZ7S are approximately 5 m lower than predictions;
- observed pressure heads in VWP WD625 vary compared to modelled predications. Pressure head in sensor 1 (217 mBGL) has been gradually declining in recent years compared to a more rapid predicted decline. Pressure head measured in sensor 3 (375 mBGL), although stable, is lower than predicted (approximately 10 m);
- pressure heads observed in VWP WD622 vary compared to modelled predictions. Pressure heads in sensor 1 (54 mBGL) and sensor 4 (334 mBGL) correlate closely with recent predictions. Data from sensor 2 (165 mBGL) and sensor 3 (314 mBGL) indicate stable pressure heads, whilst the model predicts declining pressure heads at those depths. Pressure head in sensor 5 (408 mBGL) is significantly lower than predictions in recent years (>60 m);

- observed pressure heads in VWP MTD605 typically align with the pressure head trend predicted by the model, although pressure heads are lower than those predicted. The exception being sensor 4 (215 mBGL), in which observed pressure heads are greater than predictions;
- observed pressure heads in VWP MTD614 vary considerably to modelled predictions. Observed pressure head in sensor 1 (64 mBGL) is higher than predictions (approximately 20 m), whilst sensor 2 (191 mBGL) is lower (approximately 20 m). No data is available for the remaining sensors likely due to faults in the sensors;
- pressure heads observed in VWP MTD518 sensors 2 (226.5 mBGL) and sensor 3 (142.5 mBGL) show a typically similar trend to modelled predictions, although observations are lower than those predicted. Observed pressure head in sensor 1 (358 mBGL) is erroneous, so comparison to modelled predictions cannot be determined; and
- observed pressure head trend in VWP WD615 sensor 1 (133 mBGL) correlate closely to predictions. Predicated pressure head in sensor 2 (225 mBGL) are stable whilst observed data indicate fluctuating pressure head. The modelled overpredicts pressure head in sensor 2 by up to 120 m.

7 Summary

A summary of the findings of this report are as follows:

- groundwater level in coal seams in the Western down-dip depressurised zone generally declined or remained stable during the 2023 monitoring period;
  - bores WOH2139A, MTD616P and WD622P were decommissioned during the reporting period due to mine progression;
- groundwater levels in shallow overburden monitoring bores underlying the Wollombi Brook alluvium and Warkworth Sands typically declined or remained stable during the 2023 monitoring period. Minimal interaction between the Wollombi Brook alluvium and the shallow overburden is evident;
- groundwater level in coal seams eastward and up-dip of mining recorded variable results during 2023. Bayswater monitoring bores were typically stable, whilst groundwater levels in Vaux and Warkworth coal seam bores decreased during the monitoring period;
- groundwater level in Hunter River alluvial bores were stable or decreased slightly during 2023. The exceptions being OH786, which recorded fluctuating groundwater levels and OH787, which recorded increasing water levels during the last two quarters of 2023;
- groundwater level in Wollombi Brook alluvium monitoring bores declined during the year. Groundwater levels in all Wollombi Brook alluvium monitoring bores correlate strongly with the CRD, indicating no mining related impacts;
- groundwater level in Warkworth Sands monitoring bore PZ7S declined between Q3 (August) and Q4 (November). However, no data was available for Q1 (February) and Q2 (May) after February due to wet conditions impeding access;
- one pH trigger exceedance was recorded in Redbank Creek coal seam monitoring bore WOH2155A for Q2 (May) of 2023;
- multiple pH exceedances were recorded in the shallow overburden monitoring bore MB15MTW01D in 2023. The four consecutive trigger exceedances in MB15MTW01D (in February, May, August and November) relate to the lower pH trigger level (6.9). Previous exceedances for pH in MB15MTW01D were investigated (AGE, 2022) and concluded that inappropriate trigger values were the likely causes of the exceedances;
- a single monitoring bore, eastward and up-dip of mining at MTW, recorded two consecutive pH trigger exceedances during the 2023 monitoring period. This was the Bayswater coal seam bore GW98MTCL2 (in June and September). Historical records from this bore indicate previous instances where pH was below the lower pH trigger level, indicating the fluctuations observed in 2023 were within expected natural variation for this bore;
- exceedances for pH were recorded in Hunter River Alluvium bores OH786 (in June and November) and OH787 (in September) during the 2023 monitoring period;
- a single EC exceedance was recorded in Whynot coal seam monitoring bore WOH2141A during Q3 (August) of 2023;
- shallow overburden monitoring bore, underlying Wollombi Brook alluvium and Warkworth Sands, MTD605P recorded a single EC exceedance in Q3 (August). Historical records from this bore indicate previous instances where EC exceeded the trigger level, indicating the fluctuations observed in 2023 were within expected natural variation for this bore;
- VWP sensors installed into the Bayswater coal seam recorded varied results during the 2023 monitoring period. Sensors in WD625 and MTD605 recorded decreasing pressure heads throughout the year and pressure heads in MTD613 increased. Pressure head data recorded in the Bayswater seam at WD622 is erroneous and wire connections should be inspected where possible. No data were available for VWPs MTD616 and WD615 for the 2023 period;
- VWP pressure head in sensors installed into the Mt Arthur coal seam declined during the 2023 monitoring period. The exception being sensors in MTD616 and MTD615, for which there are no data for the monitoring period;
- sensors installed into Woodlands Hill coal seam recorded decreasing or stable pressure heads during the 2023 monitoring period;
- there was no data available from sensors in the Wambo coal seam for 2023. Data from the sensor installed into the Wambo coal seam at VWP MTD518 indicates the sensor has failed;

- data was only available for one VWP sensor in the Vaux coal seam for the 2023 period. Pressure head recorded at WD625 declined in 2023;
- Whybrow coal seam VWP sensor pressure heads either declined or remained stable during the 2023 monitoring period;
- VWP pressure heads in the Glen Munro seam (at MTD614) and Blakefield seam (at MTD605) were stable during the 2023 monitoring period. No data was recorded for the Piercefield seam (at WD615);
- Z calibration factors weren't a ailable. a libration factors should be located so that Z can be reviewed in future reports; and
- observed groundwater level trends generally correlate with modelled predictions. The exceptions being Blakefield seam bore OH1122(1) in which observed groundwater levels are >35 m higher than model predictions, a weak correlation between modelled and observed level data in Bowfield seam monitoring bores, and GW98MTCL2 with a difference between observed data and modelled data of >10 m. Typically, obser ed pressure heads in V s don't align strongly with odelled predictions. There is no modelled data for bores constructed after 2015.

8 Recommendations

Based on the findings of this report the following recommendations have been made:

- calibration factors for VWP PZ1 should be determined so that pressure head trends can be discussed in future annual reviews;
- Mount Arthur, Bowfield and Vaux seam VWP sensor cables should be inspected in MTD614 for damage to determine if erroneous data is due to a poor connection to the logger;
- Vaux seam sensor in MTD605 and Wambo seam sensor in MTD518 should be inspected for damage to determine if missing (MTD605) and erroneous (MTD518) data is due to a poor connection to the logger;
- underta e re e diation actions at O (bloc ed by pu p), O (lid can't be re o ed), and MB15MTW11 (confirm bore is collapsed);
- pH trigger exceedance investigation should be undertaken at GW98MTCL2 if additional exceedances occur throughout the year;
- survey data (coordinates and top of PVC mAHD) should be obtained for bores MB15MTW01 through MB15MTW11, and MBW06A; and
- consider updating the groundwater model to incorporate newly constructed monitoring installations and the removal of decommissioned bores.

9 References

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Appendix A

Summary of groundwater monitoring program

Table A 1 Summary of 2023 groundwater monitoring program

Sample Point	Easting	Northing	ToC RL (mAHD)	Bore depth (m)	Target Seam	Water Level	EC	pH	Comprehensive Analysis
OH786	320542	6392674	55.7	7.1	Hunter River Alluvium	Q	Q	Q	A
OH787	320982	6391921	50	12.1	Hunter River Alluvium	Q	Q	Q	A
OH788	321482	6390967	45.4	22.1	Hunter River Alluvium	Q	Q[1]	Q[1]	NA[1]
OH942	320536	6392622	55.8	13.2	Hunter River Alluvium	Q	Q	Q	A*
OH943	321476	6390963	45	9.9	Hunter River Alluvium	Q	Q	Q	A
OH944	321113	6391035	47.9	8.2	Hunter River Alluvium	Q	-	-	NA
OH1121	321902	6391030	45.6	20.3	Vaux	Q	Q	Q	A
OH1122 (1)	318545	6387886	100.6	49.6	Blakefield	Q	-	-	NA[2]
OH1125 (1)	316511	6392875	86.2	40	Blakefield	Q	Q	Q	A*
OH1125 (3)	316511	6392875	86.2	62.7	Bowfield Seam	M	-	-	NA
OH1126	318586	6393387	64.5	52.5	Vaux	-	-	-	NA[3]
OH1127	321444	6392097	51.2	29	Bayswater	-	-	-	NA[3]
OH1137	318266	6393377	67.9	17.8	Vaux	Q	Q	Q	NA[4]
OH1138 (1)	317835	6393346	70.7	24.8	Warkworth	M	M	M	A
OH1138 (2)	317835	6393346	70.7	42.8	Warkworth	M	M	M	A
WOH2139A	315249	6391511	91.7	96	Blakefield	-	-	-	Decommissioned
WOH2153A	313881	6391429	68.3	42.6	Redbank	Q	Q	Q	A
WOH2153B	313881	6391429	68.3	62.4	Wambo	Q	Q	Q	A
WOH2154A	313976	6389990	68.9	69.4	Redbank	Q	Q	Q	A
WOH2154B	313976	6389990	68.9	98	Wambo	Q	Q	Q	A

Sample Point	Easting	Northing	ToC RL (mAHD)	Bore depth (m)	Target Seam	Water Level	EC	pH	Comprehensive Analysis
WOH2155A	315278	6390138	74.6	46	Redbank	Q	Q	Q	A
WOH2155B	315278	6390138	74.6	73.1	Wambo	Q	Q	Q	A
WOH2156A	315874	6388866	80.4	31.5	Redbank	Q	Q	Q	A
WOH2156B	315874	6388866	80.4	80.1	Wambo	Q	Q	Q	A
WOH2141A	314989	6392647	91.6	45.6	Whynot	Q	Q	Q	A
PZ7D	314057	6392684	58.4	30.5	Shallow overburden	Q	Q	Q	NA[1]
PZ7S	314055	6392671	58.4	11.1	Aeolian Warkworth Sands	Q	Q	Q	NA[1]
PZ8D	317001	6385418	65.8	37	Shallow overburden	Q	Q	Q	A
PZ8S	317002	6385411	65.8		Wollombi Brook Alluvium	Q	Q	Q	A
PZ9D	317541	6385652	65.5	24	Shallow overburden	Q	Q	Q	A
PZ9S	317542	6385642	65.4	6.9	Wollombi Brook Alluvium	Q	Q	Q	A
GW9706	322404	6387589	64.2	21.2	Bayswater	Q	Q	Q	A
GW9707	322319	6387569	63.9	21	Bayswater	Q	Q	Q	A
GW9708	322158	6387209	73.1	29.6	Bayswater	Q	Q	Q	A
GW9709	322251	6388026	60.3	21	Bayswater	Q	Q	Q	A
GW98MTCL1	322188	6387032	77.8	19.7	Bayswater	Q	Q	Q	A
GW98MTCL2	322669	6387462	79.5	27.6	Bayswater	Q	Q	Q	A
PZ1 (VWP)	321350	6387310	72.1	41	Mt Arthur (Shallow)	Q	-	-	-
				42	Mt Arthur (Deep)				
WD609A (VWP)	318803	63922	129.9	110	Spoil	Q	-	-	-
WD615 (VWP)	319281	6391347	160	133	Piercefield	ND	-	-	-

Sample Point	Easting	Northing	ToC RL (mAHD)	Bore depth (m)	Target Seam	Water Level	EC	pH	Comprehensive Analysis
WD625 (VWP)	314663	6390483	76.4	225	Bayswater	Q	-	-	-
				217	Woodlands Hill				
				354	Mt Arthur				
				375	Vaux				
				441	Bayswater				
WD625P	314669	6390487	76.4	31	Woodlands Hill	Q	Q	Q	A
WD622 (VWP)	316236	6389588	84.5	54	Wambo	ND	-	-	-
				165	Woodlands Hill				
				314	Mt Arthur				
				334	Vaux				
				408	Bayswater				
WD622P	316229	6389585	84.5	55	Wambo	Q1	Q1	Q1	Decommissioned
MTD616 (VWP)	316274	6387621	77.7	42	Whybrow	ND	-	-	-
				109	Wambo				
				215	Woodlands Hill				
				343	Mt Arthur				
				378	Vaux				
				446	Bayswater				
MTD616P	316269	6387618	77.8	29	Shallow overburden	Q1	Q1	Q1	Decommissioned
MTD613 (VWP)	320778	6387025	150.5	384	Broonie/Bayswater	Q	-	-	-

Sample Point	Easting	Northing	ToC RL (mAHD)	Bore depth (m)	Target Seam	Water Level	EC	pH	Comprehensive Analysis
MTD605 (VWP)	316512	6386159	77.1	58	Overburden	Q	-	-	-
				100	Whybrow				
				149	Interburden				
				215	Blakefield				
				368	Mt Arthur				
				429	Vaux				
				502	Bayswater				
MTD605P	316279	6386156	77.4	42	Shallow overburden	Q	Q	Q	A
MTD614 (VWP)	317265	6386174	72.4	64	Whybrow	Q	-	-	-
				191	Glen Munro				
				342	Mt Arthur				
				383	Vaux				
				453	Bowfield				
MTD614P	317259	6386175	72.6	30	Shallow overburden	Q	Q	Q	A
MTD518 (VWP)	316512	6386156	80	142.5	Mt Arthur	Q	-	-	-
				226.5	Blakefield/Woodlands Hill				
				358	Wambo				
MB15MTW01S	315909	6385605	-	-	Wollombi Brook Alluvium	Q	Q	Q	A
MB15MTW01D	315910	6385604	-	-	Shallow overburden	Q	Q	Q	A
MB15MTW02S	313823	6387224	-	-	Wollombi Brook Alluvium	Q	Q	Q	A
MB15MTW02D	313823	6387219	-		Shallow overburden	Q	Q	Q	A

Sample Point	Easting	Northing	ToC RL (mAHD)	Bore depth (m)	Target Seam	Water Level	EC	pH	Comprehensive Analysis
MB15MTW03	313722	6388917	-	22.7	Shallow overburden	Q	Q	Q	A
MB15MTW04	314993	6392645	-	6.5	Warkworth Sands	Q	Q	Q	NA
MB15MTW05	314645	6392758	-	6.9	Warkworth Sands	Q	Q	Q	NA
MB15MTW06	314438	6392801	-	6.9	Warkworth Sands	Q	Q	Q	A
MB15MTW07	314965	6392085	-	6.8	Warkworth Sands	Q	Q	Q	NA
MB15MTW08	314296	6392182	-	6.8	Warkworth Sands	Q	Q	Q	A
MB15MTW09	313995	6392219	-	3.1	Warkworth Sands	Q	Q	Q	NA
MB15MTW10	314667	6392134	-	3.7	Warkworth Sands	Q	Q	Q	NA
MB15MTW11	314352	6392417	-	6.9	Warkworth Sands	Q	Q	Q	NA[5]
MBW01	314379	6386796	62.4	11	Wollombi Brook Alluvium	Q	Q	Q	A
MBW02	314373	6386798	62.6	60.4	Shallow overburden	Q	Q	Q	A
MBW03	314387	6386794	62.4	84.2	Whybrow seam	Q	Q	Q	A
MBW04	314368	6386800	62.4	162	Wambo	Q	Q	Q	A
MBW6A	-	-	-	-	-	Q	Q	Q	A

Notes: ToC RL: top of casing reference elevation; VWP: vibrating wire piezometer; Q: quarterly; A: annual; M: monthly.

Comprehensive analysis includes major ions TDS, Al, As, B, Ca, Cd, Cl, (CO3), Cu, Hg, K, Mg, Na, Ni, Pb, Se, SO4 (or S), Zn, Total Alkalinity, Bicarbonate Alkalinity, Carbonate Alkalinity, Hydroxide Alkalinity.

* Comprehensive analysis also includes Mo, V, and Cr.

NA: not applicable – bore dry.

[1] No access during Q1 and Q2.

[2] Obstruction at 50 m during Q1 and Q2, then dry during Q3 and Q4.

[3] Obstruction – no data during 2023.

[4] Obstruction during Q2 – no sample taken for comprehensive analysis.

[5] Insufficient water to sample during Q3; bore broken/collapsed during Q4.

Appendix B

Groundwater level and quality graphs

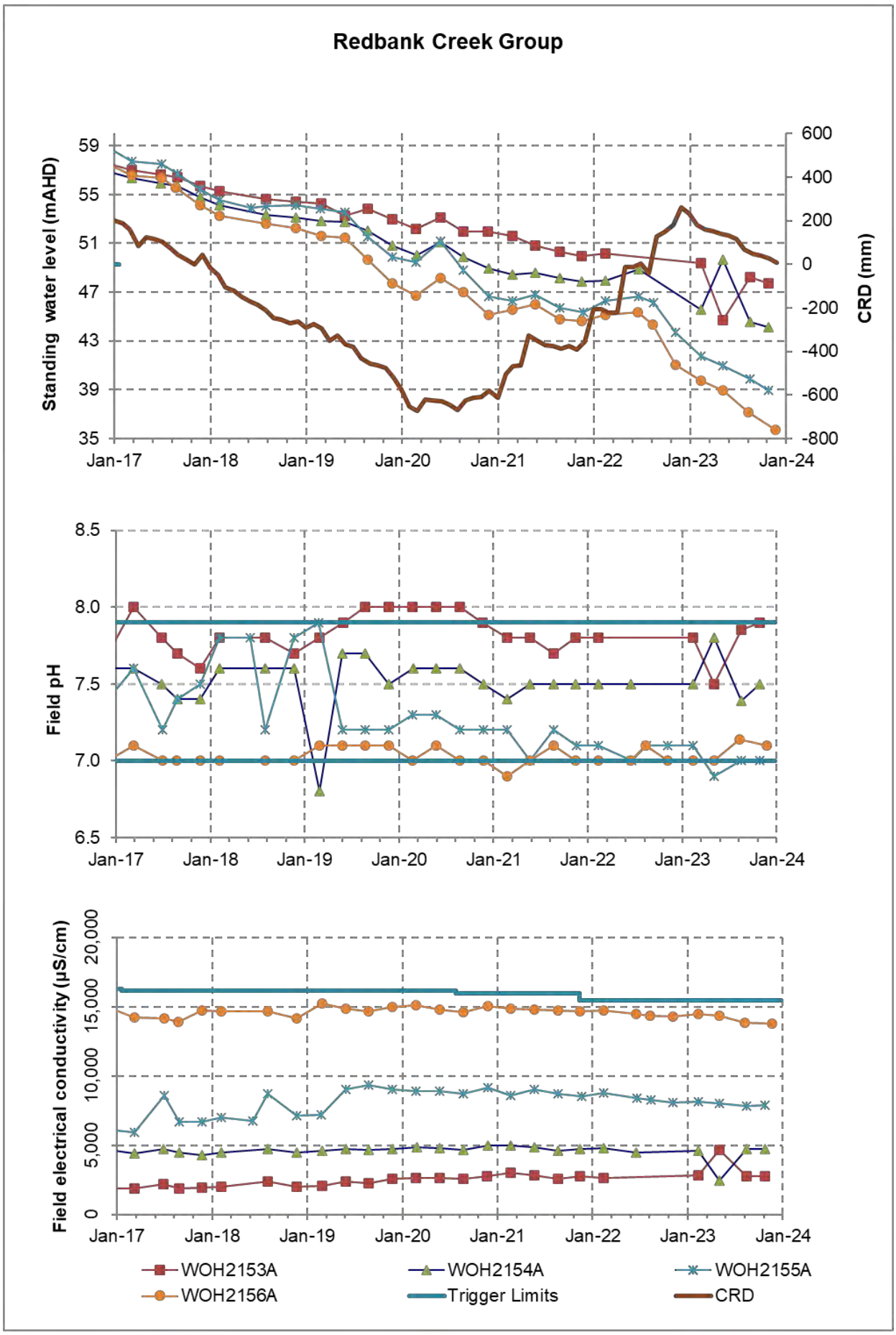


Figure B 1 Redbank Creek seam bores GWL, pH, and EC

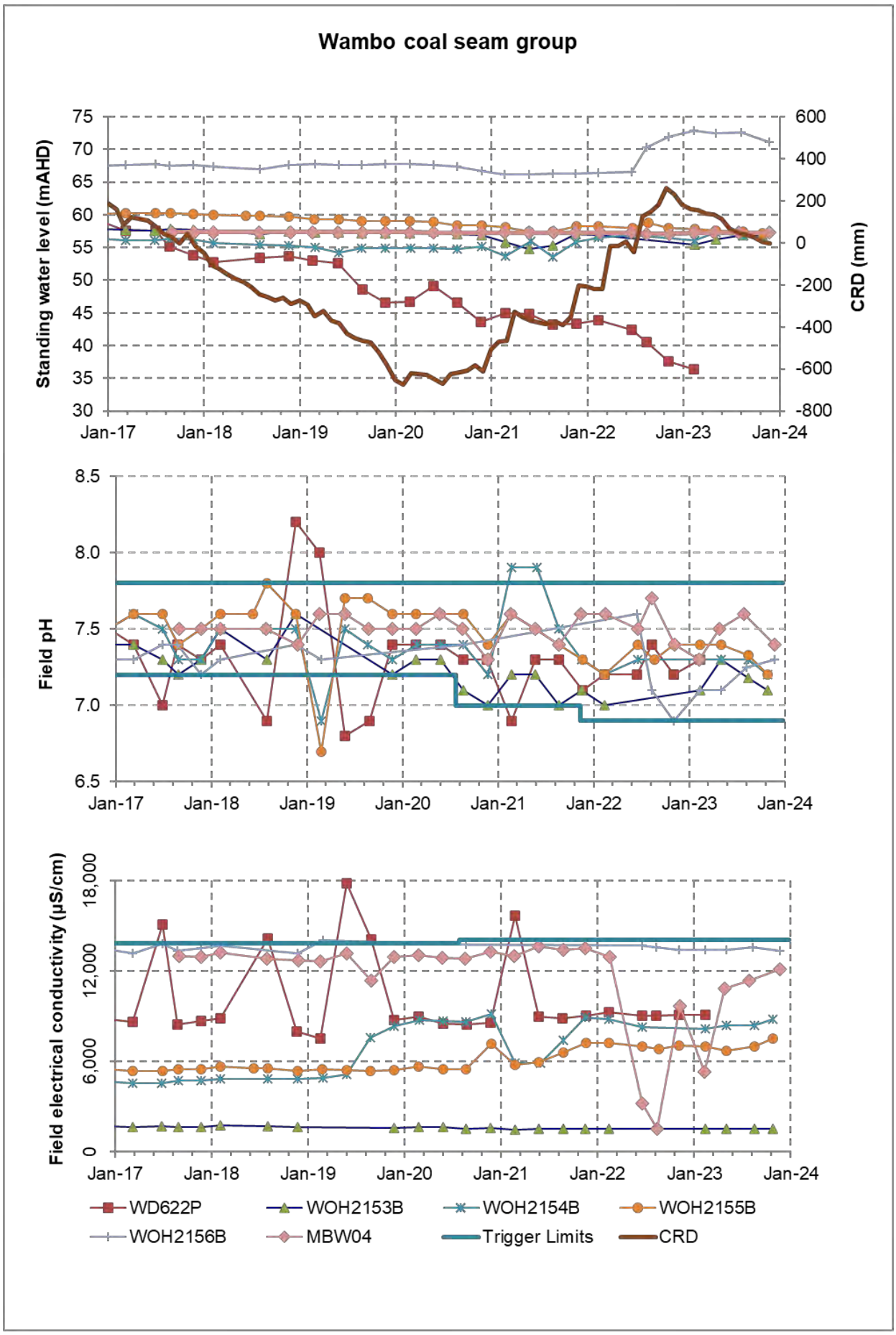


Figure B 2 Wambo coal seam bores GWL, pH, and EC

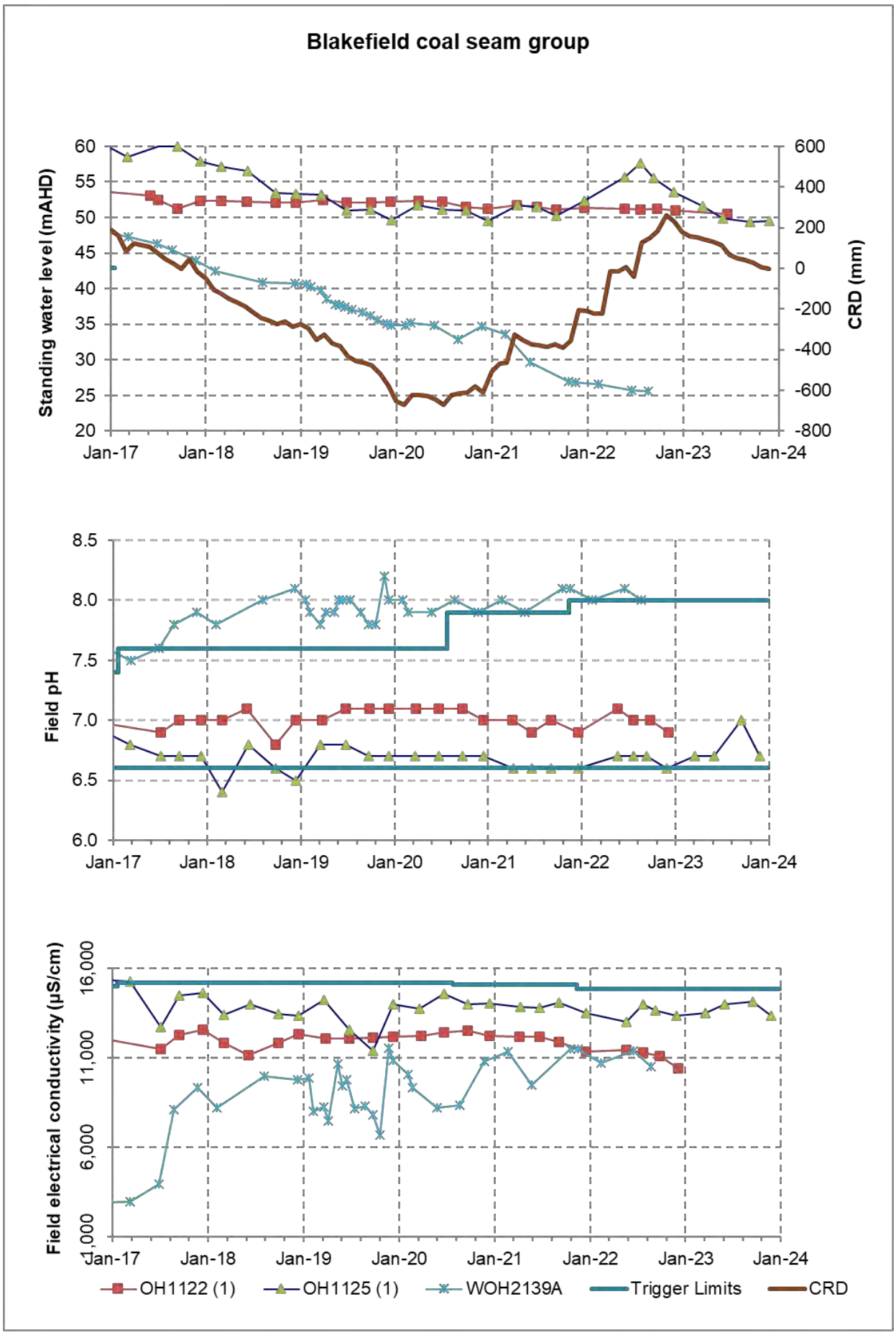


Figure B 3 Blakefield coal seam bores GWL, pH, and EC

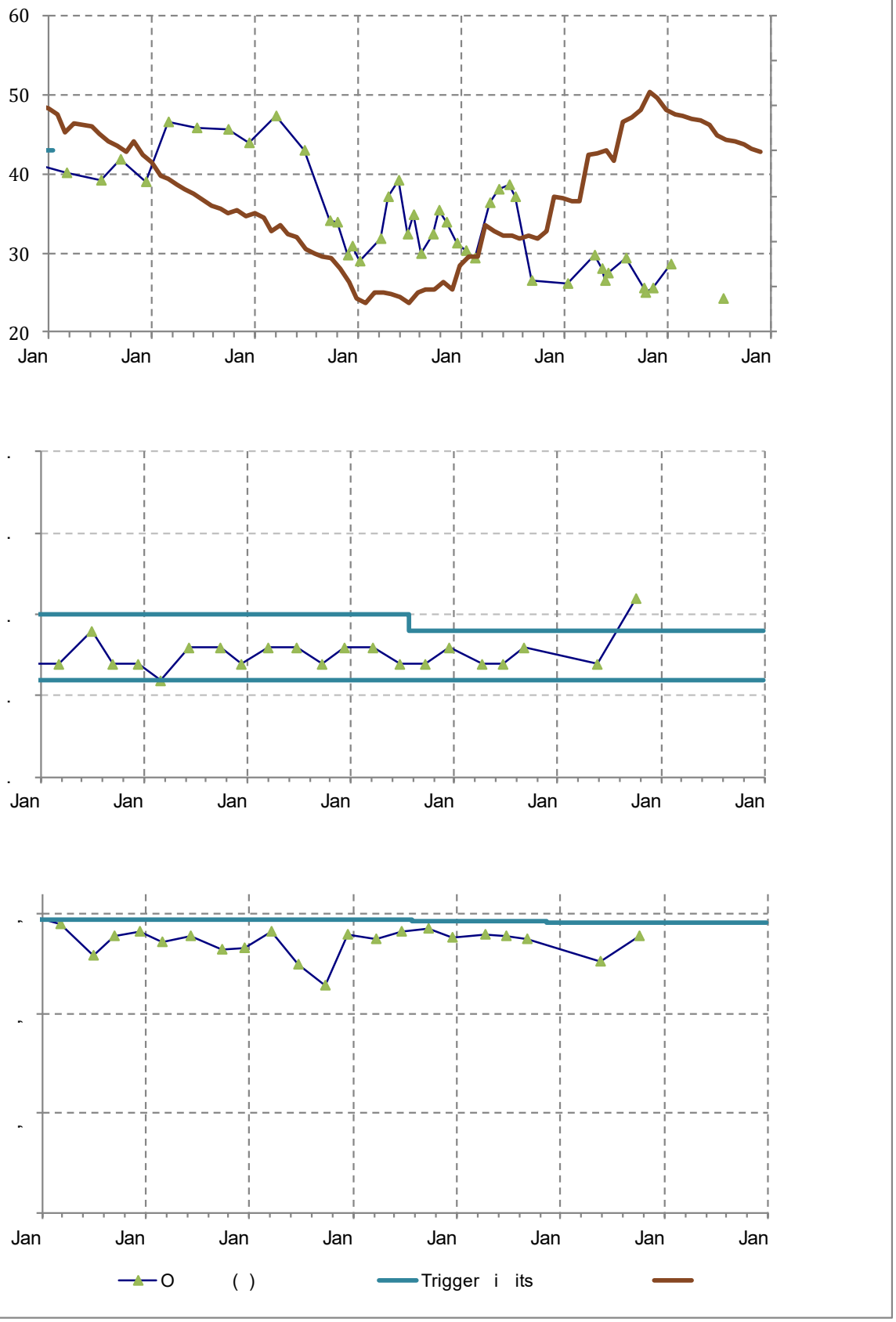


Figure B 4 Bowfield coal seam bores GWL, pH, and EC

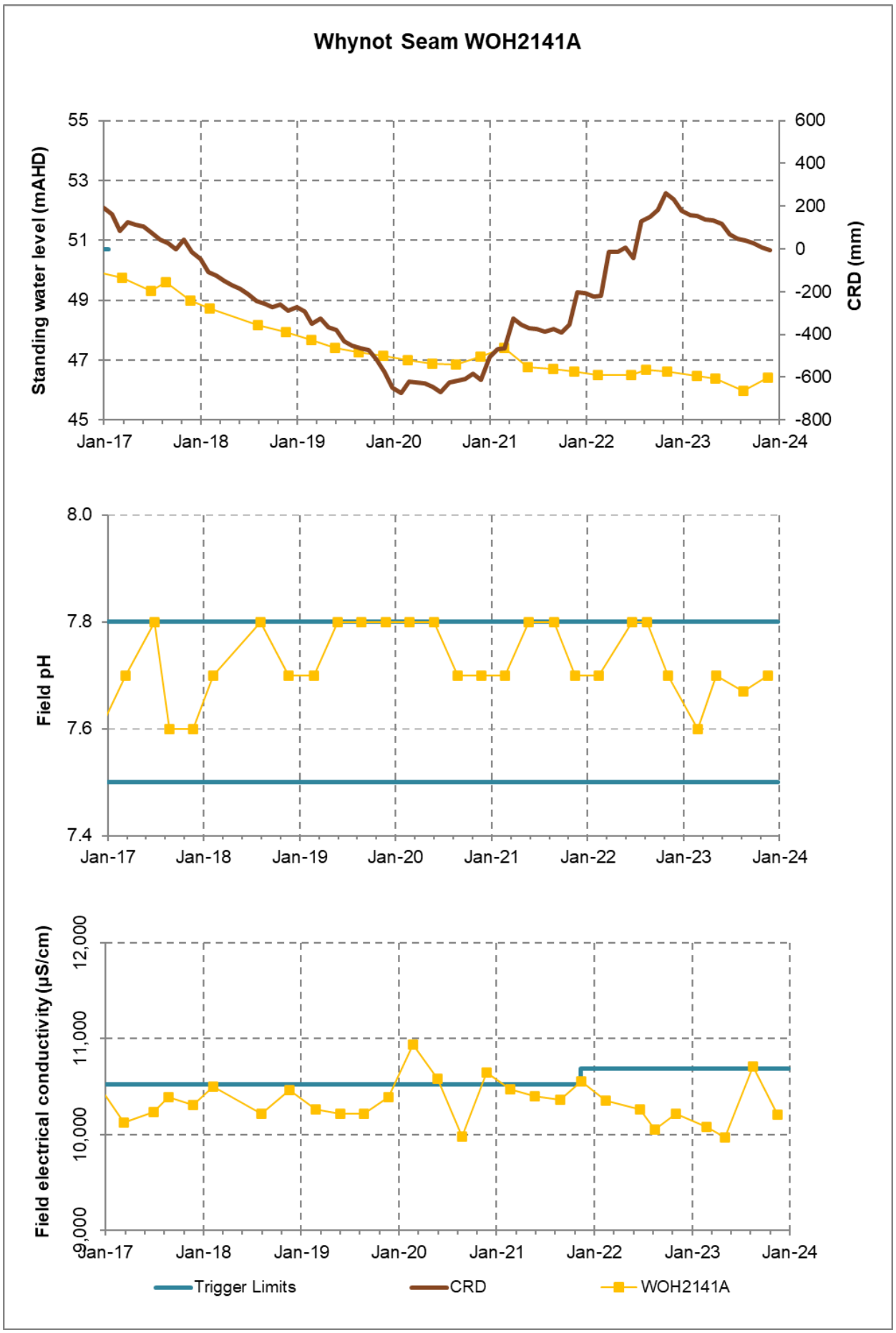


Figure B 5 Whynot coal seam bores GWL, pH, and EC

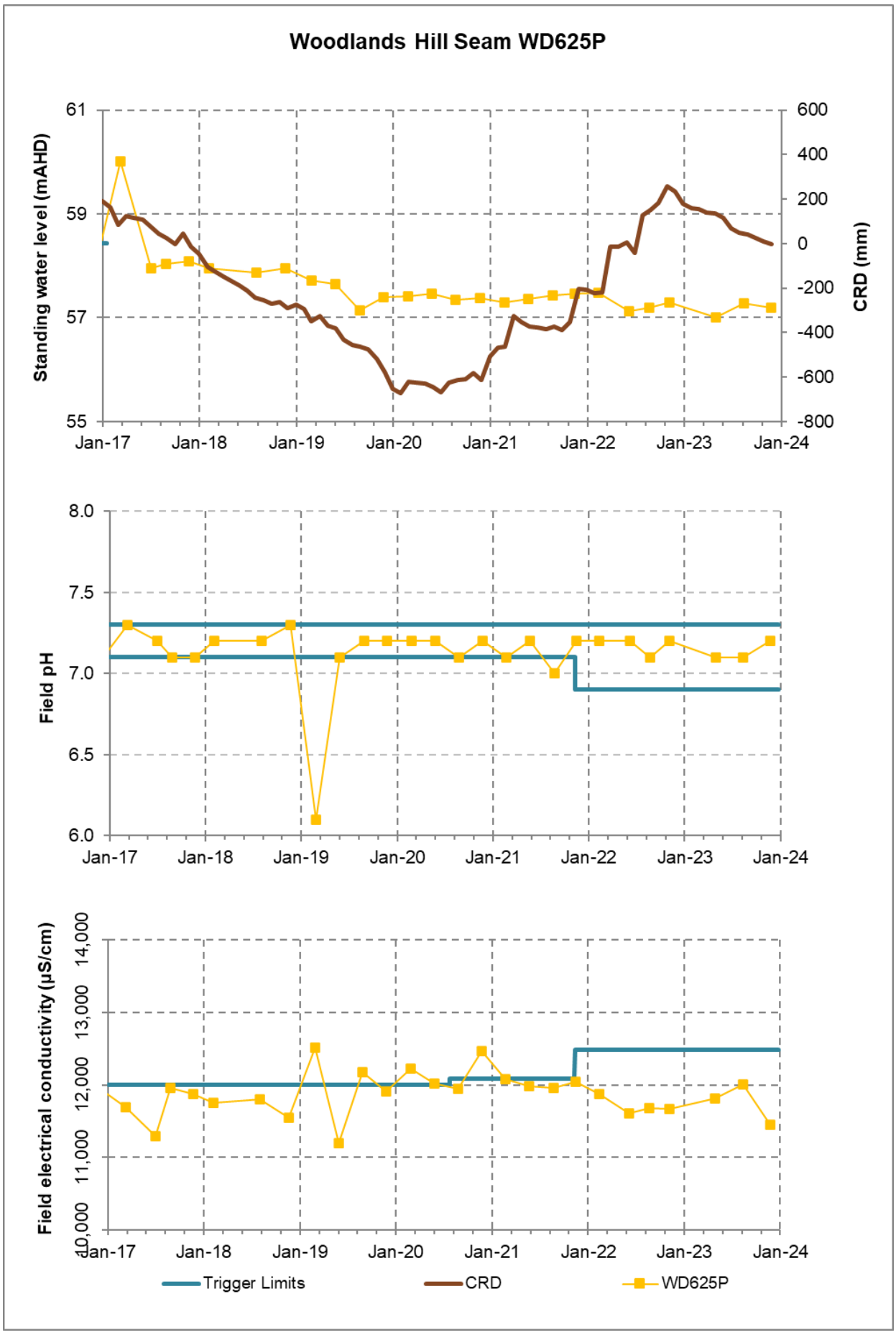


Figure B 6 Woodlands Hill coal seam bores GWL, pH, and EC

Figure B 7 Shallow overburden bores GWL, pH, and EC (1)

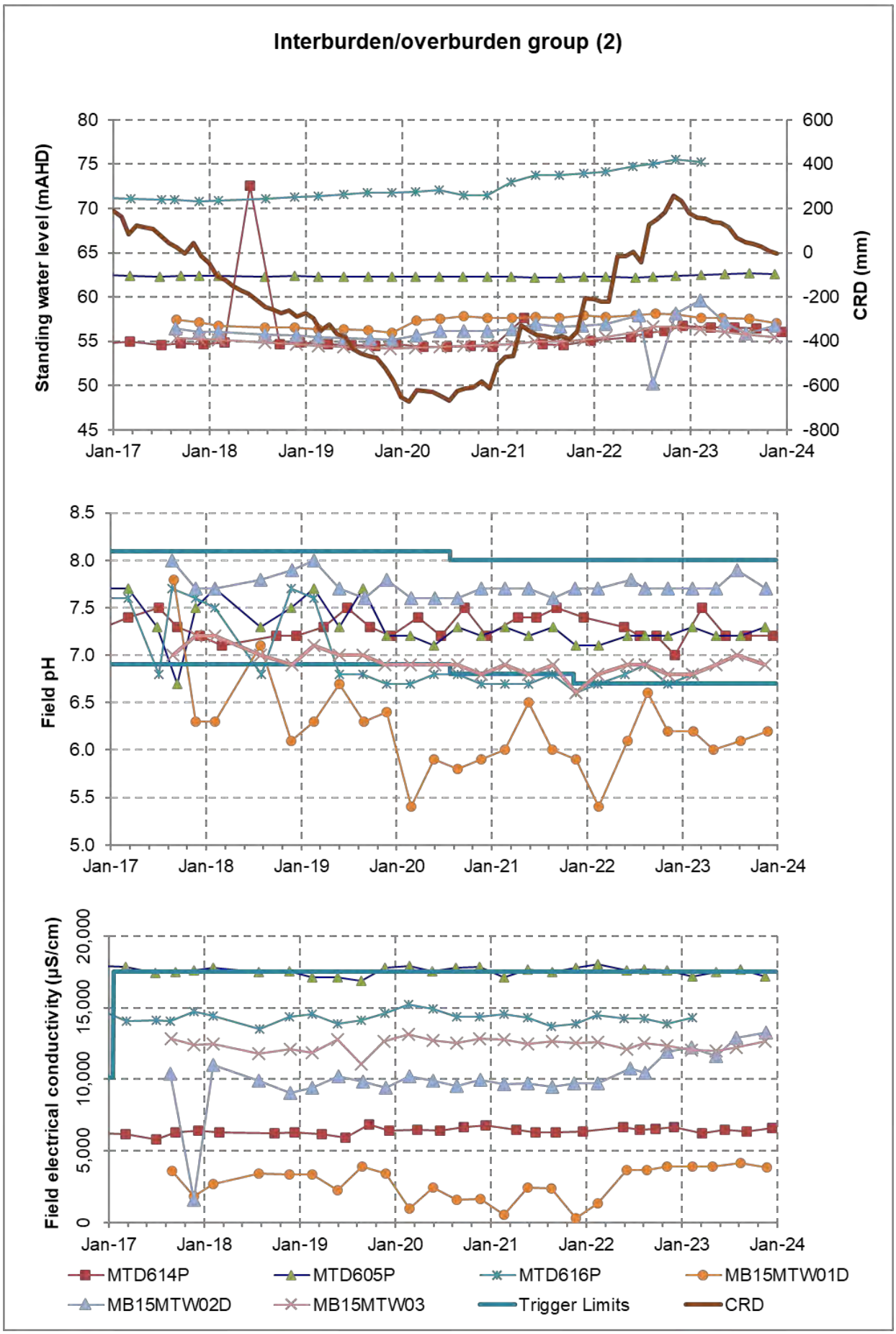


Figure B 8 Shallow overburden bores GWL, pH, and EC (2)

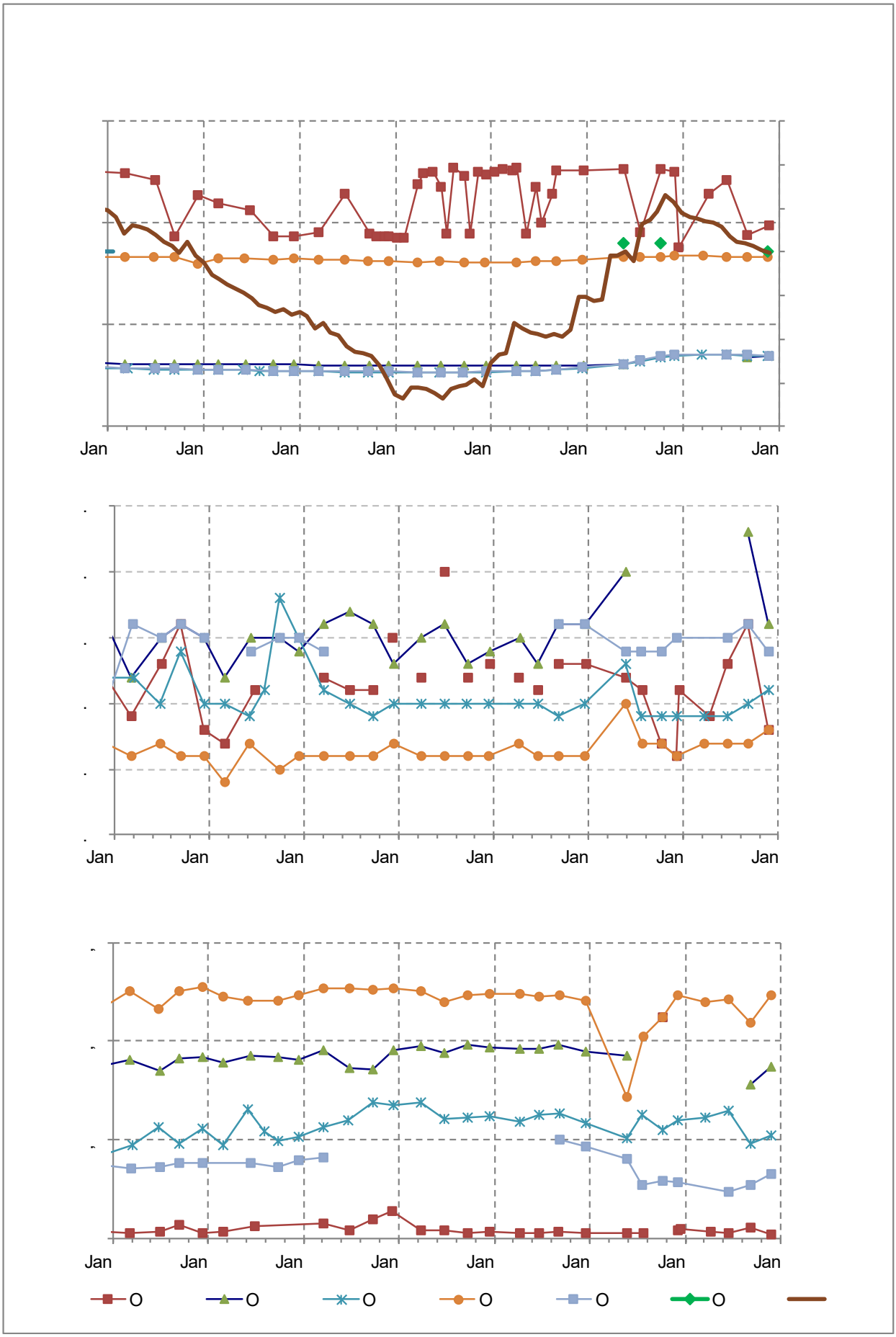


Figure B 9 Hunter River alluvium bores GWL, pH, and EC

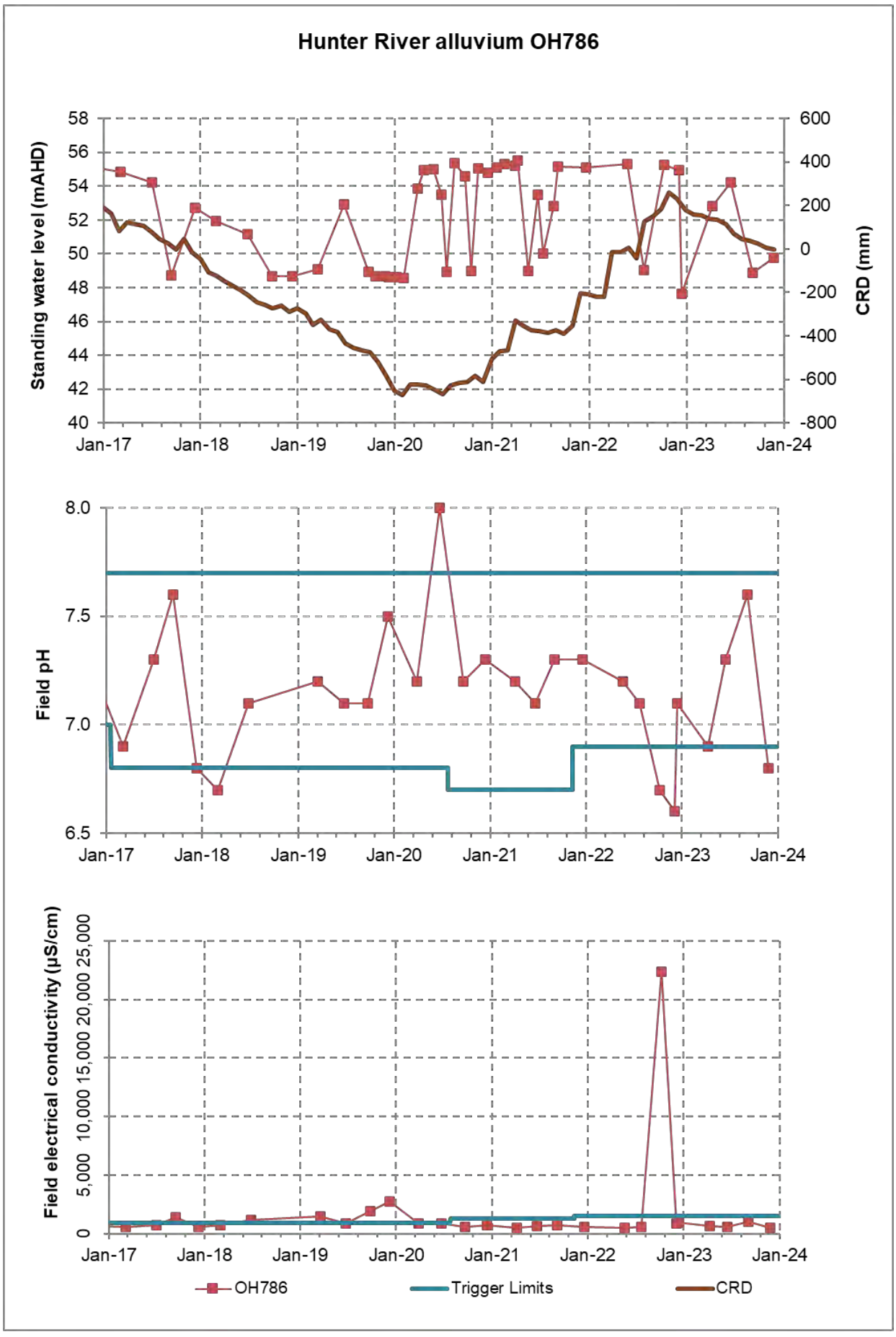


Figure B 10 Hunter River bore OH786 GWL, pH, and EC

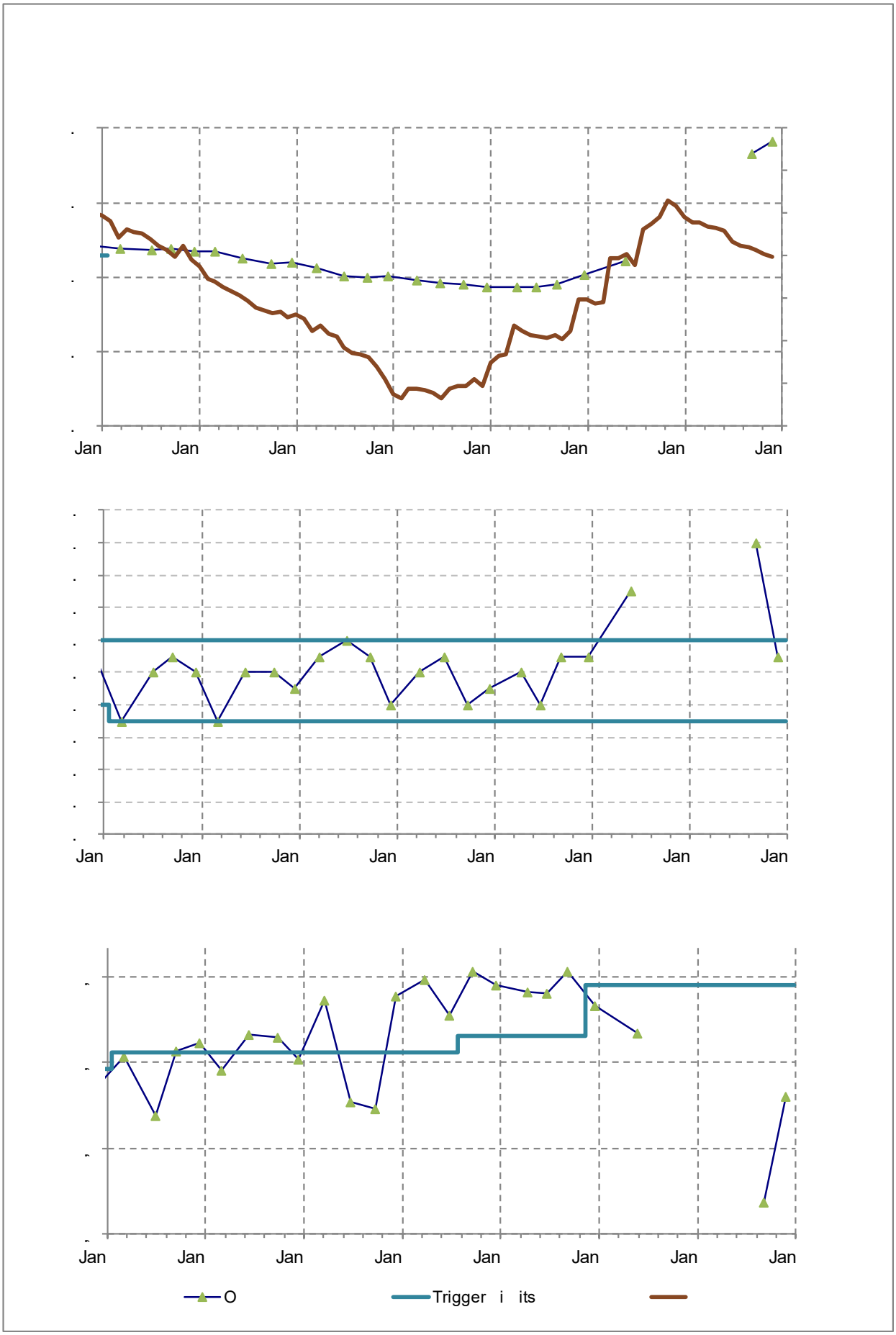


Figure B 11 Hunter River bore OH787 GWL, pH, and EC

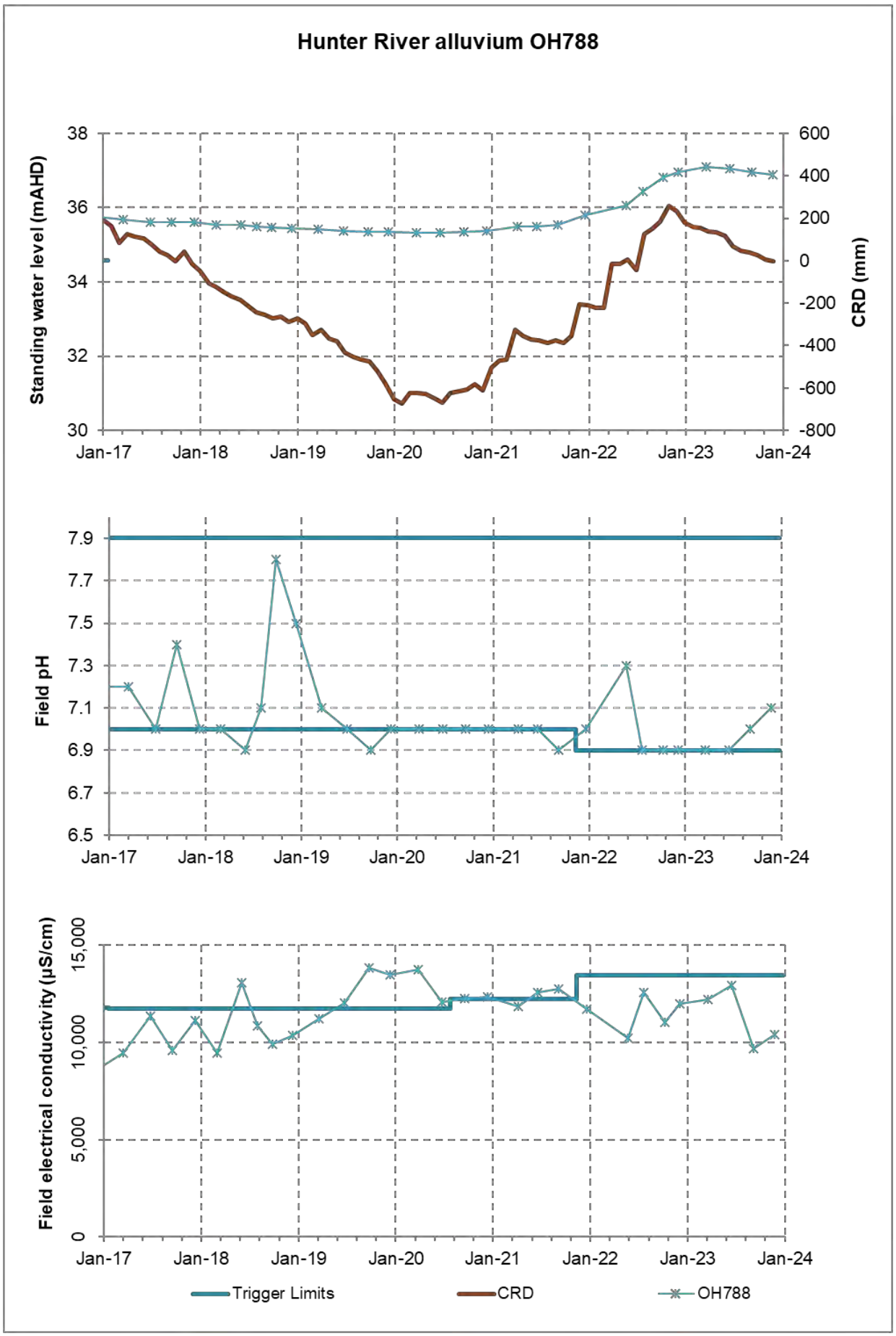


Figure B 12 Hunter River bore OH788 GWL, pH, and EC

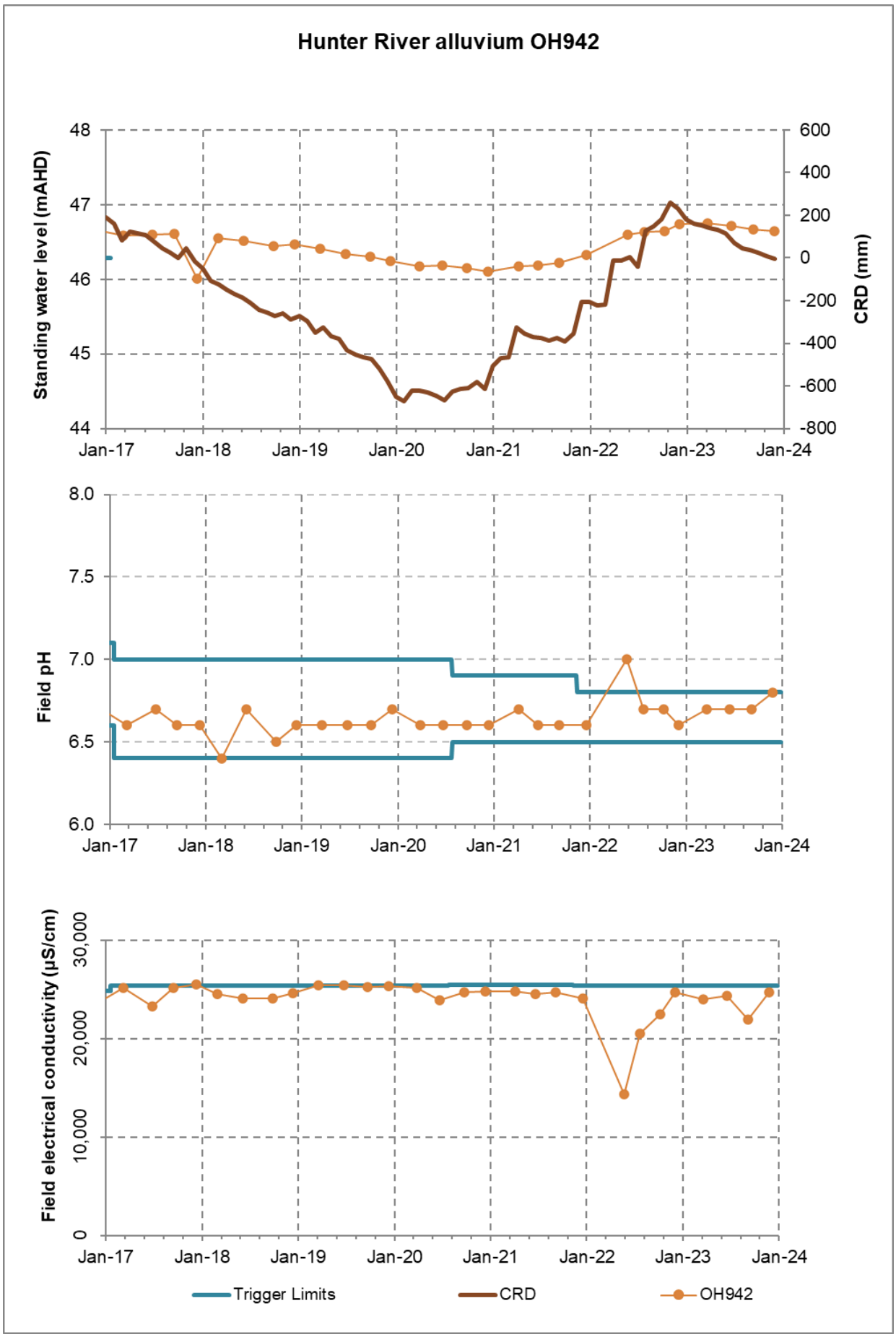


Figure B 13 Hunter River bore OH942 GWL, pH, and EC

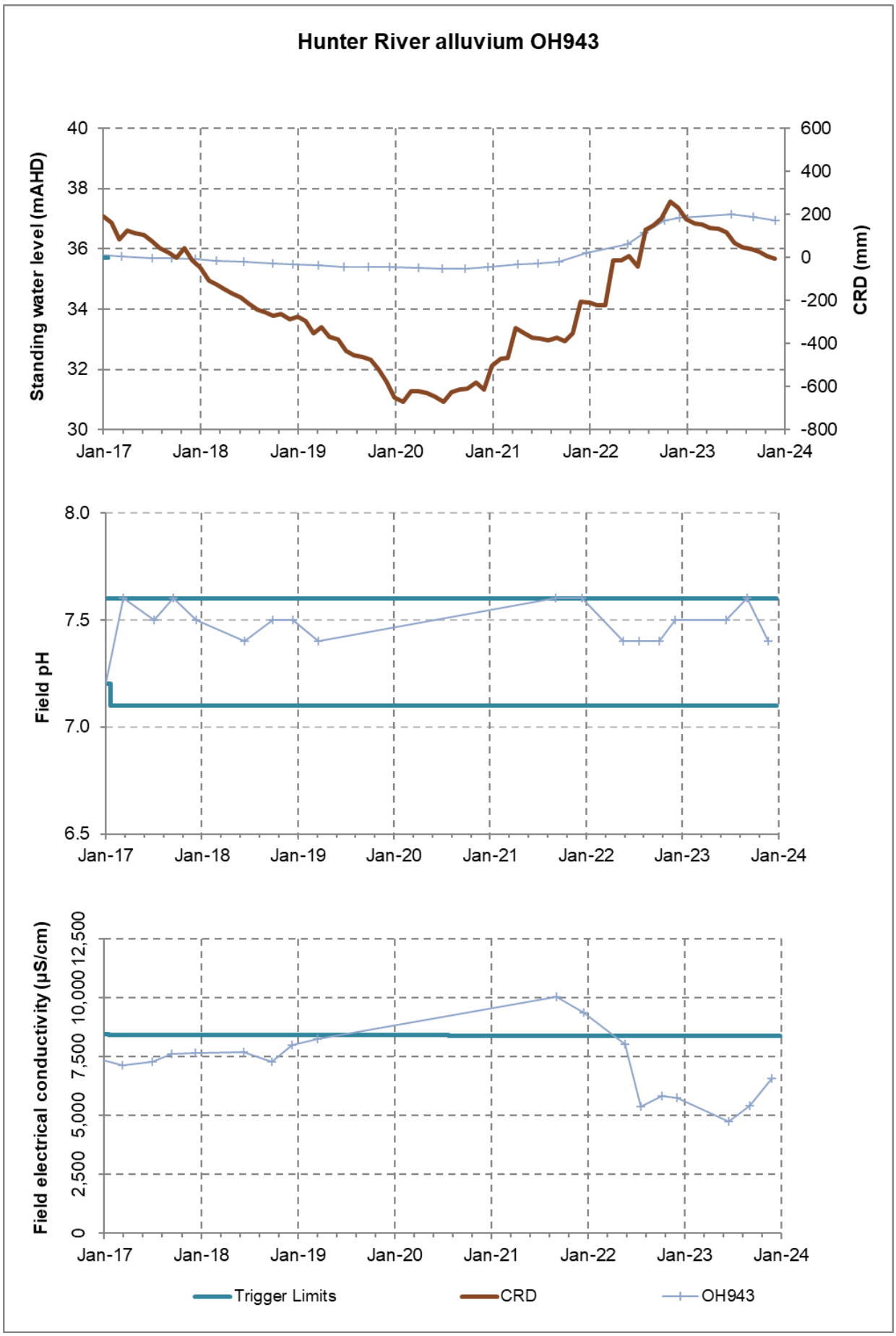


Figure B 14 Hunter River bore OH943 GWL, pH, and EC

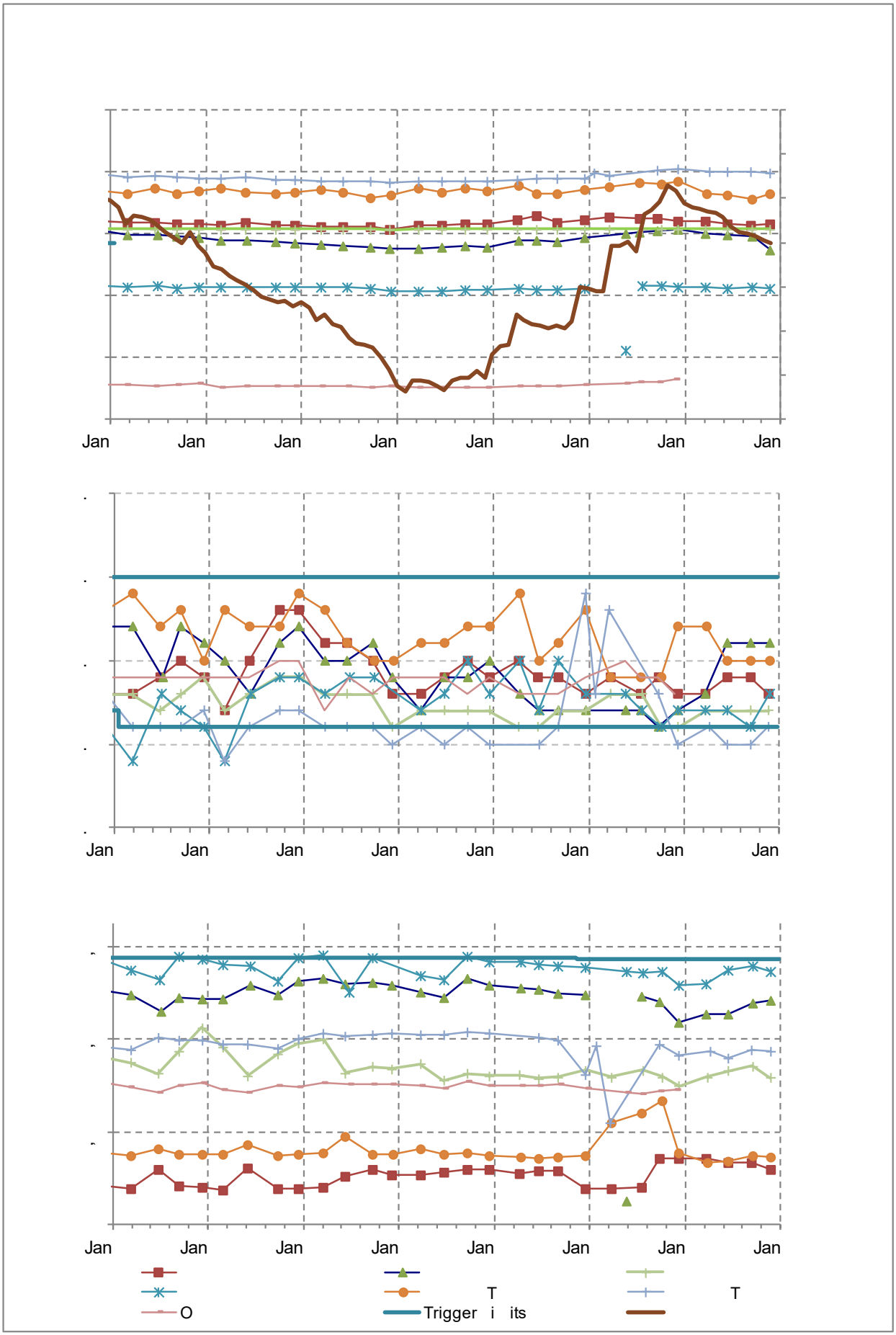


Figure B 15 Bayswater coal seam bores GWL, pH, and EC

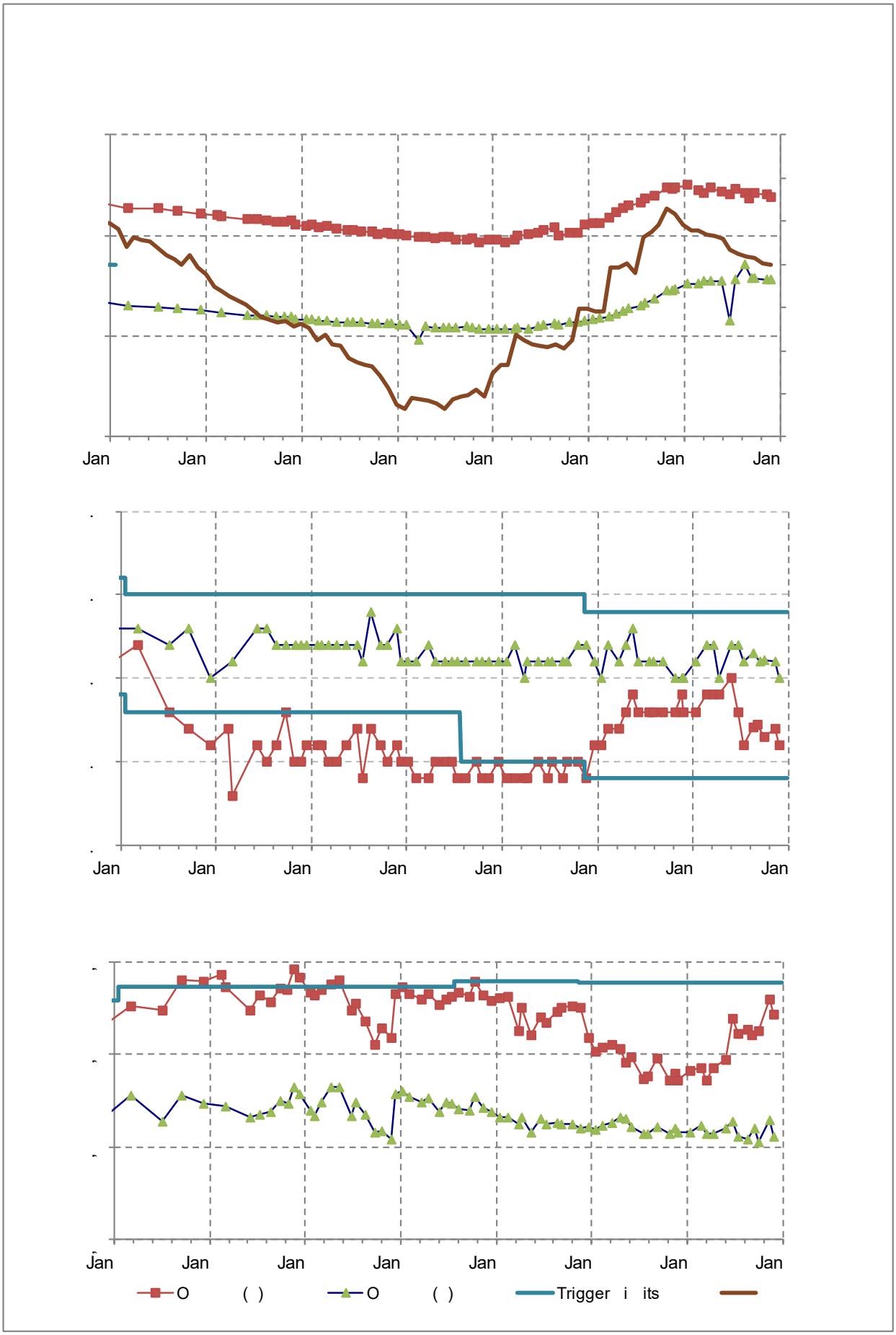


Figure B 16 Warkworth coal seam bores GWL, pH, and EC

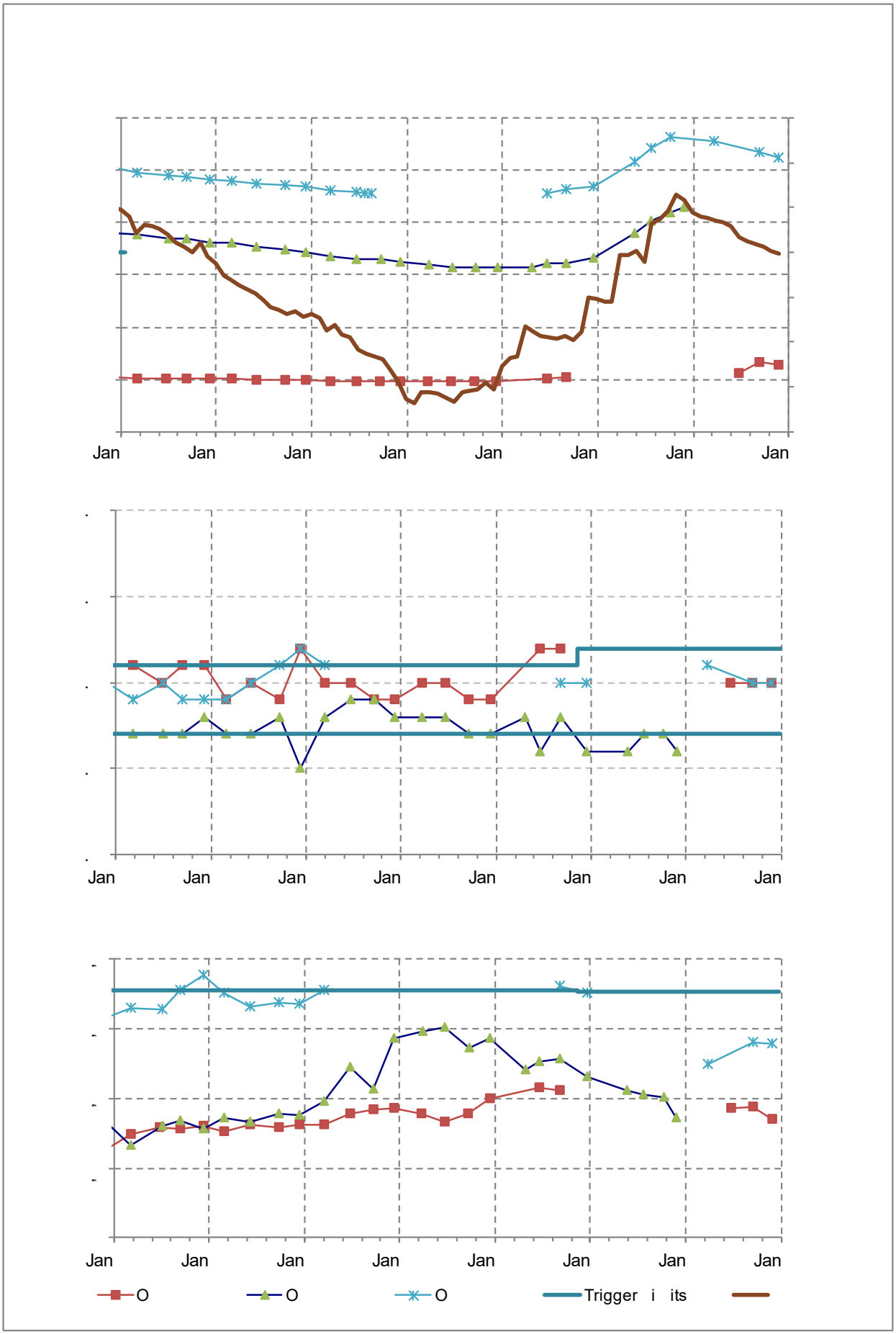


Figure B 17 Vaux coal seam bores GWL, pH, and EC

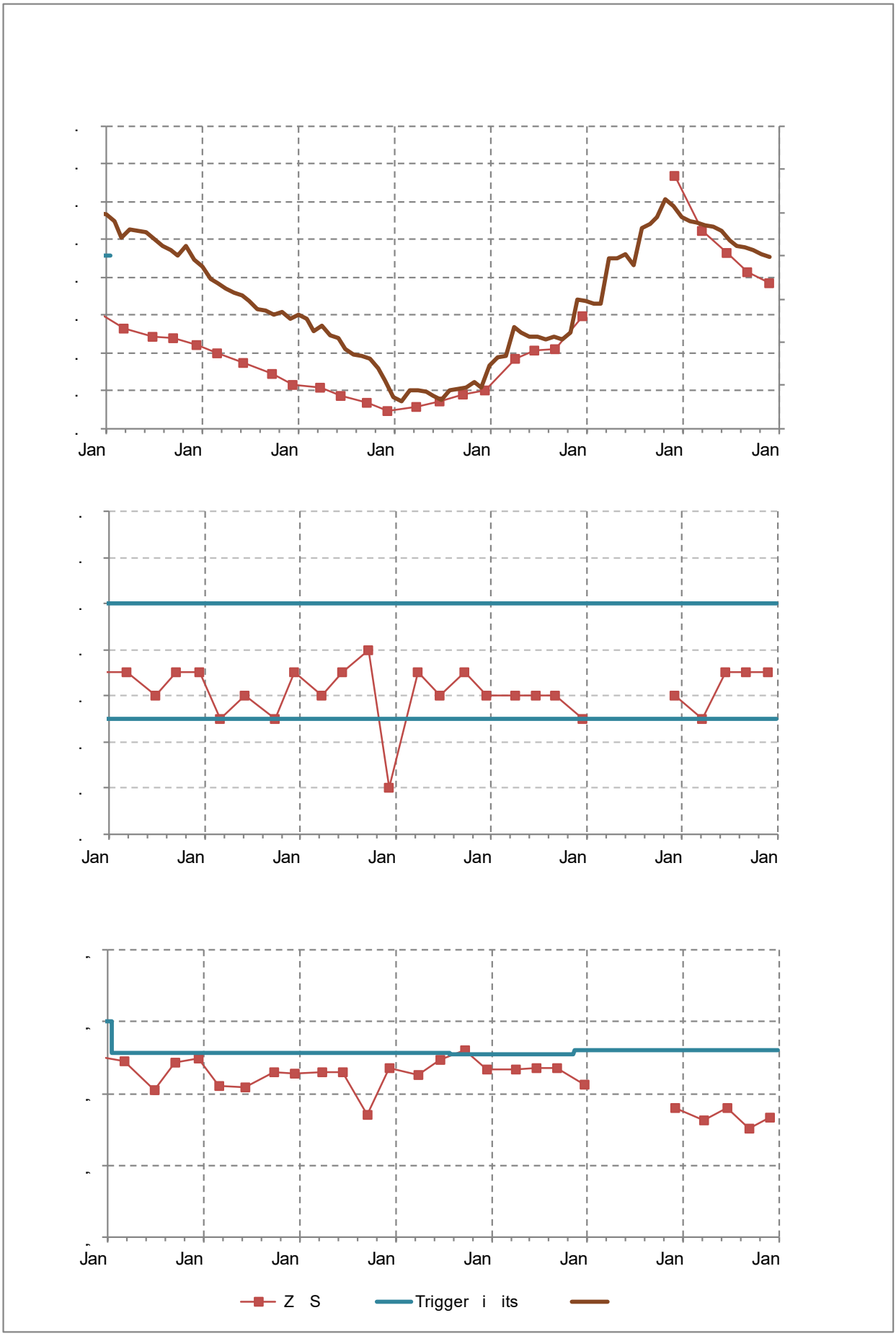


Figure B 18 Wollombi Brook alluvium bore PZ8S GWL, pH, and EC

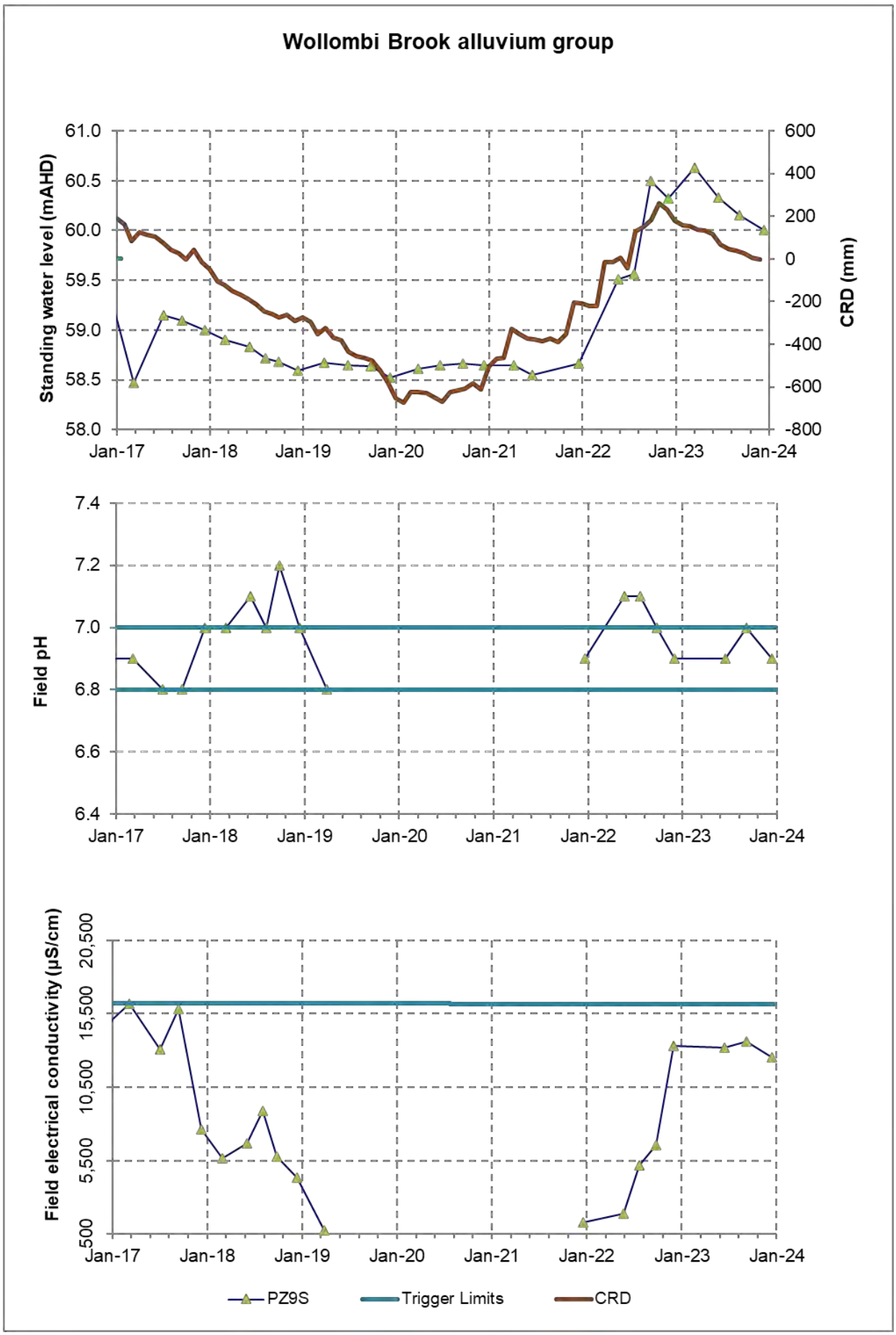


Figure B 19 Wollombi Brook alluvium bore PZ9S GWL, pH, and EC

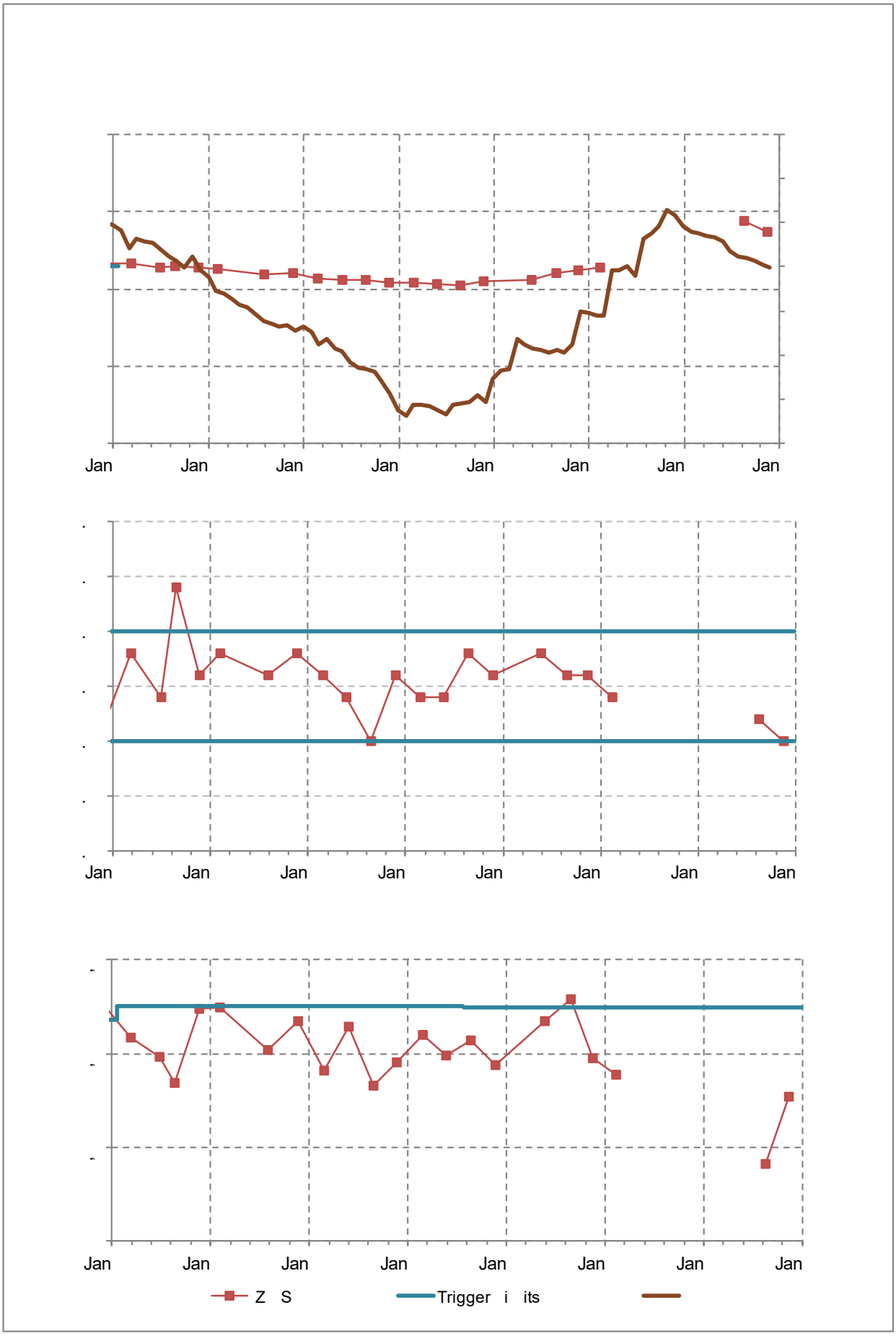


Figure B 20 Warkworth Sands bore PZ7S GWL, pH, and EC

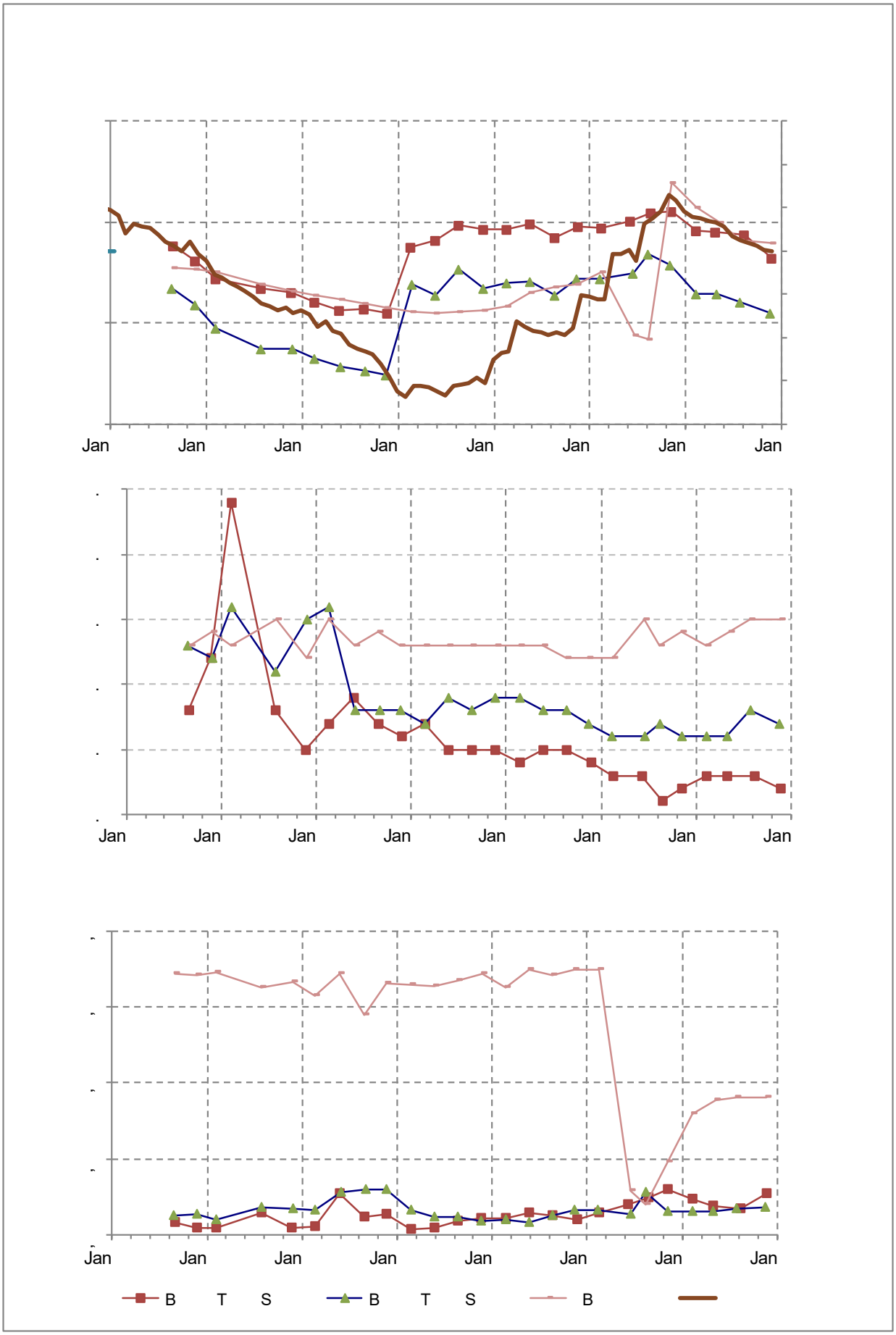


Figure B 21 Additional Wollombi Brook alluvium bores GWL, pH, and EC

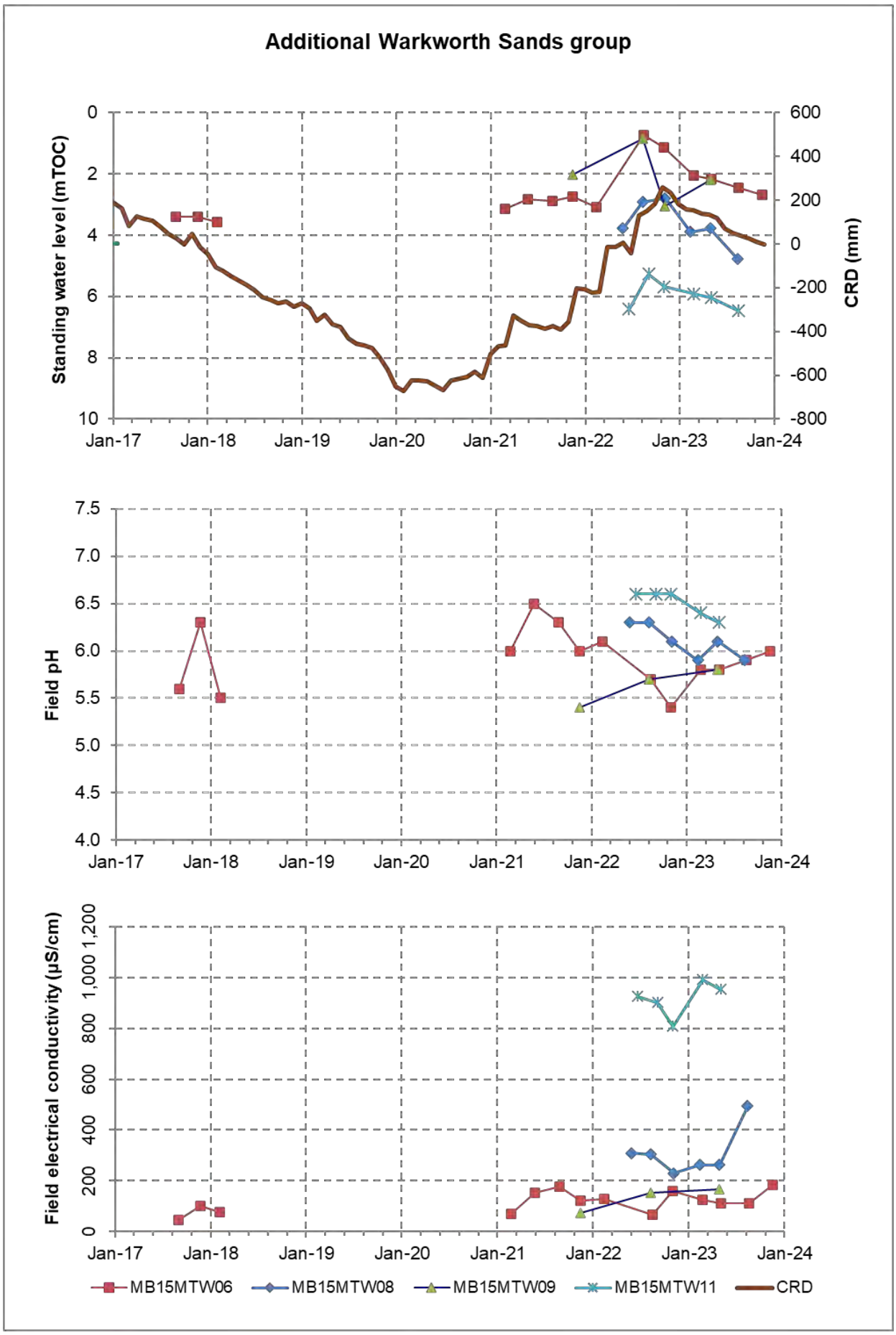


Figure B 22 Additional Warkworth Sands bores GWL, pH, and EC

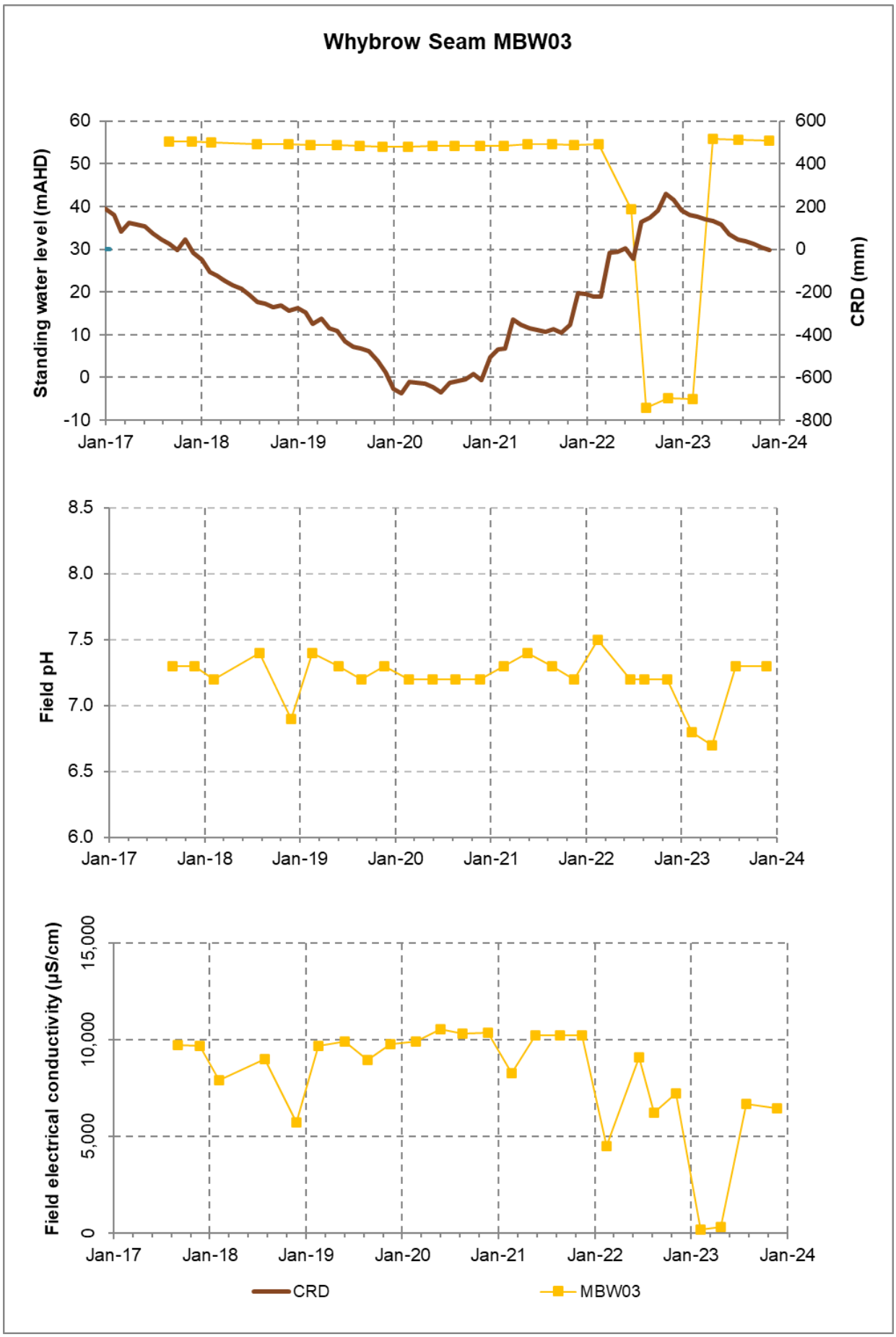


Figure B 23 Whybrow coal seam bore MBW03 GWL, pH, and EC

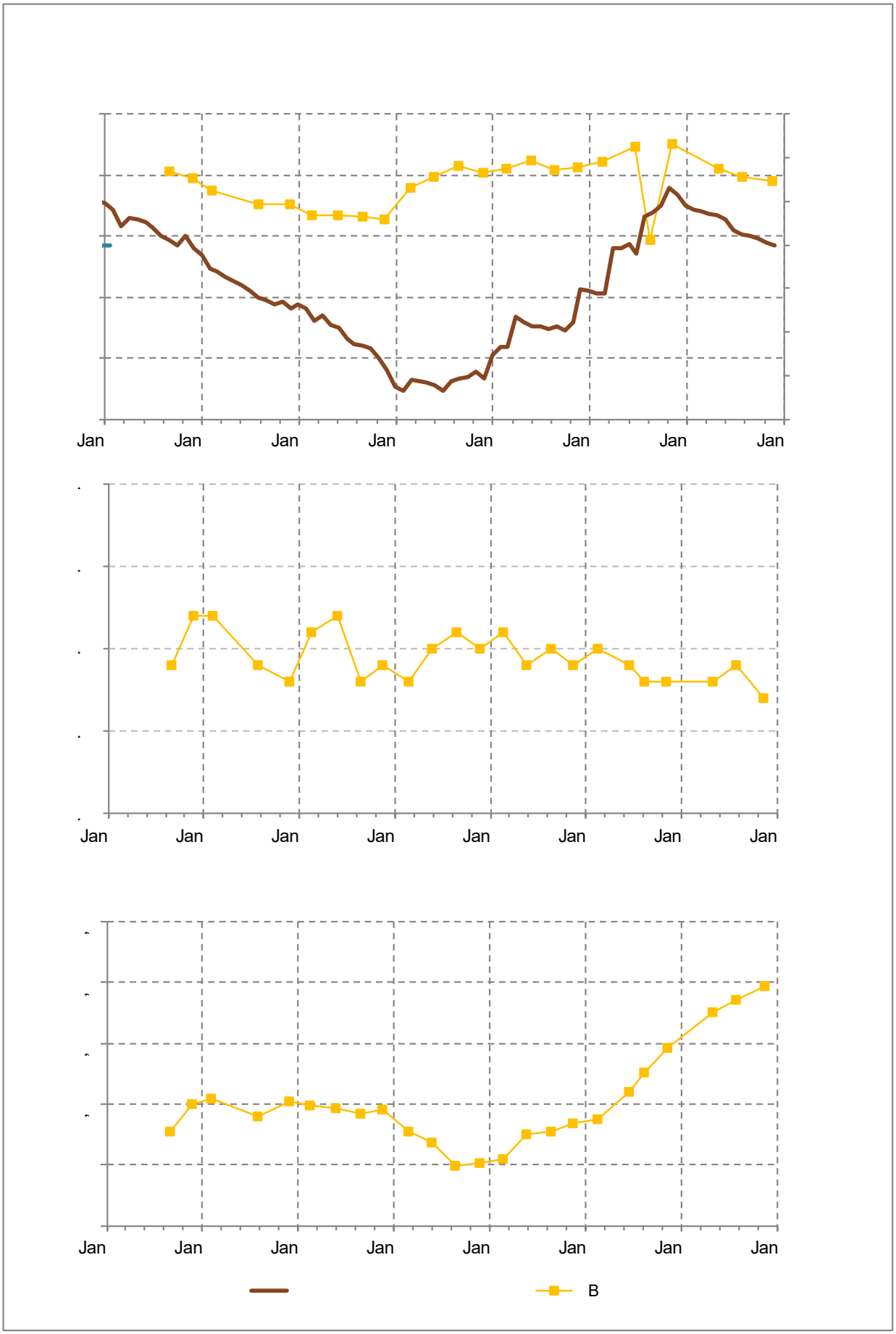
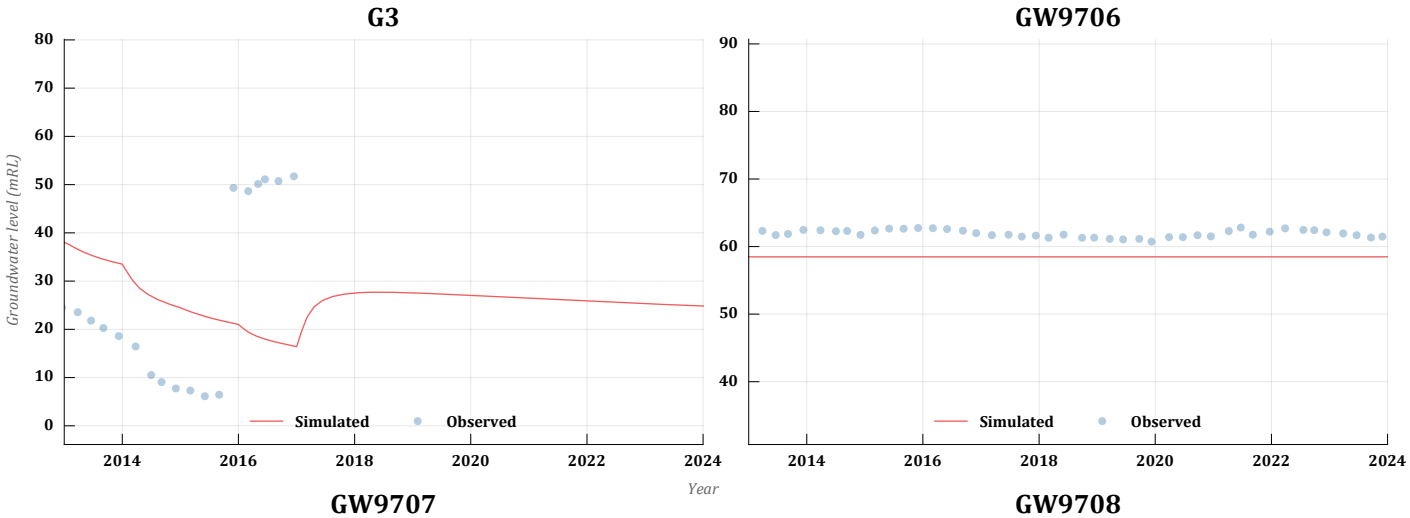


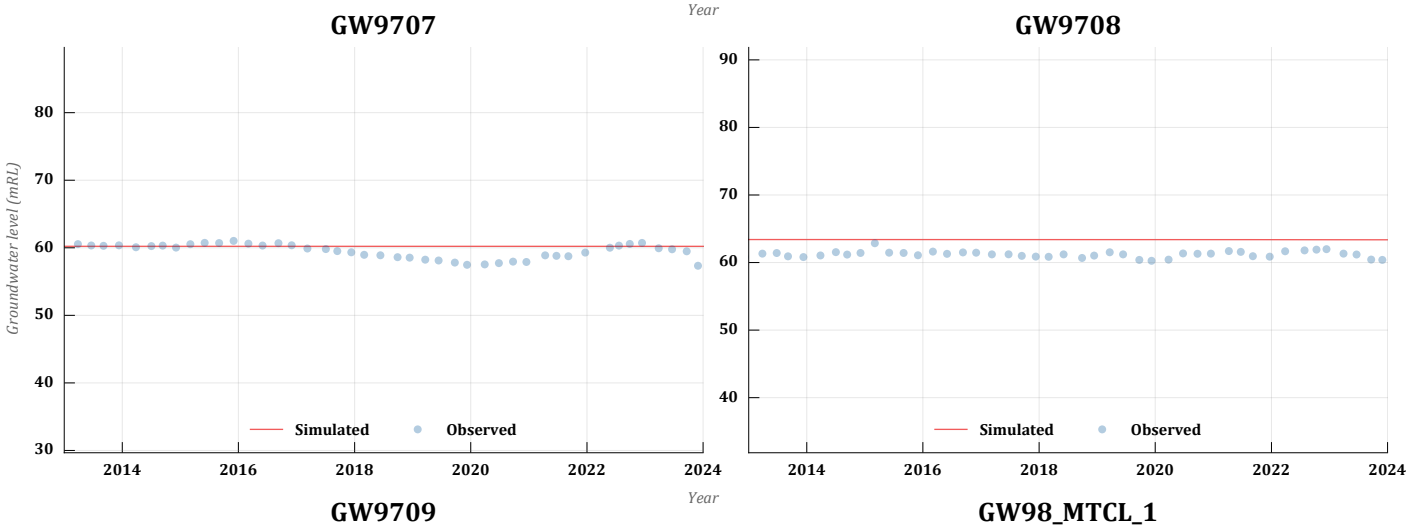
Figure B 24 MBW06 GWL, pH, and EC

Appendix C

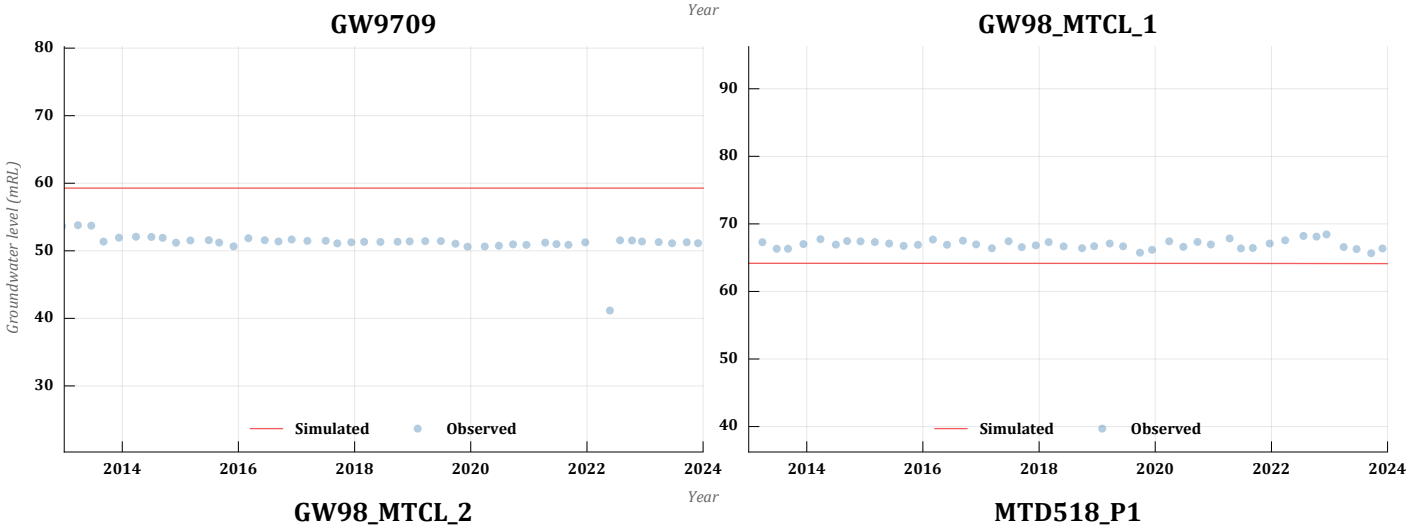
Model verification graphs


G3
Groundwater level (mRL)
Simulated
Observed
Year

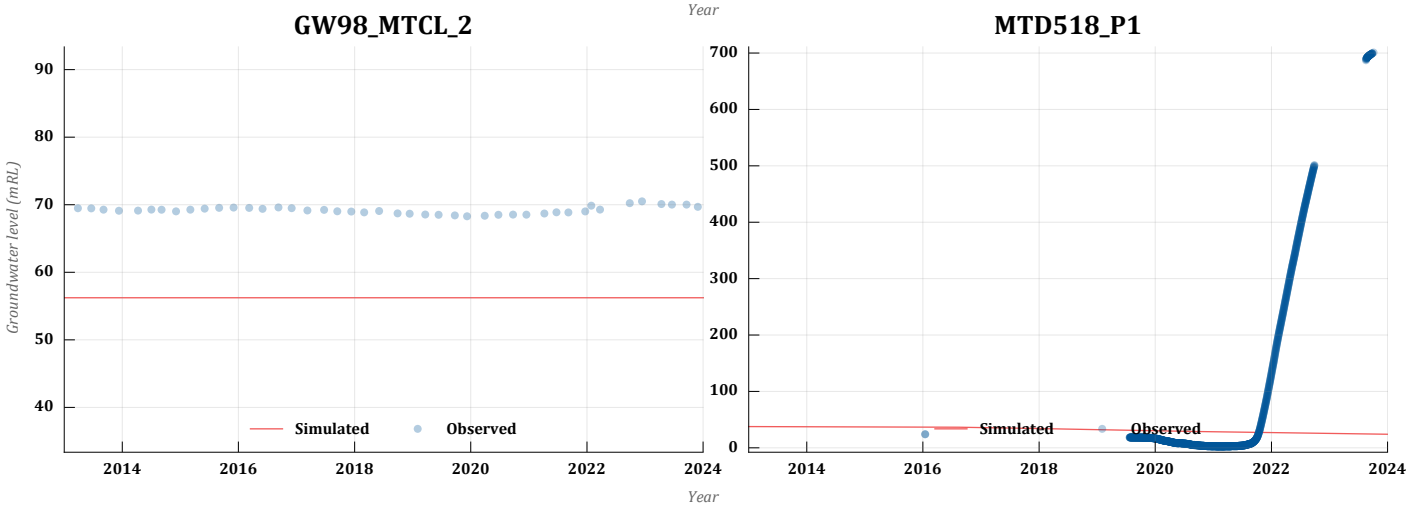
GW9706
Simulated
Observed


GW9707
Groundwater level (mRL)
Simulated
Observed
Year

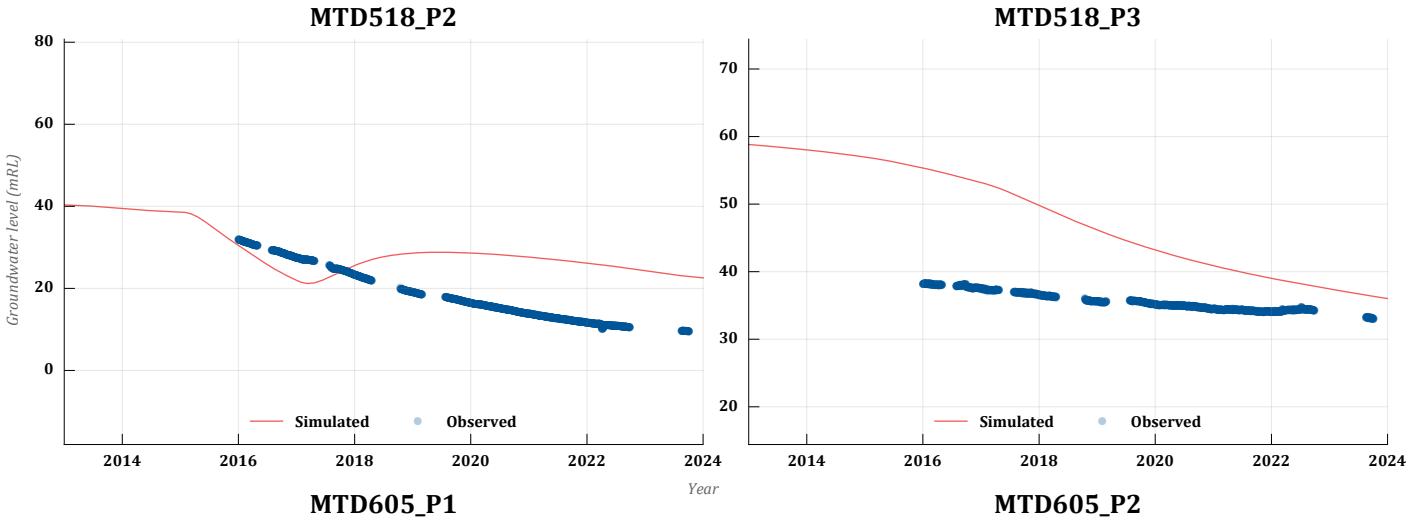
GW9708
Simulated
Observed


GW9709
Groundwater level (mRL)
Simulated
Observed
Year

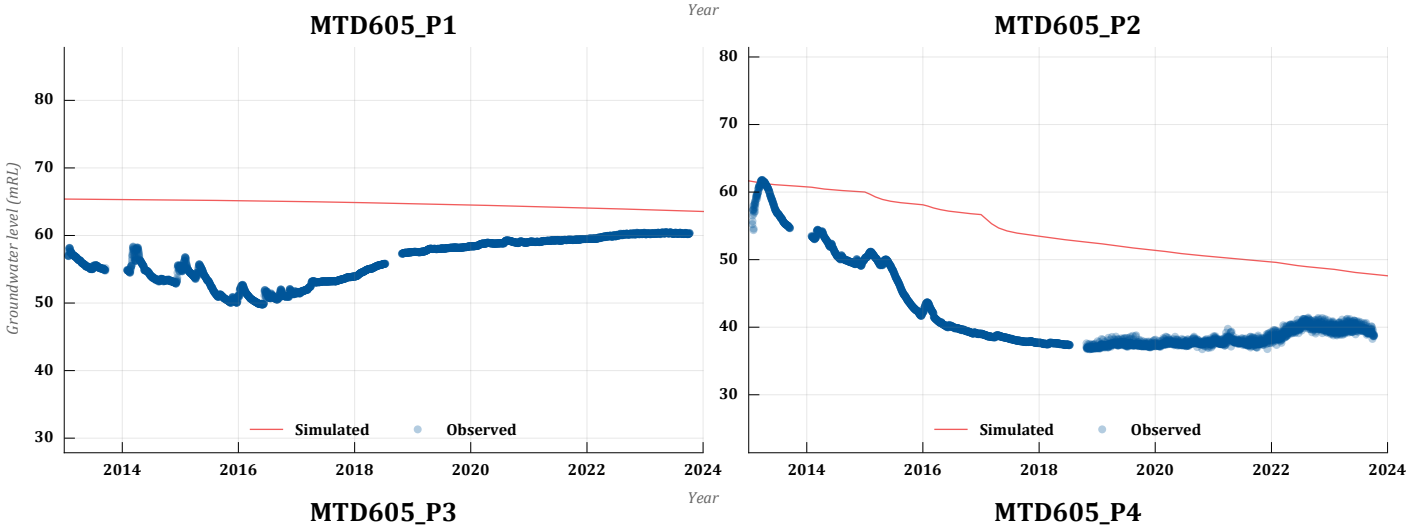
GW98_MTCL_1
Simulated
Observed


GW98_MTCL_2
Groundwater level (mRL)
Simulated
Observed
Year

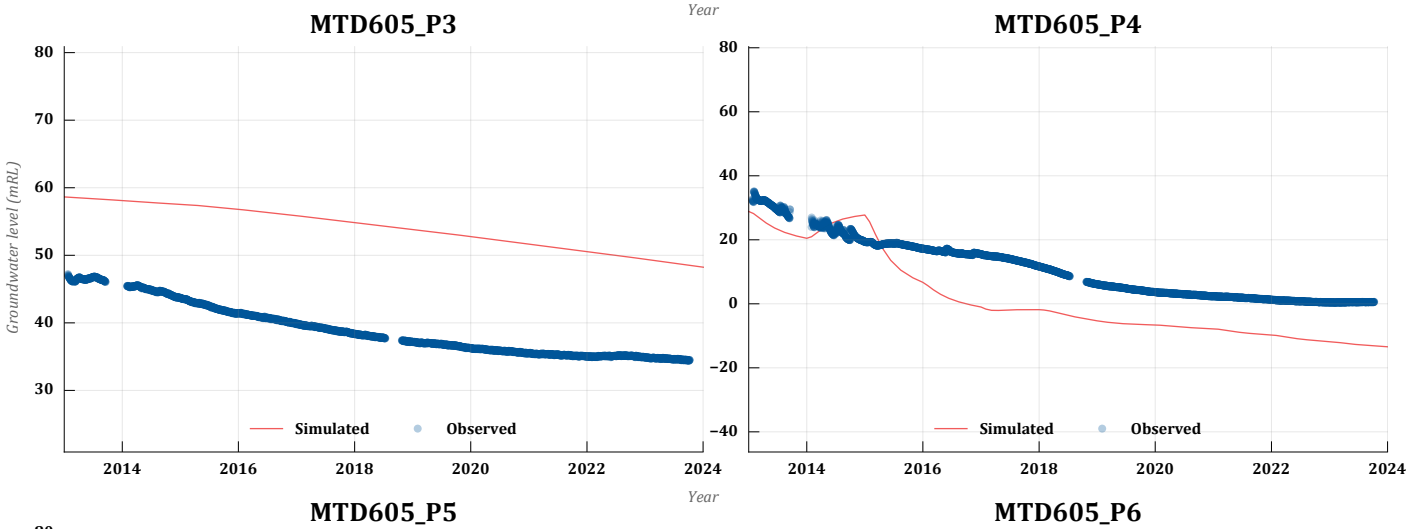
MTD518_P1
Simulated
Observed


MTD518_P2
Groundwater level (mRL)
Simulated
Observed
2014
2016
2018
2020
2022
2024
Year

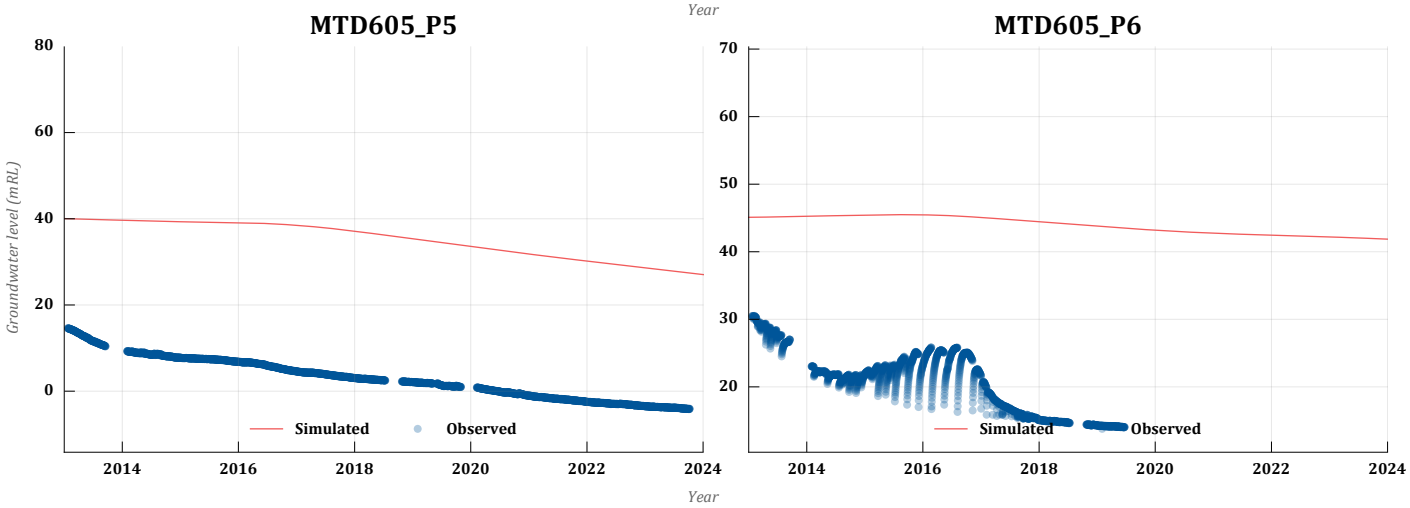
MTD518_P3
Simulated
Observed


MTD605_P1
Groundwater level (mRL)
Simulated
Observed
Year

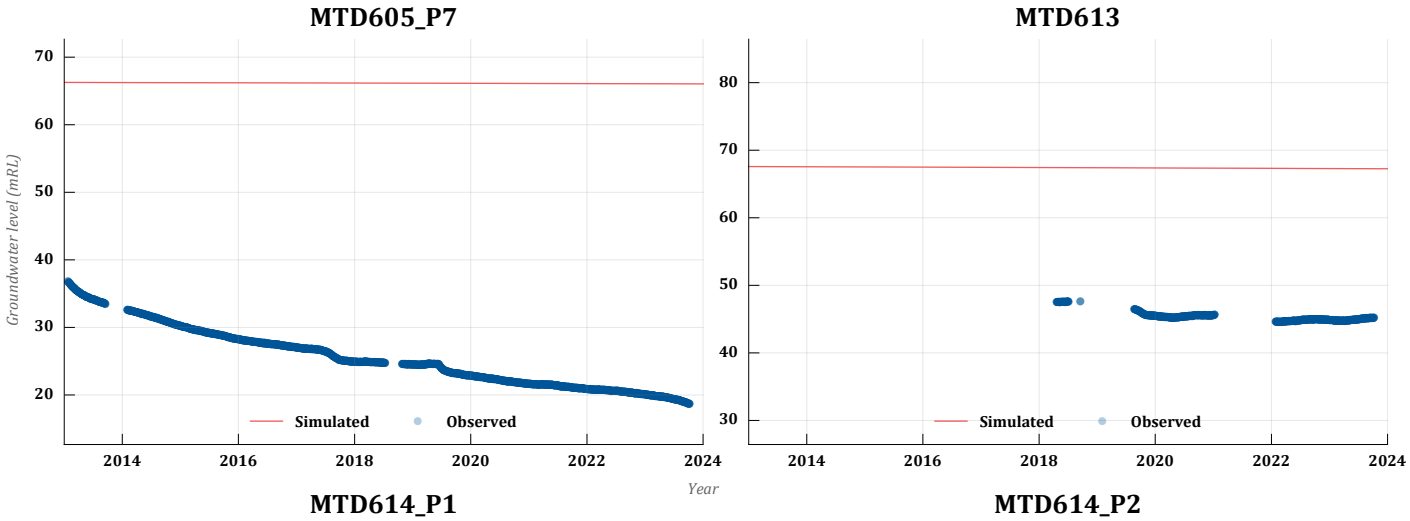
MTD605_P2
Simulated
Observed


MTD605_P3
Groundwater level (mRL)
Simulated
Observed
Year

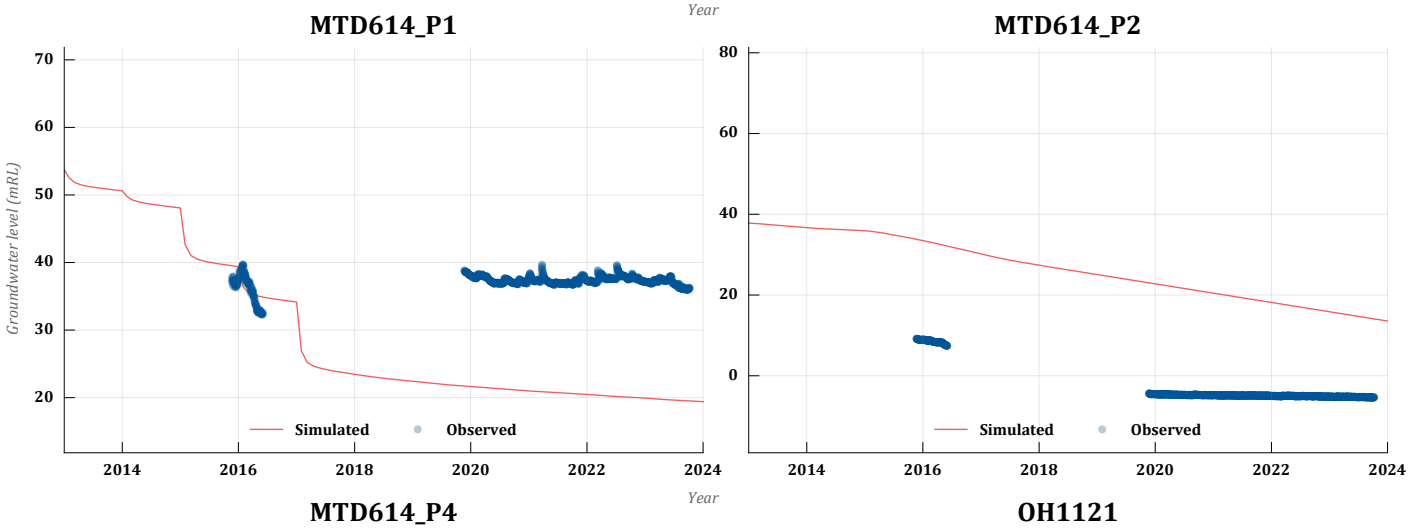
MTD605_P4
Simulated
Observed


MTD605_P5
Groundwater level (mRL)
Simulated
Observed
Year

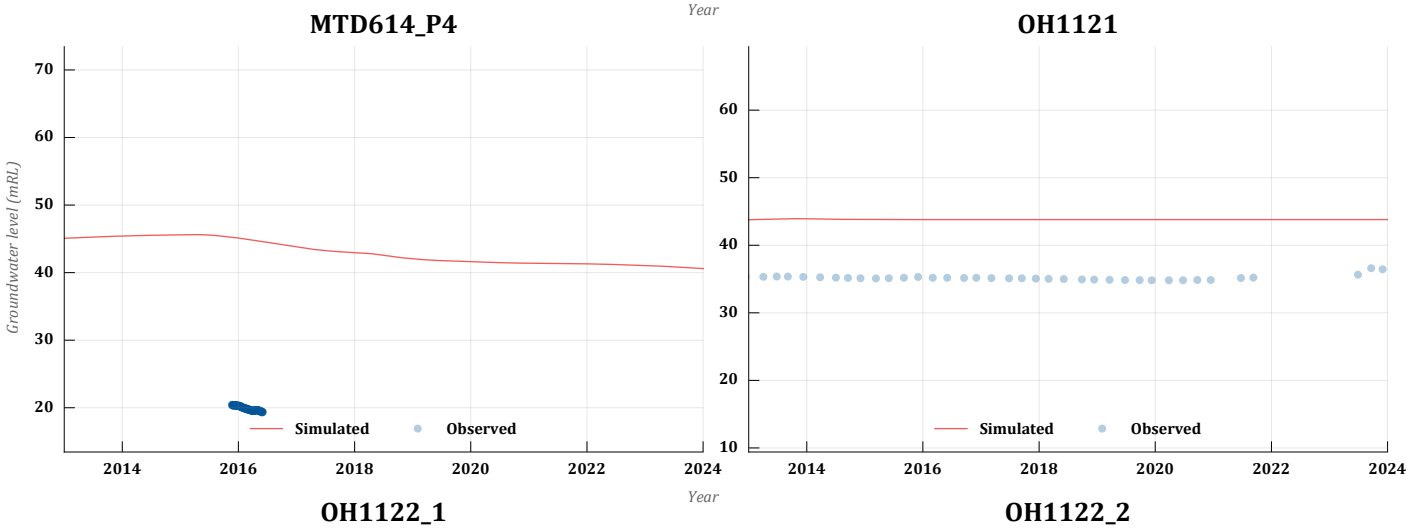
MTD605_P6
Simulated
Observed


MTD605_P7
Groundwater level (mRL)
70
60
50
40
30
20
Simulated
Observed
2014
2016
2018
2020
2022
2024
Year

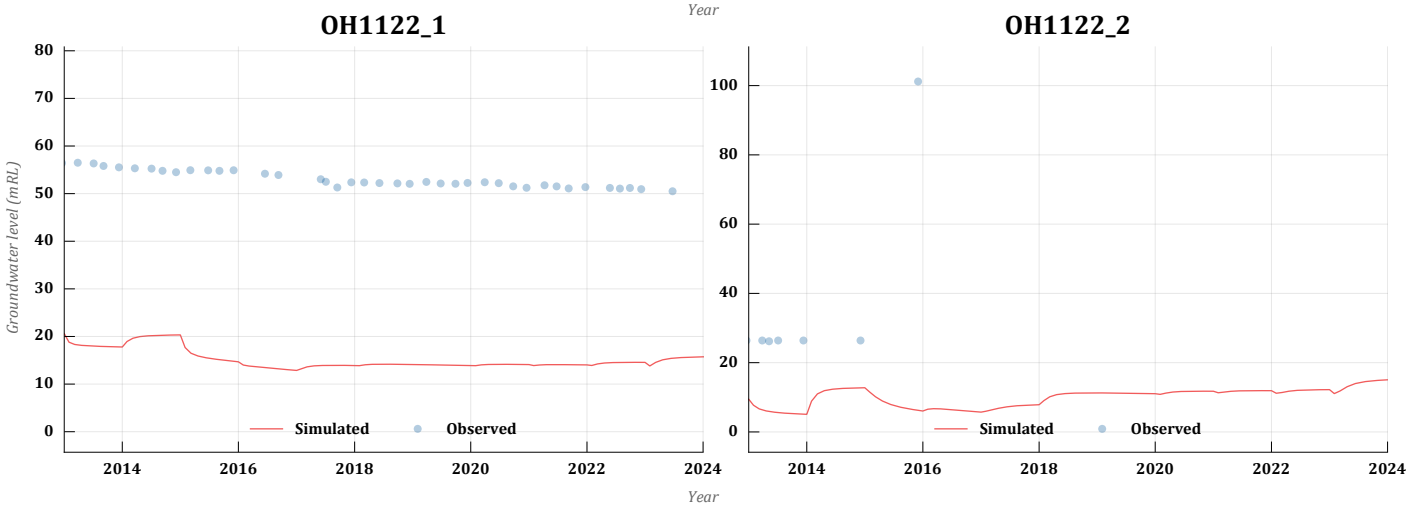
MTD613
80
70
60
50
40
30
Simulated
Observed
2014
2016
2018
2020
2022
2024


MTD614_P1
Groundwater level (mRL)
70
60
50
40
30
20
Simulated
Observed
2014
2016
2018
2020
2022
2024
Year

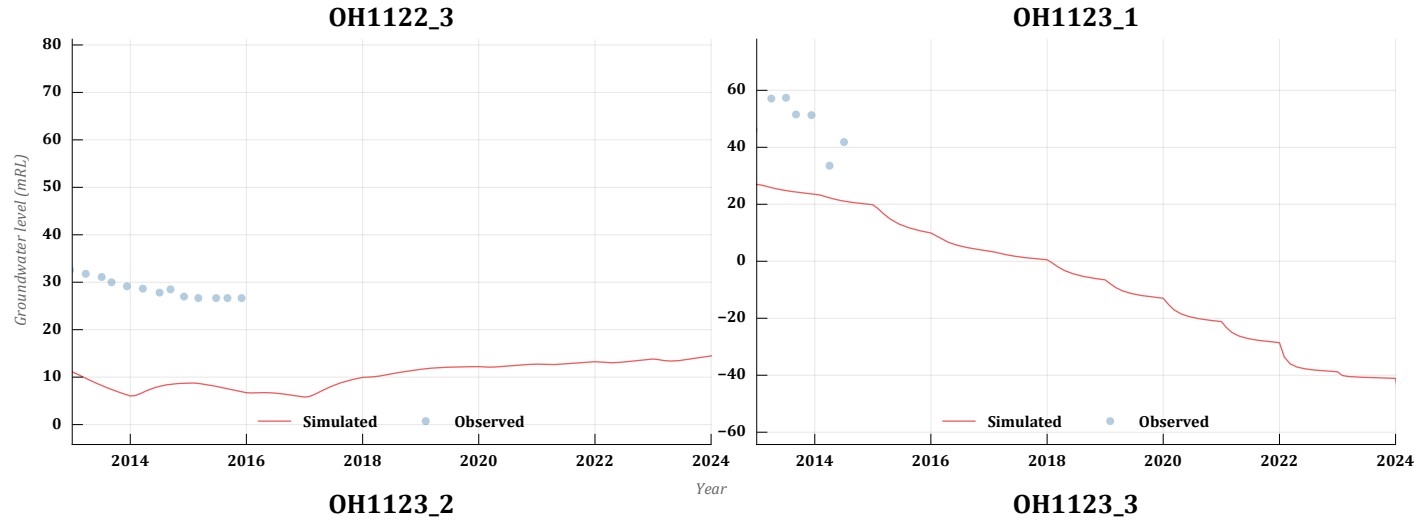
MTD614_P2
80
60
40
20
0
Simulated
Observed
2014
2016
2018
2020
2022
2024


MTD614_P4
Groundwater level (mRL)
70
60
50
40
30
20
Simulated
Observed
2014
2016
2018
2020
2022
2024
Year

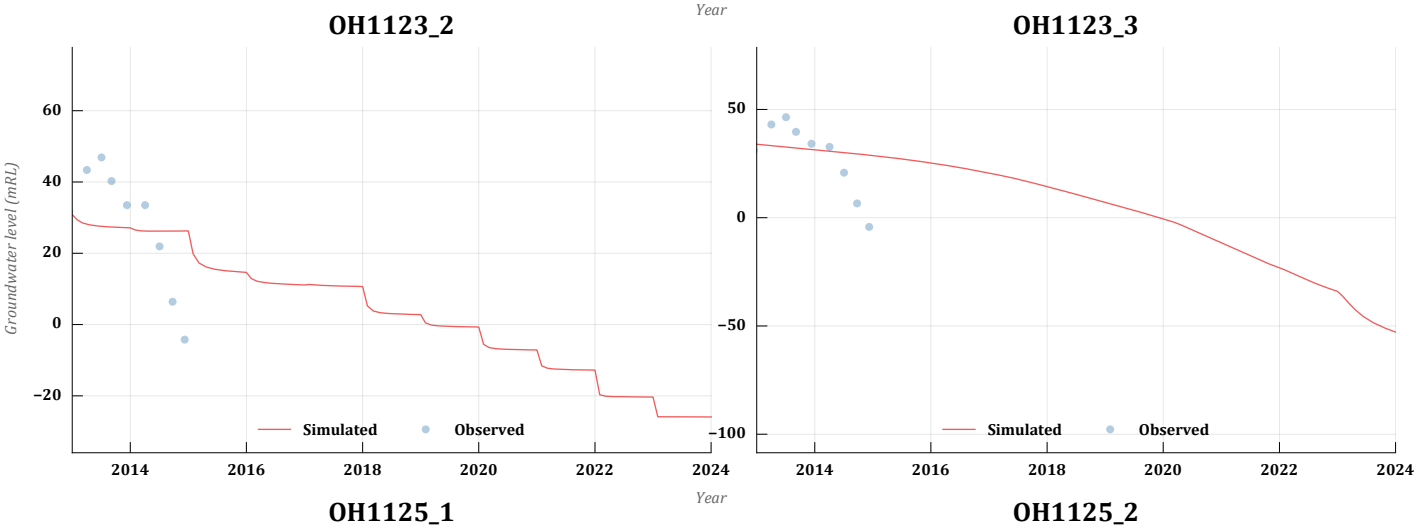
OH1121
60
50
40
30
20
10
Simulated
Observed
2014
2016
2018
2020
2022
2024


OH1122_1
Groundwater level (mRL)
80
70
60
50
40
30
20
10
0
Simulated
Observed
2014
2016
2018
2020
2022
2024
Year

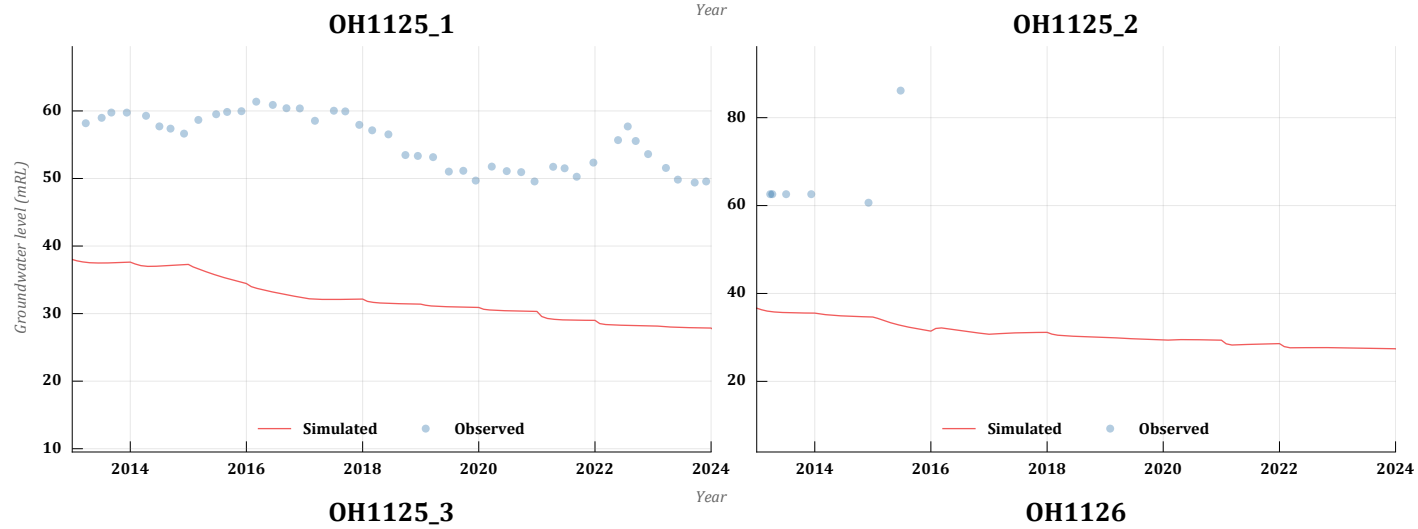
OH1122_2
100
80
60
40
20
0
Simulated
Observed
2014
2016
2018
2020
2022
2024


OH1122_3
Groundwater level (mRL)
Simulated
Observed
Year

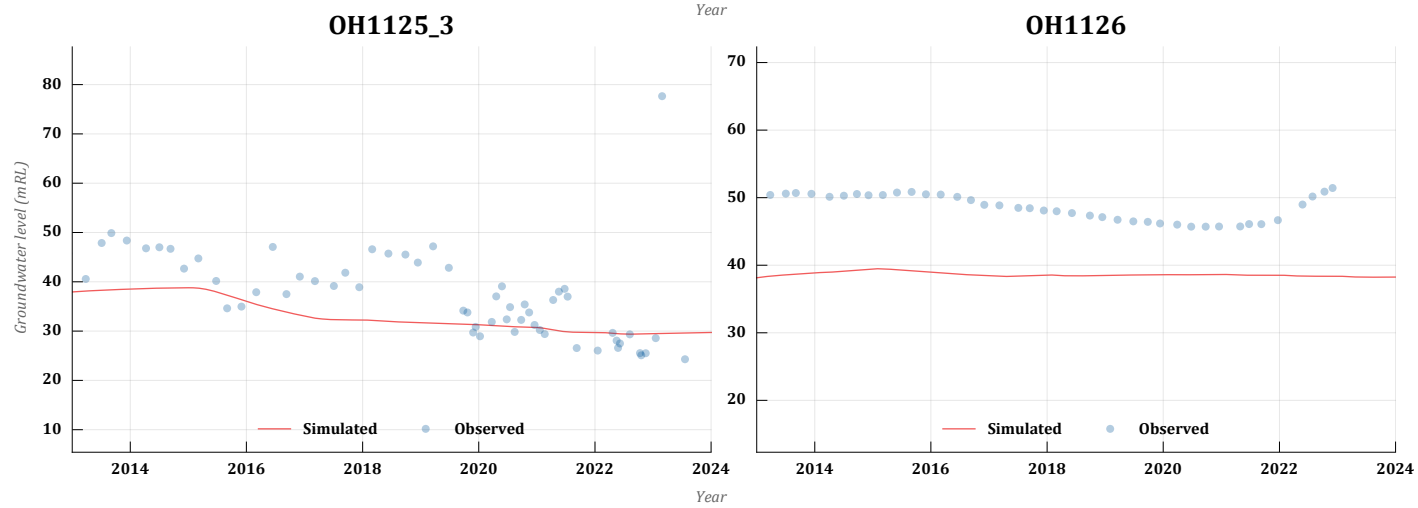
OH1123_1
Simulated
Observed


OH1123_2
Groundwater level (mRL)
Simulated
Observed
Year

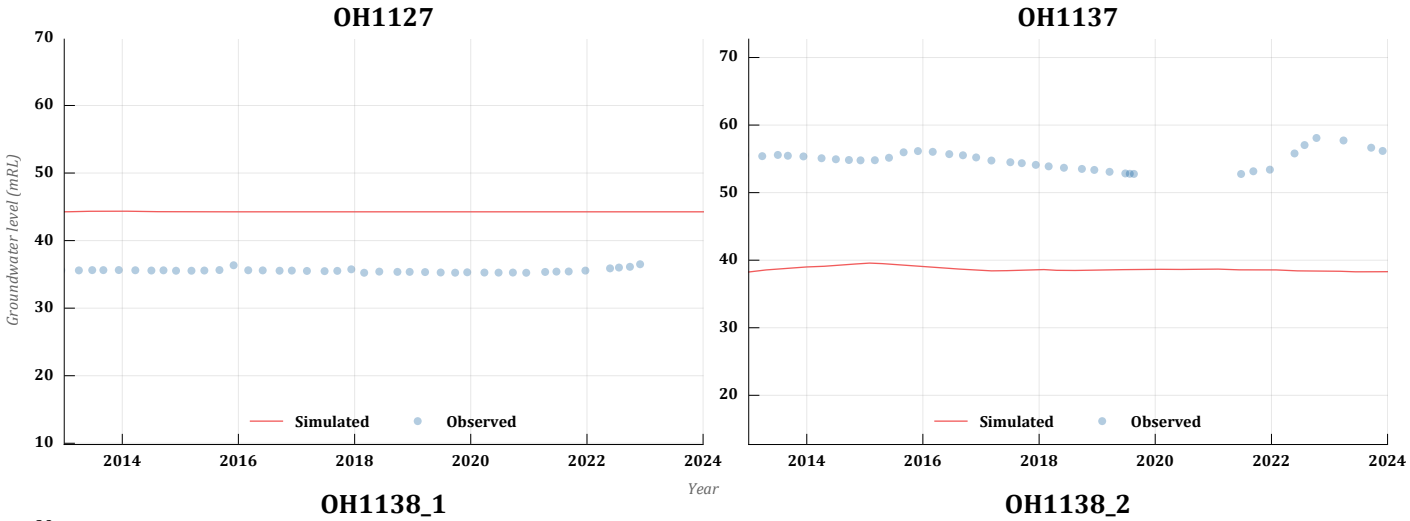
OH1123_3
Simulated
Observed


OH1125_1
Groundwater level (mRL)
Simulated
Observed
Year

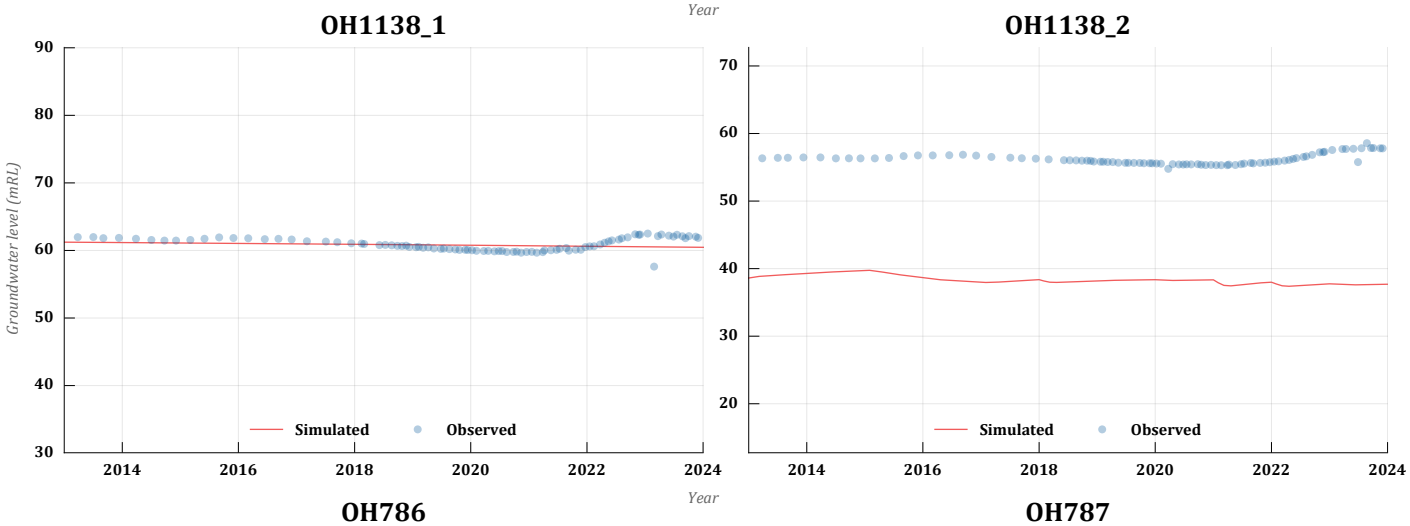
OH1125_2
Simulated
Observed


OH1125_3
Groundwater level (mRL)
Simulated
Observed
Year

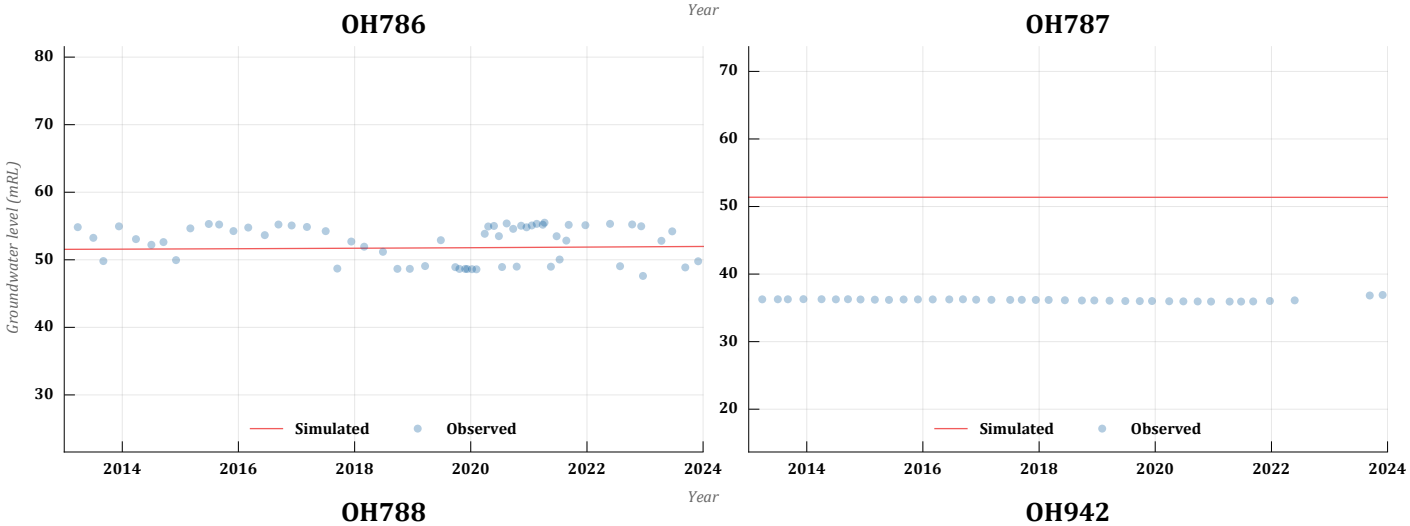
OH1126
Simulated
Observed


OH1127
Groundwater level (mRL)
Simulated
Observed
Year

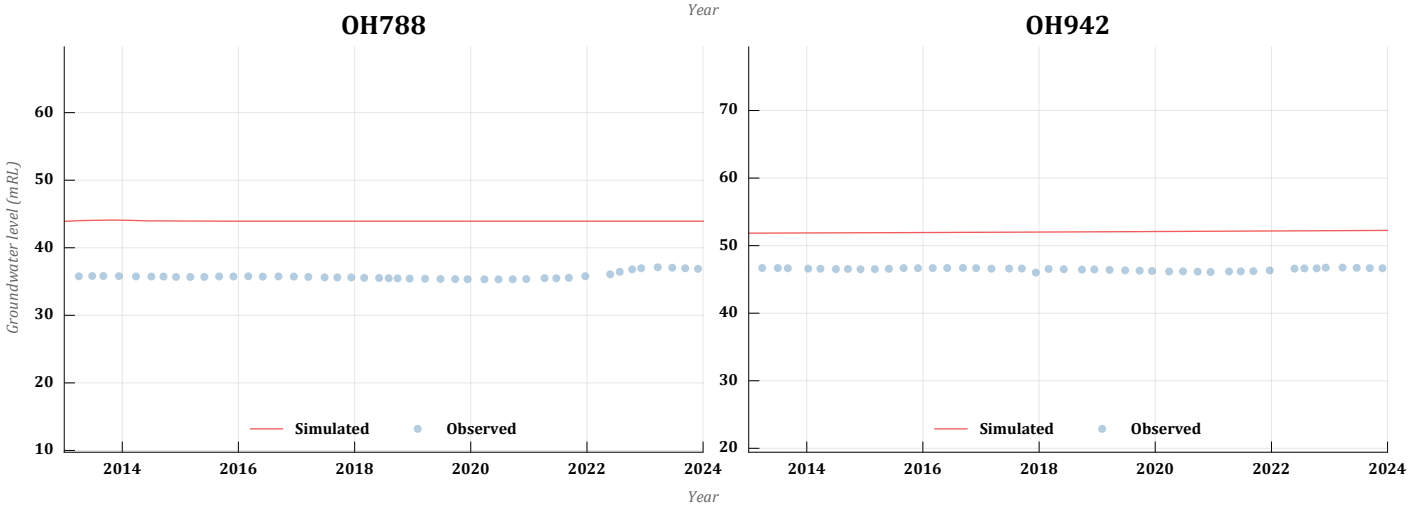
OH1137
Simulated
Observed


OH1138_1
Groundwater level (mRL)
Simulated
Observed
Year

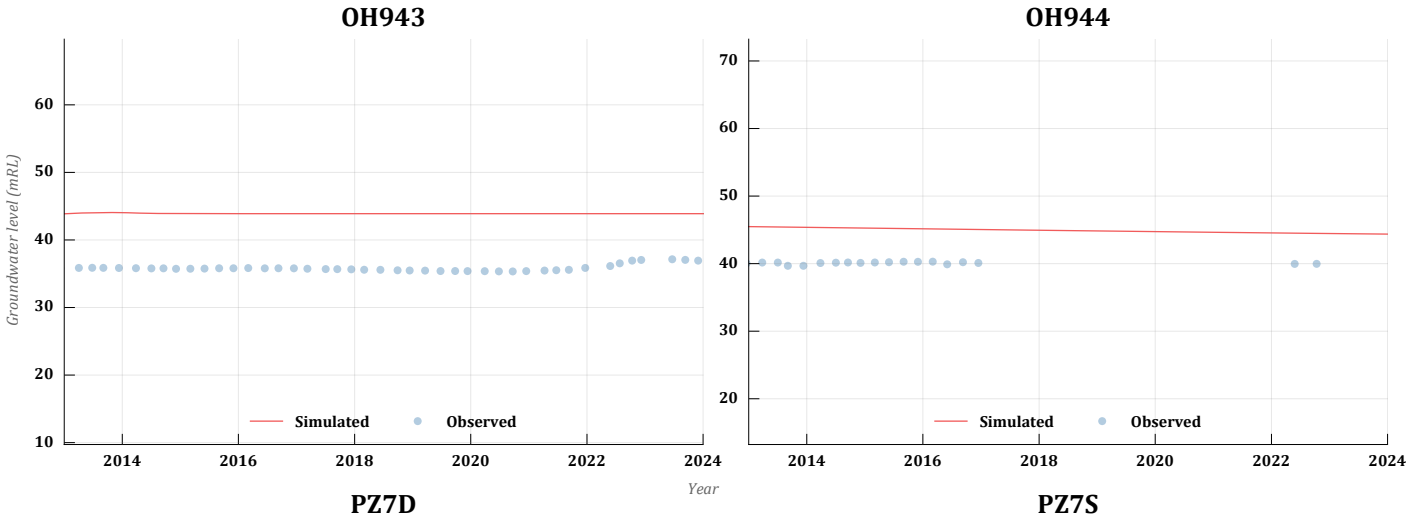
OH1138_2
Simulated
Observed


OH786
Groundwater level (mRL)
Simulated
Observed
Year

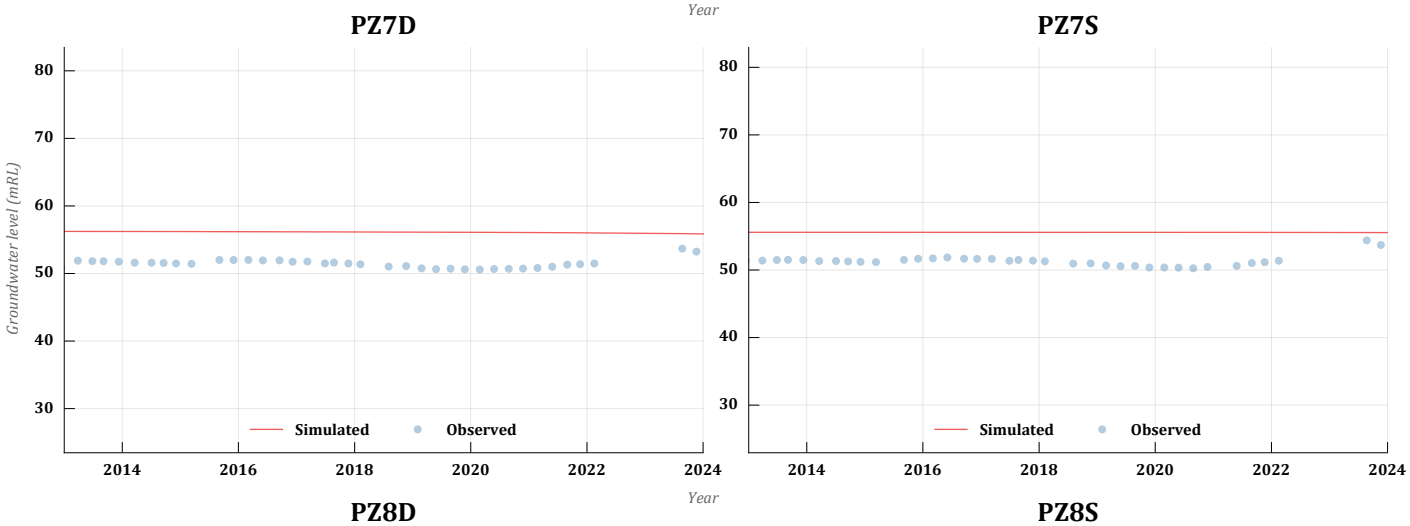
OH787
Simulated
Observed


OH788
Groundwater level (mRL)
Simulated
Observed
Year

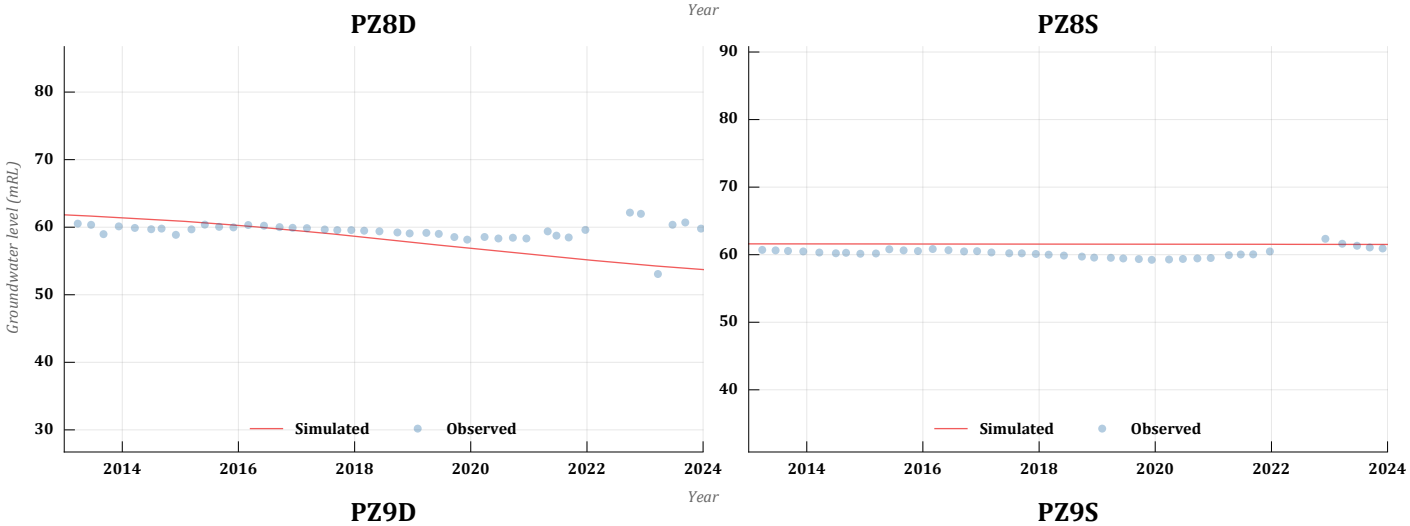
OH942
Simulated
Observed


OH943
Groundwater level (mRL)
Simulated
Observed
2014
2016
2018
2020
2022
2024

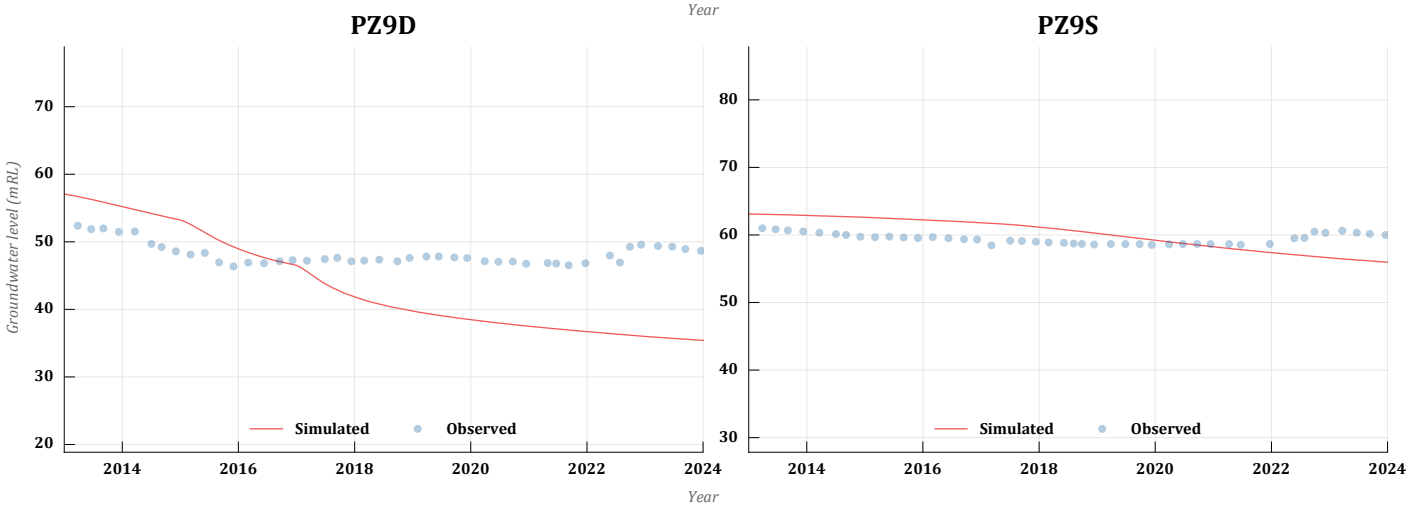
OH944
Simulated
Observed
2014
2016
2018
2020
2022
2024


PZ7D
Groundwater level (mRL)
Simulated
Observed
Year
2014
2016
2018
2020
2022
2024

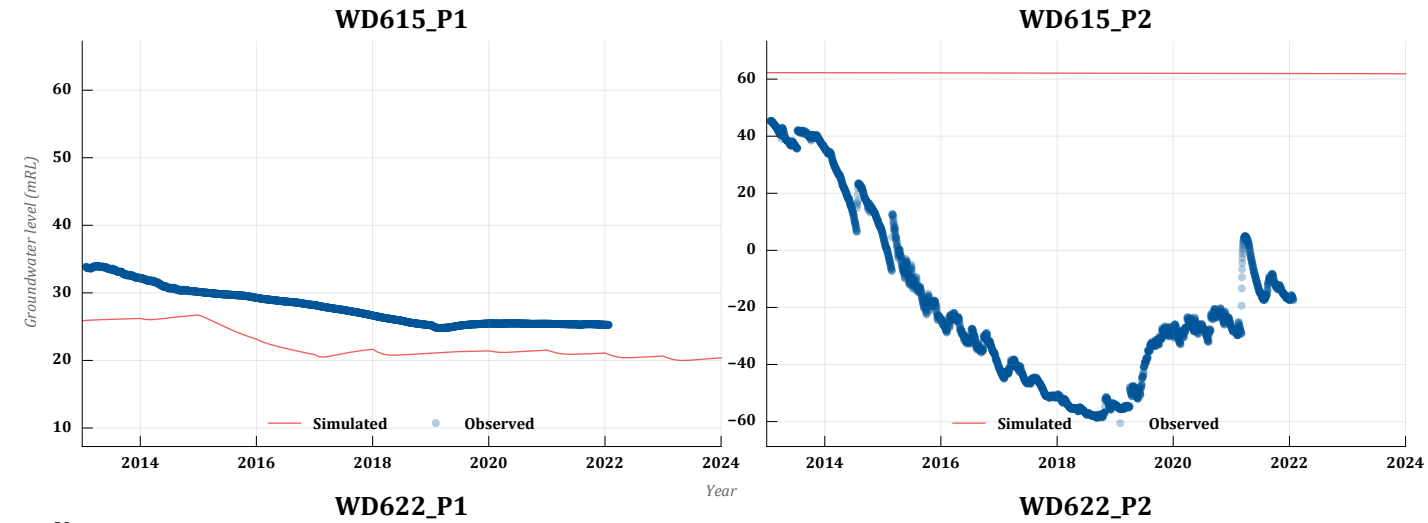
PZ7S
Simulated
Observed
2014
2016
2018
2020
2022
2024

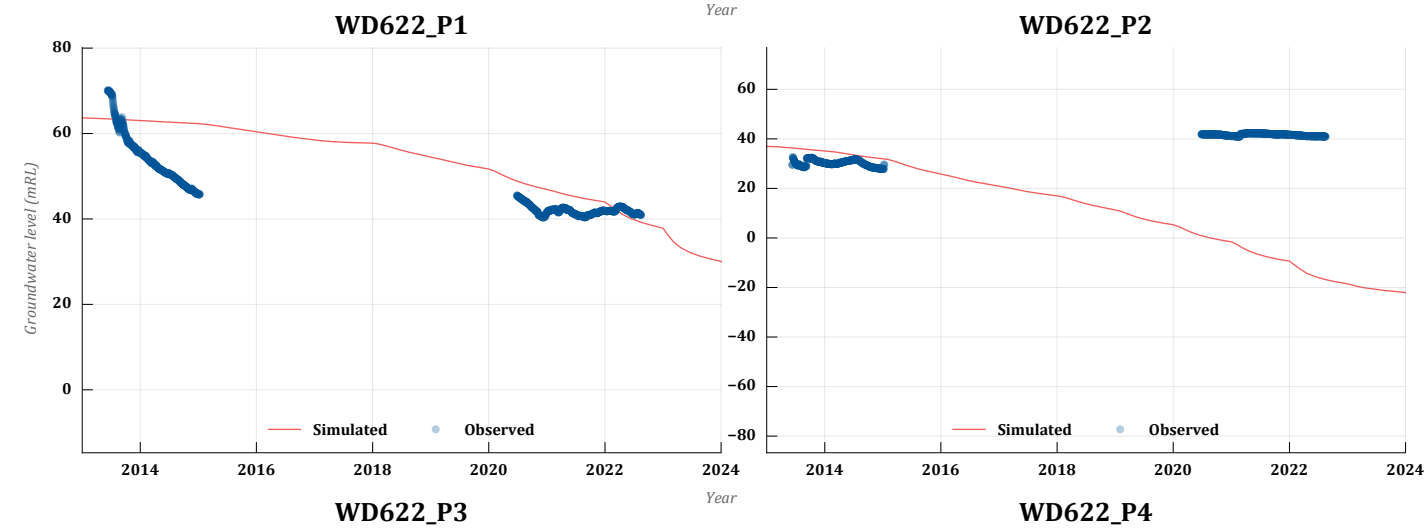

PZ8D
Groundwater level (mRL)
Simulated
Observed
Year
2014
2016
2018
2020
2022
2024

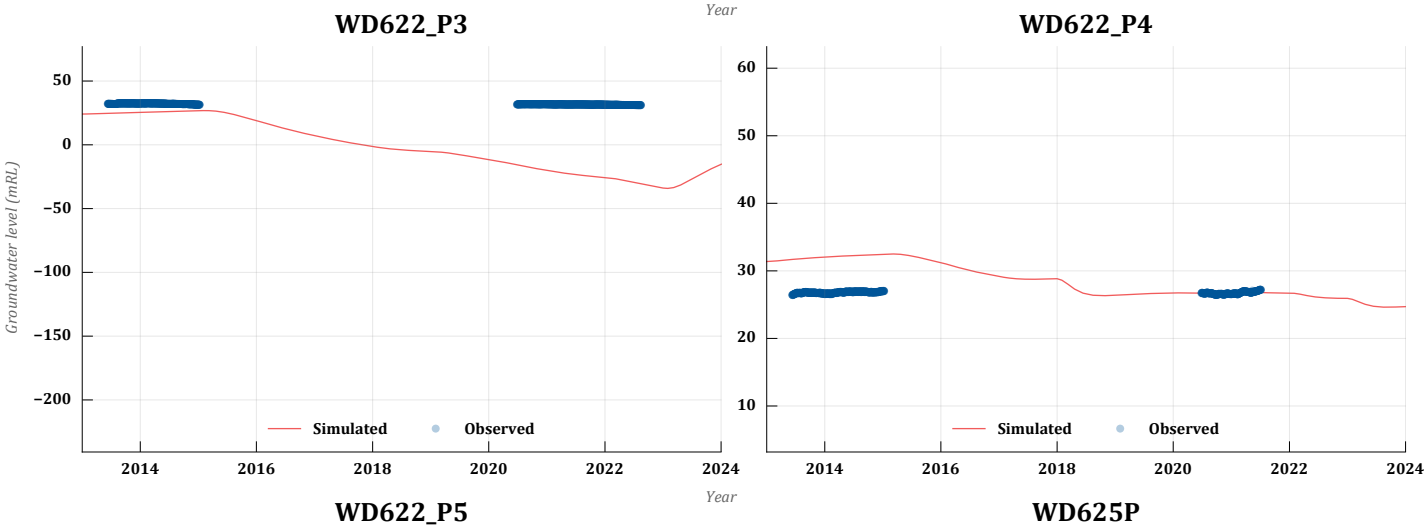
PZ8S
Simulated
Observed
2014
2016
2018
2020
2022
2024

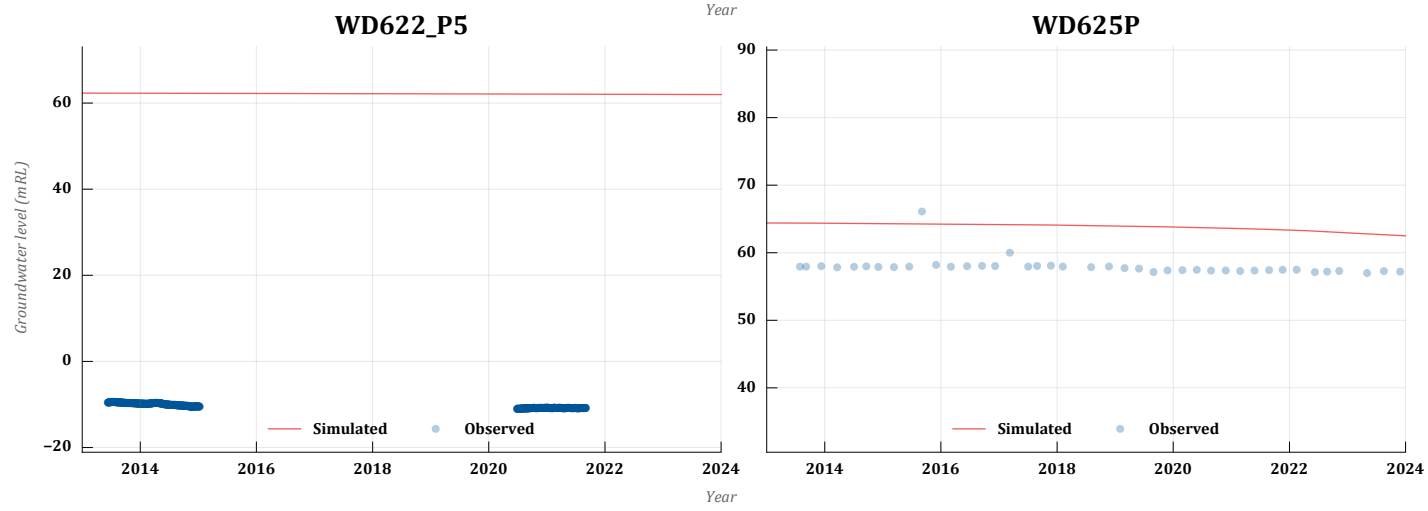

PZ9D
Groundwater level (mRL)
Simulated
Observed
Year
2014
2016
2018
2020
2022
2024

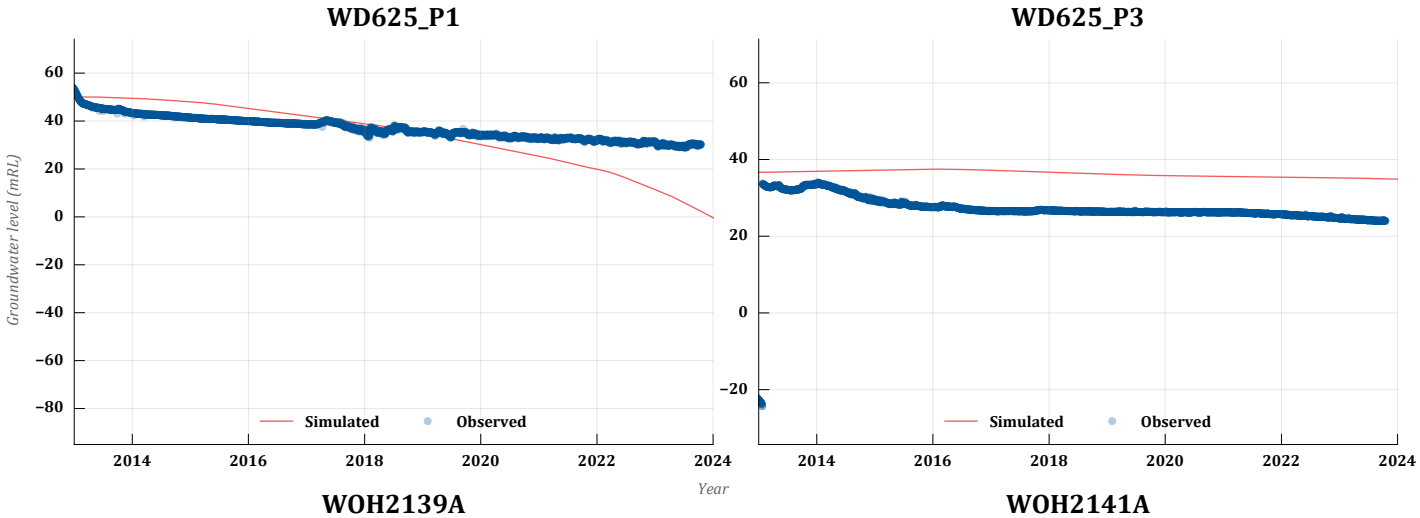
PZ9S
Simulated
Observed
2014
2016
2018
2020
2022
2024


WD615_P1
WD615_P2
Groundwater level (mRL)
Simulated
Observed
Year

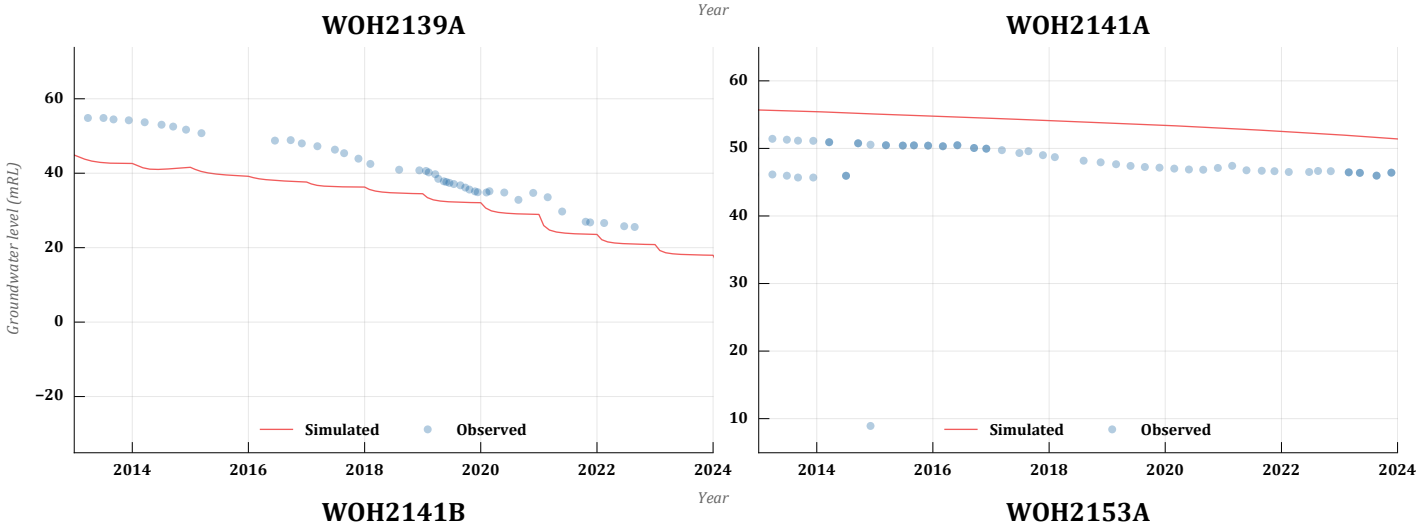

WD622_P1
WD622_P2
Groundwater level (mRL)
Simulated
Observed
Year


WD622_P3
WD622_P4
Groundwater level (mRL)
Simulated
Observed
Year

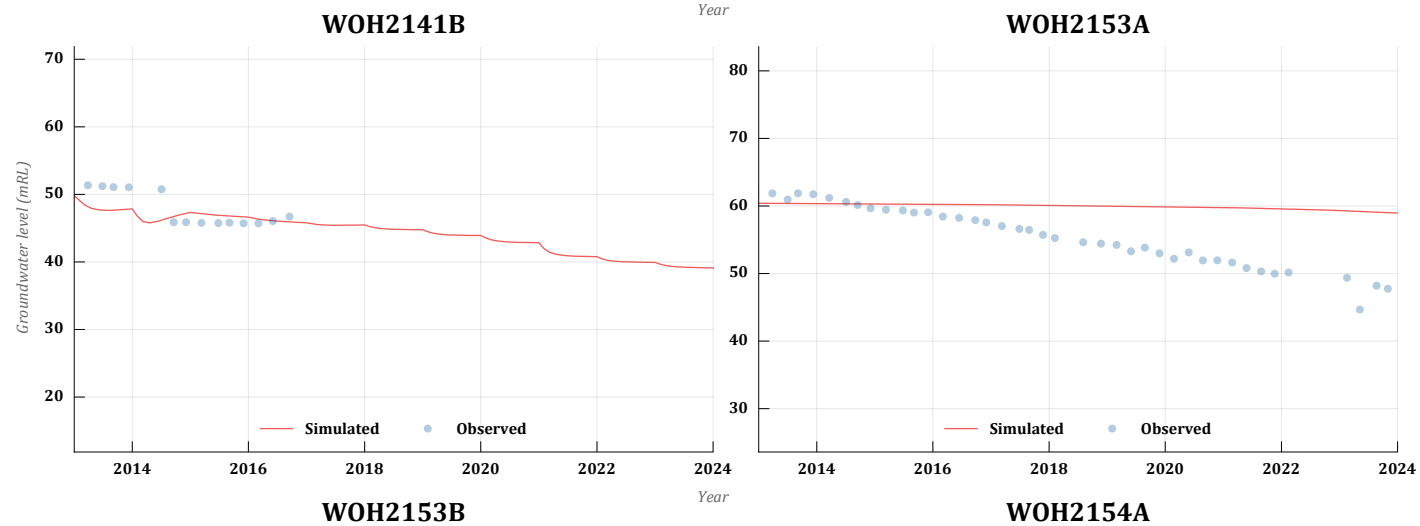

WD622_P5
WD625P
Groundwater level (mRL)
Simulated
Observed
Year


WD625_P1
Groundwater level (mRL)
Simulated
Observed

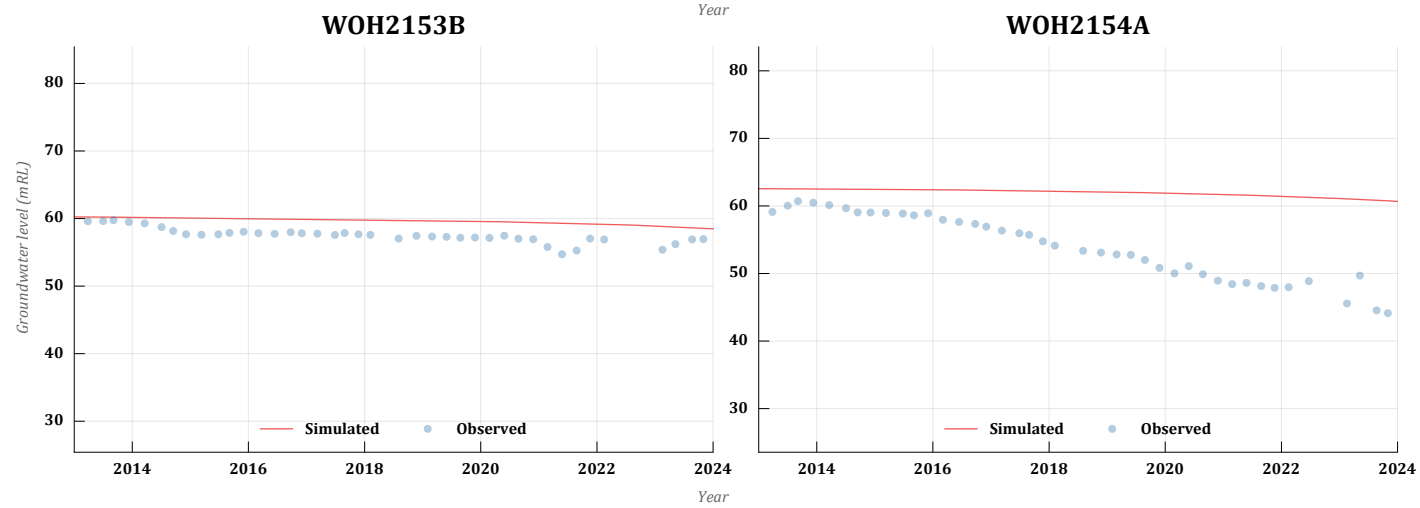
WD625_P3
Simulated
Observed


WOH2139A
Groundwater level (mRL)
Simulated
Observed
Year

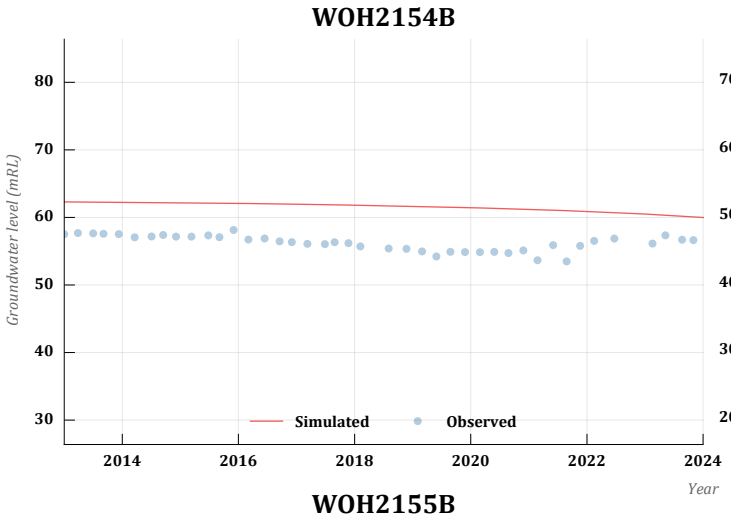
WOH2141A
Simulated
Observed

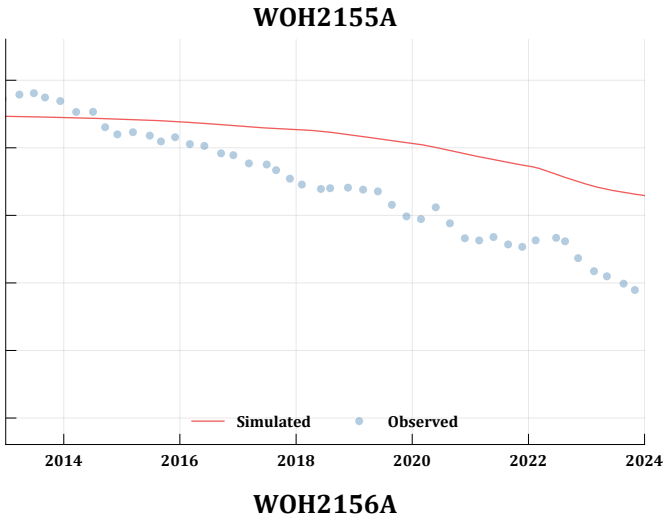

WOH2141B
Groundwater level (mRL)
Simulated
Observed

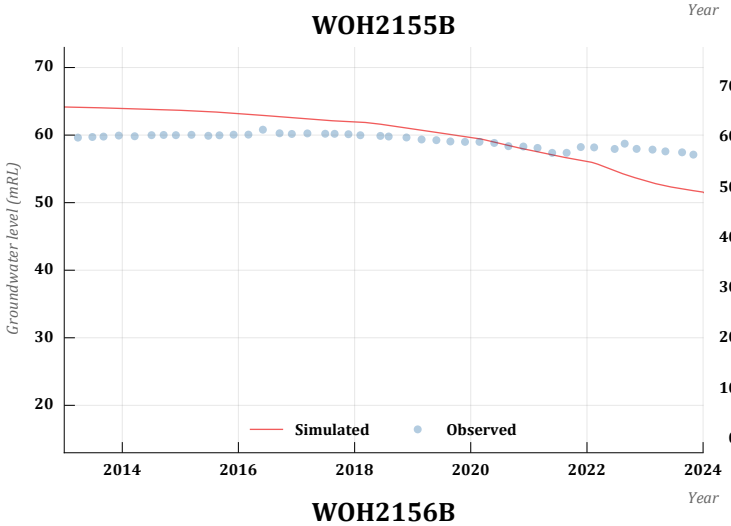
WOH2153A
Simulated
Observed
Year

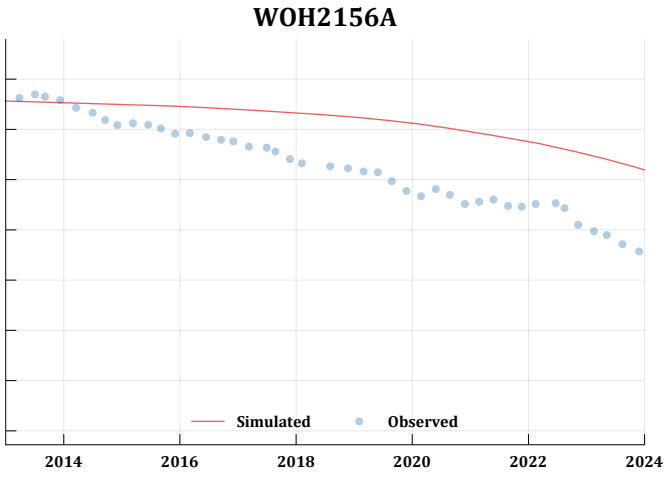

WOH2153B
Groundwater level (mRL)
Simulated
Observed

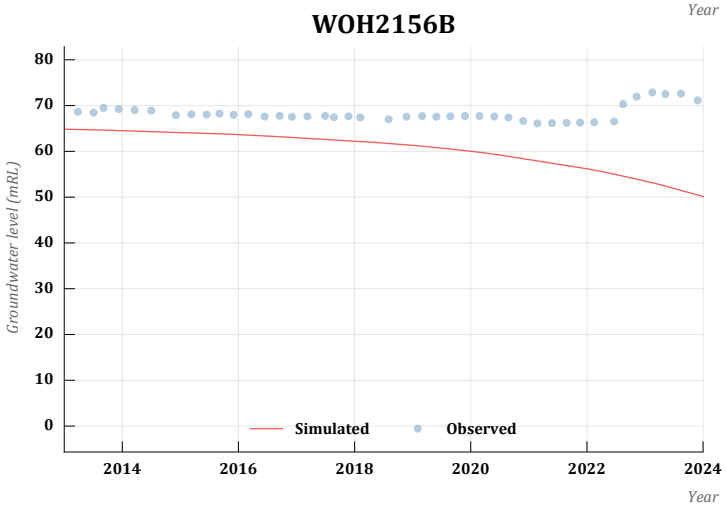
WOH2154A
Simulated
Observed
Year


WOH2154B
Groundwater level (mRL)
80
70
60
50
40
30
Simulated
Observed
2014
2016
2018
2020
2022
2024
Year


WOH2155A
70
60
50
40
30
20
Simulated
Observed
2014
2016
2018
2020
2022
2024


WOH2155B
Groundwater level (mRL)
70
60
50
40
30
20
Simulated
Observed
2014
2016
2018
2020
2022
2024
Year


WOH2156A
70
60
50
40
30
20
10
0
Simulated
Observed
2014
2016
2018
2020
2022
2024


WOH2156B
Groundwater level (mRL)
80
70
60
50
40
30
20
10
0
Simulated
Observed
2014
2016
2018
2020
2022
2024
Year

Appendix D

VWP figures

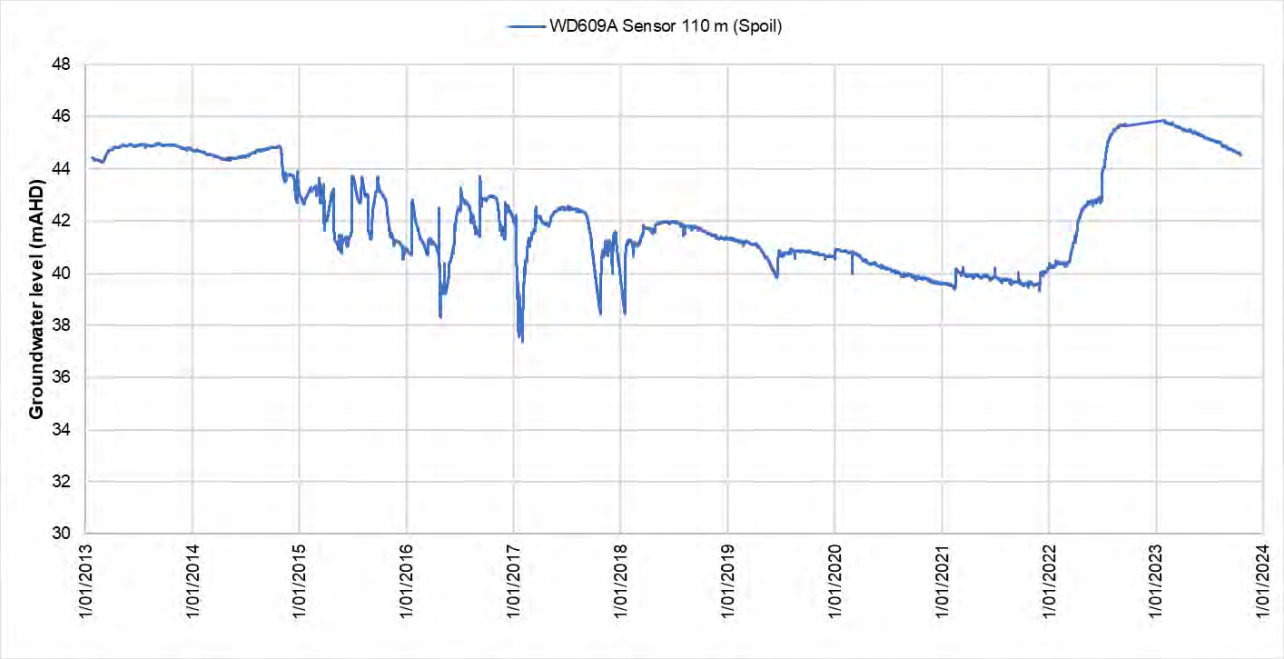


Figure D 1 VWP WD609A pressure head

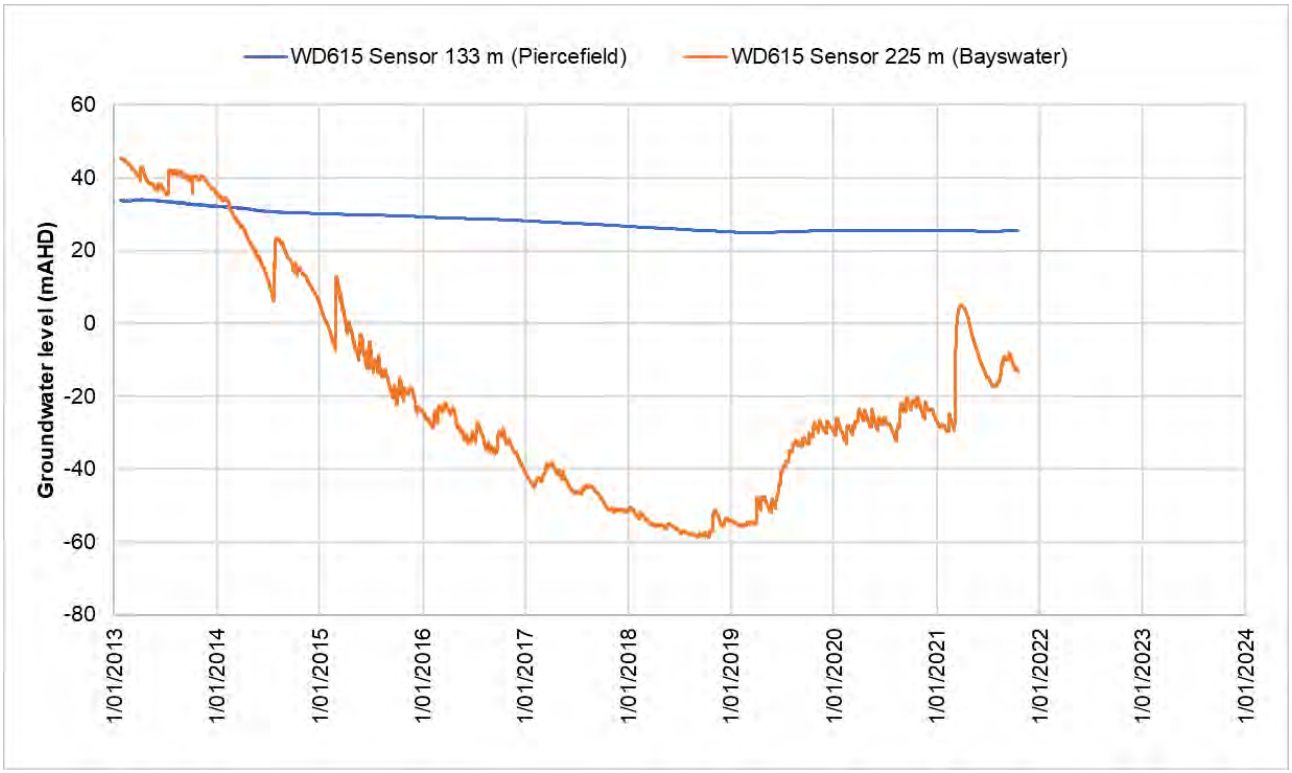


Figure D 2 VWP WD615 pressure heads

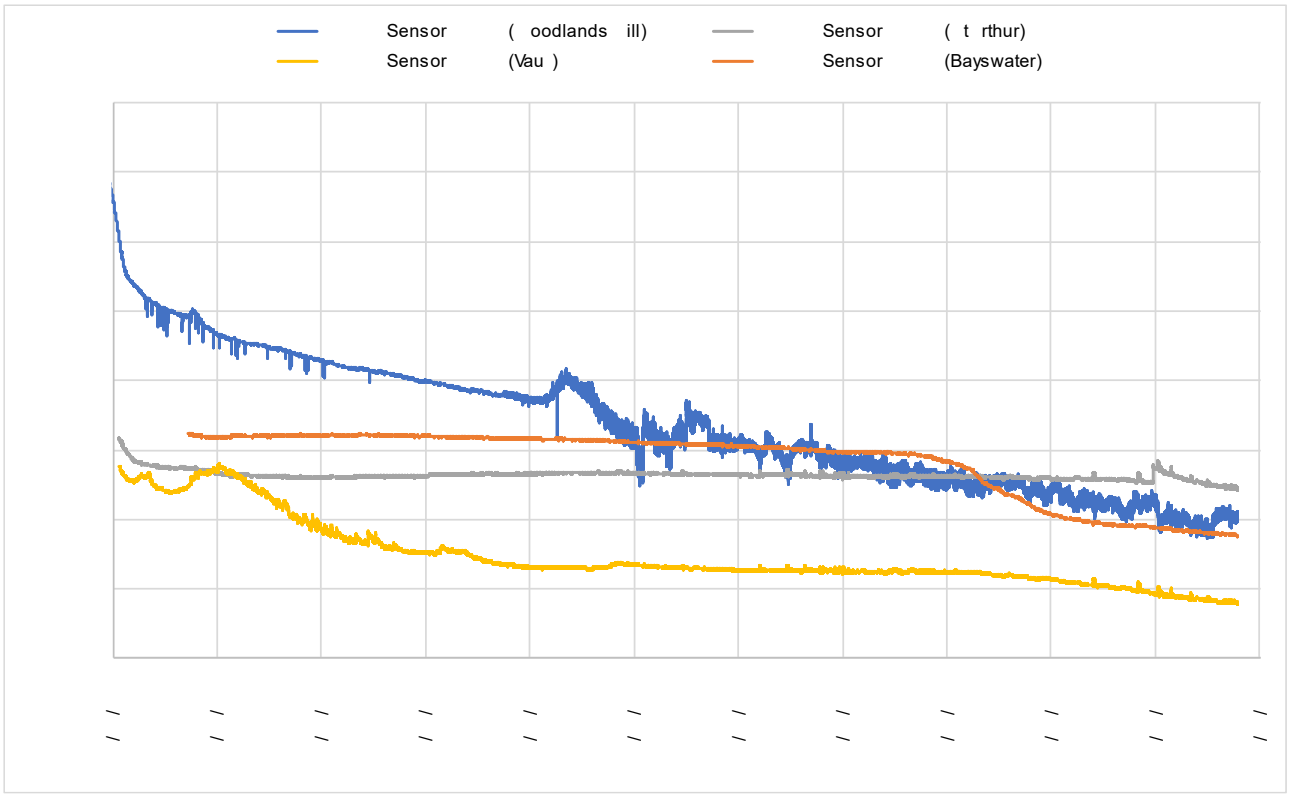


Figure D 3 VWP WD625 pressure heads

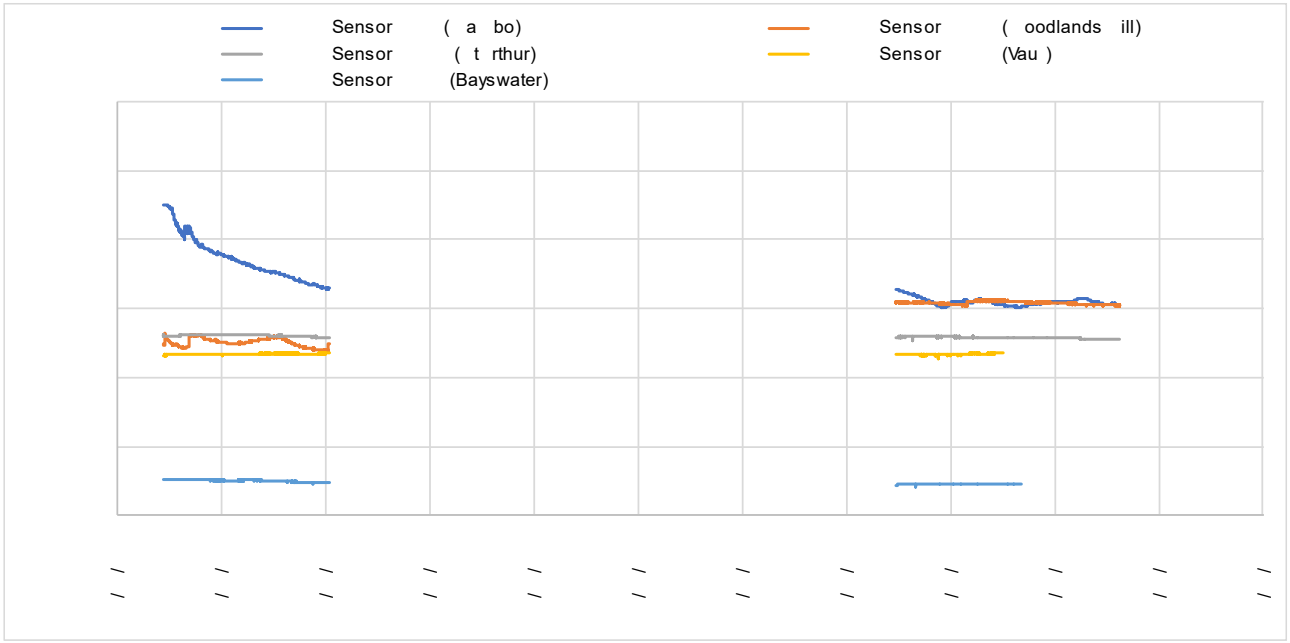


Figure D 4 VWP WD622 pressure heads

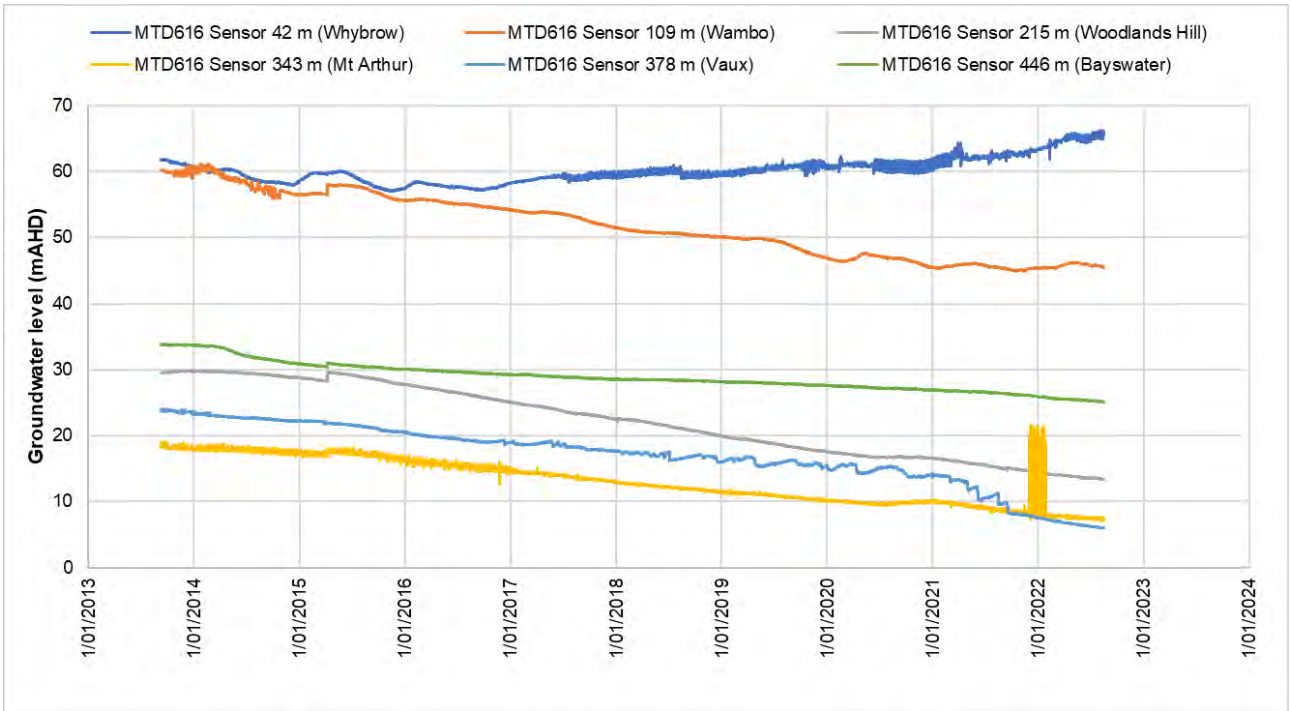


Figure D 5 VWP MTD616 pressure heads

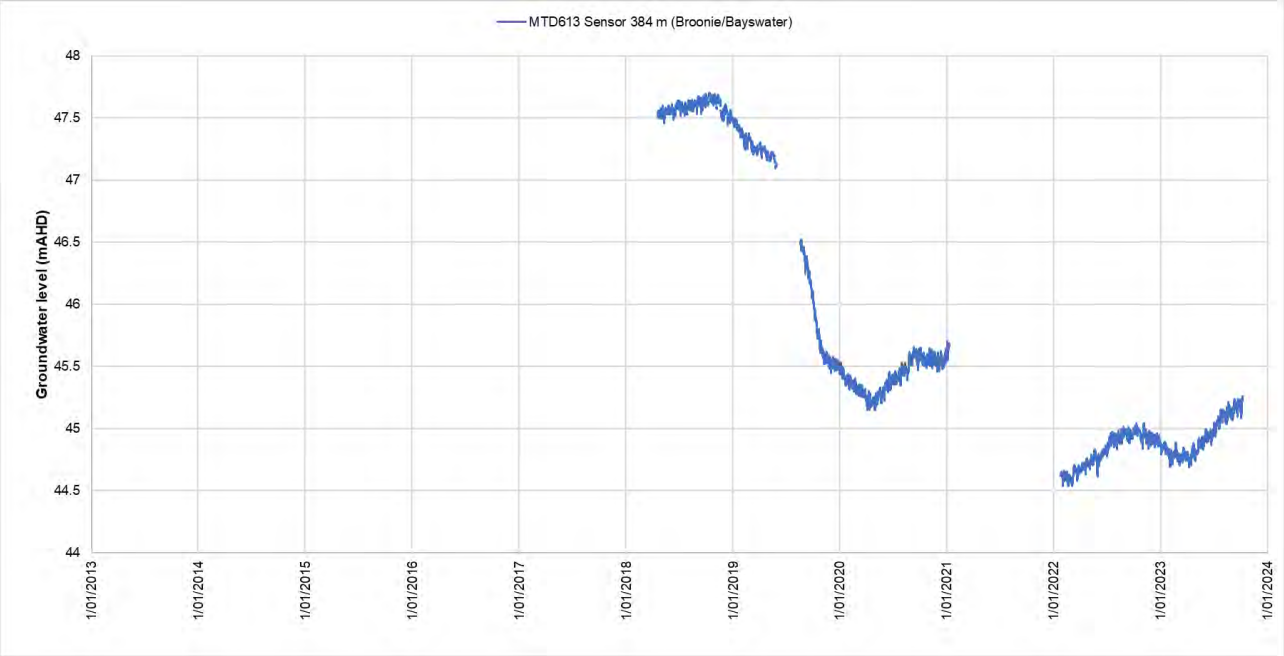


Figure D 6 VWP MTD613 pressure head

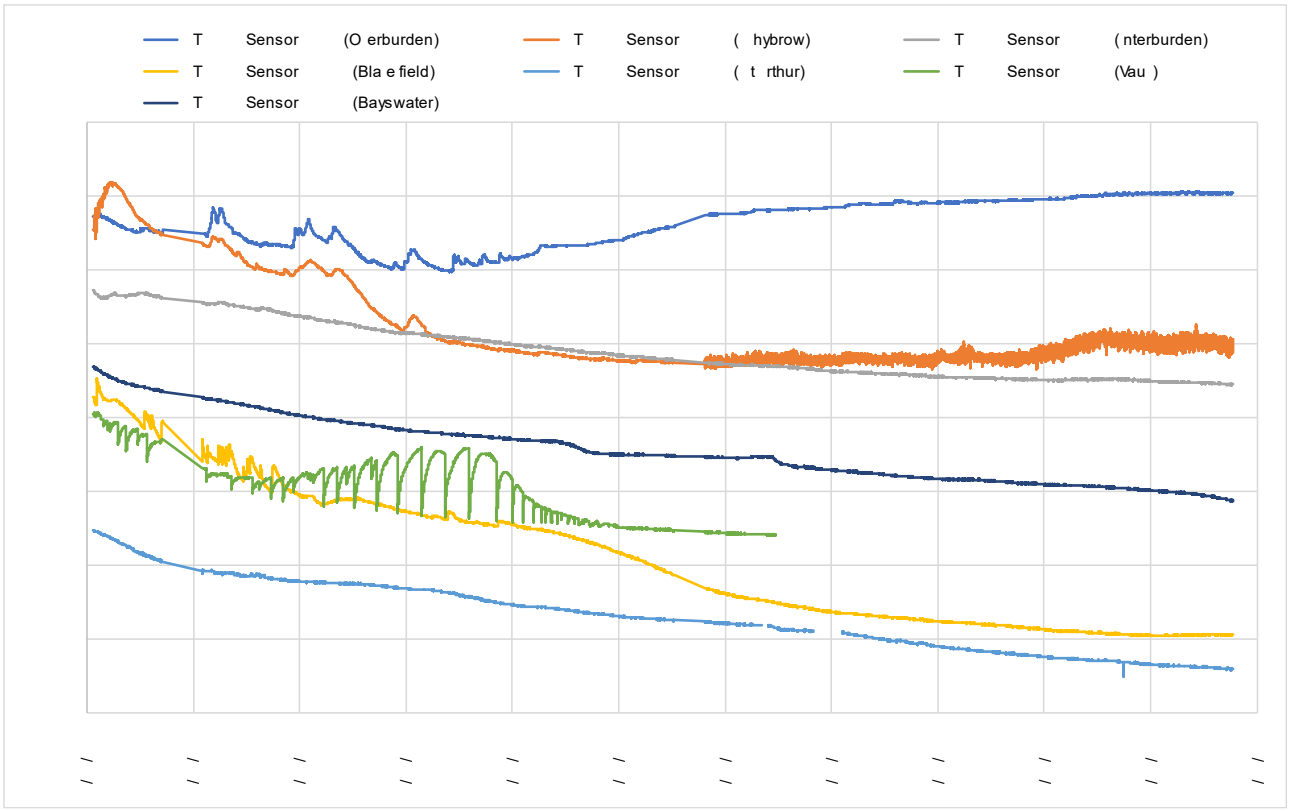


Figure D 7 VWP MTD605 pressure heads

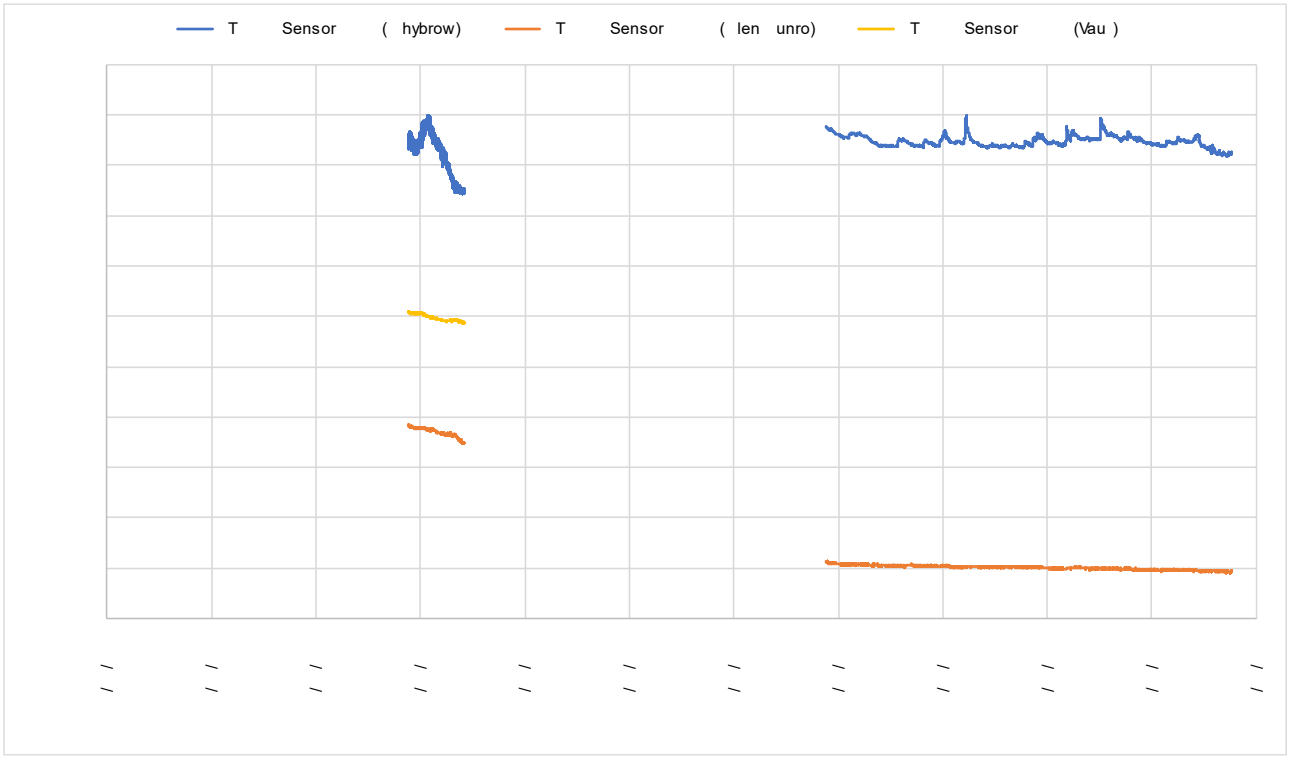


Figure D 8 VWP MTD614 pressure heads

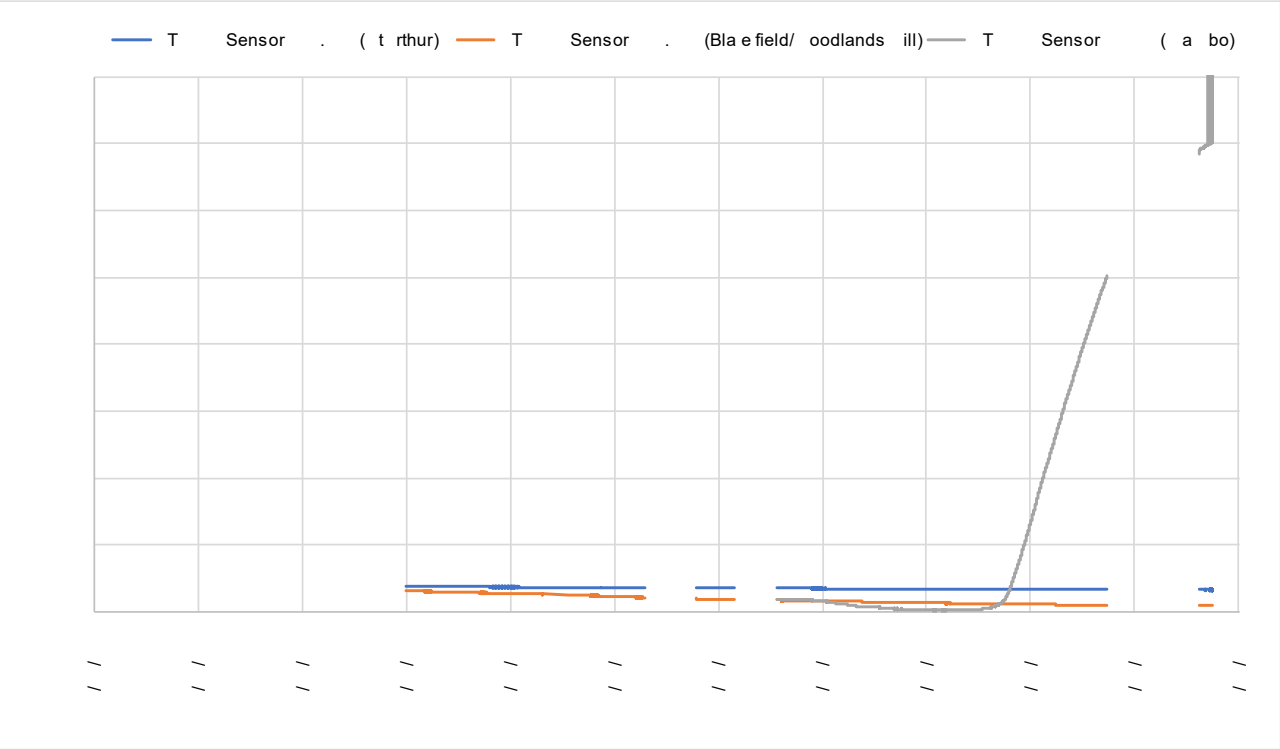


Figure D 9 VWP MTD518 pressure heads

Appendix E

Annual groundwater quality laboratory results

Table E 1 Annual groundwater quality laboratory results - 2023

Sample Point	Date	Time	EC Field (uS/cm)	pH Field	RL Standing Water Level (m)	Water Temp (Deg C)	TDS - Total (mg/l)	Hydroxide Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Bicarbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Acidity as CaCO3	SO4 - Total (mg/l)	Cl- (mg/l)	Ca - Total (mg/l)	Mg - Total (mg/l)	Na - Total (mg/l)
GW 9706	28/03/2023	1:30:00 PM	5,650	6.80	61.95	21.1											
GW 9706	20/06/2023	10:40:00 AM	5,410	6.90	61.68	19.6	3,550	<1	<1	512	512		1,350	896	140	117	904
GW 9706	19/09/2023	10:30:00 AM	5,370	6.90	61.34	21.7											
GW 9706	29/11/2023	11:25:00 AM	4,790	6.80	61.48	22.4											
GW 9707	28/03/2023	12:40:00 PM	18,140	6.80	59.93	21.7											
GW 9707	20/06/2023	10:10:00 AM	18,190	7.10	59.78	18.1	16,400	<1	<1	1,170	1170		4,590	4,030	355	508	3,390
GW 9707	20/09/2023	11:30:00 AM	19,080	7.10	59.48	20.8											
GW 9707	30/11/2023	9:45:00 AM	19,360	7.10	57.34	19.6											
GW 9708	30/03/2023	2:00:00 PM	12,730	6.70	61.32	22.9											
GW 9708	20/06/2023	12:30:00 PM	13,280	6.70	61.19	20.7	10,500	<1	<1	697	697		4,630	2,250	434	404	2,190
GW 9708	20/09/2023	11:00:00 AM	13,710	6.70	60.44	24.2											
GW 9708	29/11/2023	1:25:00 PM	12,700	6.70	60.39	24											
GW 9709	28/03/2023	11:50:00 AM	20,800	6.70	51.29	21.4											
GW 9709	20/06/2023	9:30:00 AM	22,000	6.70	51.12	17.8	17,800	<1	<1	803	803		6,190	5,080	571	769	4,000
GW 9709	20/09/2023	11:40:00 AM	22,300	6.60	51.26	21.5											
GW 9709	30/11/2023	9:05:00 AM	21,800	6.80	51.13	20.6											
GW98 MTCL 1	31/03/2023	2:00:00 PM	5,380	7.20	66.57	21.9											
GW98 MTCL 1	20/06/2023	12:00:00 PM	5,460	7.00	66.27	20	3,560	<1	<1	893	893		799	862	50	75	1,080
GW98 MTCL 1	20/09/2023	10:45:00 AM	5,900	7.00	65.65	22.6											
GW98 MTCL 1	30/11/2023	9:55:00 AM	5,840	7.00	66.36	21.7											
GW98 MTCL 2	14/04/2023	12:50:00 PM	14,920	6.60	70.1	23.2											
GW98 MTCL 2	19/06/2023	1:10:00 PM	14,380	6.50	70.02	20.6	12,200	<1	<1	641	641		4,580	3,390	574	563	2,770
GW98 MTCL 2	19/09/2023	9:40:00 AM	15,030	6.50	70.02	21.9											
GW98 MTCL 2	29/11/2023	10:20:00 AM	14,950	6.60	69.69	23.1											
MB15MTW01D	15/02/2023	9:00:00 AM	3,940	6.20	57.603	20.4											
MB15MTW01D	4/05/2023	12:15:00 PM	3,890	6.00	57.613	20.2											
MB15MTW01D	18/08/2023	2:10:00 PM	4,150	6.10	57.513	19.8	2,370	<1	<1	47	47		124	1,280	106	82	526
MB15MTW01D	28/11/2023	12:40:00 PM	3,840	6.20	57.09	19.6											
MB15MTW01S	14/02/2023	12:00:00 PM	3,340	6.30	57.828	19.6											
MB15MTW01S	2/05/2023	1:55:00 PM	2,900	6.30	57.808	19.2											
MB15MTW01S	18/08/2023	2:30:00 PM	2,730	6.30	57.738	19	1,630	<1	<1	42	42		87	869	75	74	320
MB15MTW01S	28/11/2023	1:00:00 PM	3,730	6.20	57.288	18.9											
MB15MTW02D	13/02/2023	10:35:00 AM	12,250	7.70	59.631	21.6											
MB15MTW02D	16/05/2023	9:00:00 AM	11,630	7.70	57.161	18.4											
MB15MTW02D	3/08/2023	11:40:00 AM	12,910	7.90	55.871	20.4	8,110	<1	<1	2,140	2140		<1	3,350	26	26	3,110
MB15MTW02D	23/11/2023	1:10:00 PM	13,250	7.70	56.73	20.8											
MB15MTW02S	13/02/2023	10:55:00 AM	2,530	6.60	56.58	22.9											
MB15MTW02S	5/05/2023	1:30:00 PM	2,540	6.60	56.58	19.7											
MB15MTW02S	3/08/2023	11:50:00 AM	2,700	6.80	56.43	19.4	1,440	<1	<1	202	202		14	701	40	41	453
MB15MTW02S	23/11/2023	12:40:00 PM	2,800	6.70	56.2	20.6											
MB15MTW03	13/02/2023	9:10:00 AM	12,030	6.80	56.317	20.4											
MB15MTW03	16/05/2023	9:50:00 AM	11,950	6.90	56.037	19.4											
MB15MTW03	3/08/2023	10:50:00 AM	12,220	7.00	55.757	19.4	7,690	<1	<1	1,040	1040		333	3,660	195	239	2,380
MB15MTW03	20/11/2023	9:10:00 AM	12,630	6.90	55.51	19.5											
MB15MTW04	28/02/2023	1:00:00 PM			Dry												
MB15MTW04	9/05/2023	9:25:00 AM			Dry												
MB15MTW04	22/08/2023	1:00:00 PM			Dry												
MB15MTW04	20/11/2023	1:10:00 PM			Dry												
MB15MTW05	28/02/2023	12:50:00 PM			Dry												
MB15MTW05	9/05/2023	9:15:00 AM			Dry												
MB15MTW05	22/08/2023	12:40:00 PM			Dry												
MB15MTW05	20/11/2023	1:00:00 PM			Dry												
MB15MTW06	28/02/2023	11:40:00 AM	125	5.80	Top RL not provided	24											
MB15MTW06	9/05/2023	10:25:00 AM	112	5.80	Top RL not provided	20.7											

Table E 1 Annual groundwater quality laboratory results - 2023 Continued

Sample Point	Date	Time	K - Total (mg/l)	Al - Total (mg/l)	As - Total (mg/l)	Cd - Total (mg/l)	Cu - Total (mg/l)	Pb - Total (mg/l)	Ni - Total (mg/l)	Se (mg/l)	Zn - Total (mg/l)	B (mg/l)	Hg - Total (mg/l)	Mo (mg/l)	V (mg/l)	Cr (mg/l)	Total anions	Total Cations	Ionic Balance
GW 9706	28/03/2023	1:30:00 PM																	
GW 9706	20/06/2023	10:40:00 AM	13	0.02	<0.001	<0.0001	<0.001	<0.001	0.003	<0.01	<0.005	0.16	<0.0001				63.6	56.3	6.12
GW 9706	19/09/2023	10:30:00 AM																	
GW 9706	29/11/2023	11:25:00 AM																	
GW 9707	28/03/2023	12:40:00 PM																	
GW 9707	20/06/2023	10:10:00 AM	16	0.08	<0.001	<0.0001	0.008	<0.001	0.007	<0.01	0.008	0.38	<0.0001				233	207	5.73
GW 9707	20/09/2023	11:30:00 AM																	
GW 9707	30/11/2023	9:45:00 AM																	
GW 9708	30/03/2023	2:00:00 PM																	
GW 9708	20/06/2023	12:30:00 PM	19	0.04	<0.001	<0.0001	<0.001	<0.001	0.001	<0.01	<0.005	0.31	<0.0001				174	151	7.13
GW 9708	20/09/2023	11:00:00 AM																	
GW 9708	29/11/2023	1:25:00 PM																	
GW 9709	28/03/2023	11:50:00 AM																	
GW 9709	20/06/2023	9:30:00 AM	20	0.04	<0.001	<0.0001	0.008	<0.001	0.013	<0.01	0.018	0.36	<0.0001				288	266	3.96
GW 9709	20/09/2023	11:40:00 AM																	
GW 9709	30/11/2023	9:05:00 AM																	
GW98 MTCL 1	31/03/2023	2:00:00 PM																	
GW98 MTCL 1	20/06/2023	12:00:00 PM	14	0.02	<0.001	<0.0001	<0.001	<0.001	0.002	0.01	<0.005	0.18	<0.0001				58.8	56	2.43
GW98 MTCL 1	20/09/2023	10:45:00 AM																	
GW98 MTCL 1	30/11/2023	9:55:00 AM																	
GW98 MTCL 2	14/04/2023	12:50:00 PM																	
GW98 MTCL 2	19/06/2023	1:10:00 PM	36	0.02	0.001	<0.0001	<0.001	<0.001	<0.001	<0.01	<0.005	0.2	<0.0001				204	196	1.85
GW98 MTCL 2	19/09/2023	9:40:00 AM																	
GW98 MTCL 2	29/11/2023	10:20:00 AM																	
MB15MTW01D	15/02/2023	9:00:00 AM																	
MB15MTW01D	4/05/2023	12:15:00 PM																	
MB15MTW01D	18/08/2023	2:10:00 PM	8	0.3	<0.001	<0.0001	0.001	<0.001	0.022	<0.01	0.066	<0.05	<0.0001				39.6	35.1	6.03
MB15MTW01D	28/11/2023	12:40:00 PM																	
MB15MTW01S	14/02/2023	12:00:00 PM																	
MB15MTW01S	2/05/2023	1:55:00 PM																	
MB15MTW01S	18/08/2023	2:30:00 PM	8	0.04	0.002	<0.0001	<0.001	<0.001	0.004	<0.01	0.006	<0.05	<0.0001				27.2	24	6.27
MB15MTW01S	28/11/2023	1:00:00 PM																	
MB15MTW02D	13/02/2023	10:35:00 AM																	
MB15MTW02D	16/05/2023	9:00:00 AM																	
MB15MTW02D	3/08/2023	11:40:00 AM	7	0.25	0.001	<0.0001	0.002	<0.001	<0.001	<0.01	0.023	0.26	<0.0001				137	139	0.58
MB15MTW02D	23/11/2023	1:10:00 PM																	
MB15MTW02S	13/02/2023	10:55:00 AM																	
MB15MTW02S	5/05/2023	1:30:00 PM																	
MB15MTW02S	3/08/2023	11:50:00 AM	5	0.01	0.002	<0.0001	<0.001	<0.001	0.011	<0.01	0.014	0.06	<0.0001				24.1	25.2	2.22
MB15MTW02S	23/11/2023	12:40:00 PM																	
MB15MTW03	13/02/2023	9:10:00 AM																	
MB15MTW03	16/05/2023	9:50:00 AM																	
MB15MTW03	3/08/2023	10:50:00 AM	21	0.12	<0.001	<0.0001	<0.001	<0.001	0.001	<0.01	<0.005	0.12	<0.0001				131	133	0.94
MB15MTW03	20/11/2023	9:10:00 AM																	
MB15MTW04	28/02/2023	1:00:00 PM																	
MB15MTW04	9/05/2023	9:25:00 AM																	
MB15MTW04	22/08/2023	1:00:00 PM																	
MB15MTW04	20/11/2023	1:10:00 PM																	
MB15MTW05	28/02/2023	12:50:00 PM																	
MB15MTW05	9/05/2023	9:15:00 AM																	
MB15MTW05	22/08/2023	12:40:00 PM																	
MB15MTW05	20/11/2023	1:00:00 PM																	
MB15MTW06	28/02/2023	11:40:00 AM																	
MB15MTW06	9/05/2023	10:25:00 AM																	

Table E 1 Annual groundwater quality laboratory results - 2023 Continued

Sample Point	Date	Time	EC Field (uS/cm)	pH Field	RL Standing Water Level (m)	Water Temp (Deg C)	TDS - Total (mg/l)	Hydroxide Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Bicarbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Acidity as CaCO3	SO4 - Total (mg/l)	Cl- (mg/l)	Ca - Total (mg/l)	Mg - Total (mg/l)	Na - Total (mg/l)
MB15MTW06	23/08/2023	10:40:00 AM	113	5.90	Top RL not provided	18.1	111	<1	<1	18	18		4	21	3	<1	18
MB15MTW06	23/11/2023	10:30:00 AM	184	6.00	Top RL not provided	20.9											
MB15MTW07	2/05/2023	11:10:00 AM			Dry												
MB15MTW07	18/08/2023	12:15:00 PM			Dry												
MB15MTW07	1/11/2023	9:25:00 AM			Dry												
MB15MTW08	17/02/2023	1:45:00 PM	262	5.90	Top RL not provided	22.6											
MB15MTW08	4/05/2023	10:35:00 AM	263	6.10	Top RL not provided	19.4											
MB15MTW08	18/08/2023	10:50:00 AM	494	5.90	Top RL not provided	17.9	296	<1	<1	45	45		18	114	9	13	71
MB15MTW08	28/11/2023	10:00:00 AM			Dry												
MB15MTW09	16/02/2023	12:05:00 PM			Dry												
MB15MTW09	4/05/2023	10:00:00 AM	168	5.80	Top RL not provided	19.7											
MB15MTW09	18/08/2023	10:30:00 AM			Dry												
MB15MTW09	1/11/2023	9:55:00 AM			Dry												
MB15MTW10	17/02/2023	1:15:00 PM			Dry												
MB15MTW10	2/05/2023	11:25:00 AM			Dry												
MB15MTW10	18/08/2023	11:30:00 AM			Dry												
MB15MTW10	1/11/2023	9:35:00 AM			Dry												
MB15MTW11	28/02/2023	1:45:00 PM	990	6.40	Top RL not provided	21.5											
MB15MTW11	9/05/2023	10:10:00 AM	952	6.30	Top RL not provided	19.1											
MB15MTW11	22/08/2023	1:30:00 PM			Dry												
MB15MTW11	20/11/2023	1:20:00 PM			Blocked												
MBW01	13/02/2023	1:20:00 PM	8,930	7.30	58.28	22.9											
MBW01	16/05/2023	8:40:00 AM	9,820	7.40	58	18.4											
MBW01	3/08/2023	1:10:00 PM	10,010	7.50	57.65	19.5	5,920	<1	<1	816	816		248	2,900	34	115	2,090
MBW01	28/11/2023	11:00:00 AM	10,030	7.50	57.58	18.8											
MBW02	13/02/2023	12:40:00 PM	9,390	7.20	55.74	23.2											
MBW02	5/05/2023	12:00:00 PM	9,600	7.10	55.64	20.7											
MBW02	3/08/2023	12:50:00 PM	9,690	7.20	55.46	20.7	5,970	<1	<1	1,750	1750		<1	2,520	48	38	2,280
MBW02	28/11/2023	11:10:00 AM	9,480	7.20	55.31	21.1											
MBW03	13/02/2023	1:00:00 PM	221	6.80	-4.95	21											
MBW03	1/05/2023	12:30:00 PM	324	6.70	55.79	21											
MBW03	3/08/2023	1:20:00 PM	6,720	7.30	55.57	20.7	3,030	<1	<1	2,000	2000		<1	934	16	9	1,210
MBW03	28/11/2023	10:40:00 AM	6,470	7.30	55.4	21.2											
MBW04	13/02/2023	12:50:00 PM	5,350	7.30	48.68	21.8											
MBW04	1/05/2023	11:50:00 AM	10,840	7.50	48.54	20											
MBW04	3/08/2023	1:50:00 PM	11,400	7.60	48.28	22.4	6,430	<1	<1	2,530	2530		135	2,230	42	76	2,400
MBW04	28/11/2023	11:50:00 AM	12,160	7.40	48.08	21.6											
MBW6A	5/05/2023	10:15:00 AM	1,760	6.30	Top RL not provided	20.4											
MBW6A	3/08/2023	12:20:00 PM	1,856	6.40	Top RL not provided	20.9	1,110	<1	<1	115	115		28	543	35	44	293
MBW6A	20/11/2023	8:20:00 AM	1,970	6.20	Top RL not provided	20.3											
MTD605P	14/02/2023	1:30:00 PM	17,170	7.30	62.46	21.4											
MTD605P	16/05/2023	11:10:00 AM	17,460	7.20	62.55	22.3											
MTD605P	18/08/2023	1:40:00 PM	17,660	7.20	62.64	21.5	11,200	<1	<1	2,190	2190		789	5,100	68	30	4,720
MTD605P	20/11/2023	10:30:00 AM	17,170	7.30	62.61	21.7											
MTD614P	23/03/2023	9:25:00 AM	6,210	7.50	56.57	20.4											
MTD614P	20/06/2023	1:40:00 PM	6,490	7.20	56.6	19.4	3,830	<1	<1	1,670	1670		127	1,280	67	148	1,250
MTD614P	11/09/2023	10:20:00 AM	6,380	7.20	56.49	20.7											
MTD614P	19/12/2023	12:50:00 PM	6,610	7.20	56.06	21.4											
MTD616P	16/02/2023	9:30:00 AM	14,320	6.80	75.21	22.9											
MTD616P	9/05/2023				Decommissioned												
OH1121	31/03/2023	2:35:00 PM			Not accessible												
OH1121	29/06/2023	12:00:00 PM	9,290	7.00	35.64	19.4	5,350	<1	<1	728	728		239	2,980	174	191	1,600
OH1121	20/09/2023	9:50:00 AM	9,410	7.00	36.6	22.1											
OH1121	1/12/2023	11:50:00 AM	8,490	7.00	36.44	21.6											
OH1122 (1)	28/03/2023	3:00:00 PM			Obstructed												
OH1122 (1)	23/06/2023	1:40:00 PM			50.5												

Table E 1 Annual groundwater quality laboratory results - 2023 Continued

Sample Point	Date	Time	K - Total (mg/l)	Al - Total (mg/l)	As - Total (mg/l)	Cd - Total (mg/l)	Cu - Total (mg/l)	Pb - Total (mg/l)	Ni - Total (mg/l)	Se (mg/l)	Zn - Total (mg/l)	B (mg/l)	Hg - Total (mg/l)	Mo (mg/l)	V (mg/l)	Cr (mg/l)	Total anions	Total Cations	Ionic Balance
MB15MTW06	23/08/2023	10:40:00 AM	2	0.17	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.01	<0.005	<0.05	<0.0001				1.04	0.98	
MB15MTW06	23/11/2023	10:30:00 AM																	
MB15MTW07	2/05/2023	11:10:00 AM																	
MB15MTW07	18/08/2023	12:15:00 PM																	
MB15MTW07	1/11/2023	9:25:00 AM																	
MB15MTW08	17/02/2023	1:45:00 PM																	
MB15MTW08	4/05/2023	10:35:00 AM																	
MB15MTW08	18/08/2023	10:50:00 AM	1	10.3	0.008	<0.0001	0.017	0.016	0.019	<0.01	3.69	<0.05	<0.0001				4.49	4.63	1.57
MB15MTW08	28/11/2023	10:00:00 AM																	
MB15MTW09	16/02/2023	12:05:00 PM																	
MB15MTW09	4/05/2023	10:00:00 AM																	
MB15MTW09	18/08/2023	10:30:00 AM																	
MB15MTW09	1/11/2023	9:55:00 AM																	
MB15MTW10	17/02/2023	1:15:00 PM																	
MB15MTW10	2/05/2023	11:25:00 AM																	
MB15MTW10	18/08/2023	11:30:00 AM																	
MB15MTW10	1/11/2023	9:35:00 AM																	
MB15MTW11	28/02/2023	1:45:00 PM																	
MB15MTW11	9/05/2023	10:10:00 AM																	
MB15MTW11	22/08/2023	1:30:00 PM																	
MB15MTW11	20/11/2023	1:20:00 PM																	
MBW01	13/02/2023	1:20:00 PM																	
MBW01	16/05/2023	8:40:00 AM																	
MBW01	3/08/2023	1:10:00 PM	14	0.22	0.002	<0.0001	0.002	<0.001	0.003	<0.01	<0.005	0.07	<0.0001				103	102	0.42
MBW01	28/11/2023	11:00:00 AM																	
MBW02	13/02/2023	12:40:00 PM																	
MBW02	5/05/2023	12:00:00 PM																	
MBW02	3/08/2023	12:50:00 PM	14	0.02	0.017	<0.0001	<0.001	<0.001	0.004	<0.01	<0.005	0.15	<0.0001				106	105	0.49
MBW02	28/11/2023	11:10:00 AM																	
MBW03	13/02/2023	1:00:00 PM																	
MBW03	1/05/2023	12:30:00 PM																	
MBW03	3/08/2023	1:20:00 PM	12	8.26	0.004	<0.0001	0.007	0.044	0.006	<0.01	0.019	0.14	<0.0001				66.4	54.5	9.87
MBW03	28/11/2023	10:40:00 AM																	
MBW04	13/02/2023	12:50:00 PM																	
MBW04	1/05/2023	11:50:00 AM																	
MBW04	3/08/2023	1:50:00 PM	14	1.76	<0.001	<0.0001	0.003	0.001	0.002	<0.01	0.015	0.16	<0.0001				116	113	1.4
MBW04	28/11/2023	11:50:00 AM																	
MBW6A	5/05/2023	10:15:00 AM																	
MBW6A	3/08/2023	12:20:00 PM	3	0.46	<0.001	<0.0001	0.001	<0.001	0.005	<0.01	0.016	0.09	<0.0001				18.2	18.2	0.03
MBW6A	20/11/2023	8:20:00 AM																	
MTD605P	14/02/2023	1:30:00 PM																	
MTD605P	16/05/2023	11:10:00 AM																	
MTD605P	18/08/2023	1:40:00 PM	13	0.3	0.001	<0.0001	0.008	<0.001	0.015	<0.01	0.011	0.31	<0.0001				204	212	1.79
MTD605P	20/11/2023	10:30:00 AM																	
MTD614P	23/03/2023	9:25:00 AM																	
MTD614P	20/06/2023	1:40:00 PM	11	0.02	0.002	<0.0001	<0.001	<0.001	0.002	<0.01	<0.005	0.14	<0.0001				72.1	70.2	1.36
MTD614P	11/09/2023	10:20:00 AM																	
MTD614P	19/12/2023	12:50:00 PM																	
MTD616P	16/02/2023	9:30:00 AM																	
MTD616P	9/05/2023																		
OH1121	31/03/2023	2:35:00 PM																	
OH1121	29/06/2023	12:00:00 PM	16	0.43	0.001	<0.0001	<0.001	<0.001	0.002	<0.01	<0.005	0.08	<0.0001				104	94.4	4.63
OH1121	20/09/2023	9:50:00 AM																	
OH1121	1/12/2023	11:50:00 AM																	
OH1122 (1)	28/03/2023	3:00:00 PM																	
OH1122 (1)	23/06/2023	1:40:00 PM																	

Table E 1 Annual groundwater quality laboratory results - 2023 Continued

Sample Point	Date	Time	EC Field (uS/cm)	pH Field	RL Standing Water Level (m)	Water Temp (Deg C)	TDS - Total (mg/l)	Hydroxide Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Bicarbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Acidity as CaCO3	SO4 - Total (mg/l)	Cl- (mg/l)	Ca - Total (mg/l)	Mg - Total (mg/l)	Na - Total (mg/l)
OH1122 (1)	19/09/2023	8:30:00 AM			Dry												
OH1122 (1)	1/12/2023	9:35:00 AM			Dry												
OH1125 (1)	23/03/2023	1:45:00 PM	13,510	6.70	51.56	23.2											
OH1125 (1)	6/06/2023	1:35:00 PM	13,970	6.70	49.83	21.2	8,760	<1	<1	966	966	123	786	4,290	336	578	2,140
OH1125 (1)	20/09/2023	9:25:00 AM	14,140	7.00	49.4	22.5											
OH1125 (1)	1/12/2023	10:00:00 AM	13,370	6.70	49.56	21.5											
OH1125 (3)	18/01/2023	2:40:00 PM			28.57												
OH1125 (3)	27/02/2023				77.65												
OH1125 (3)	23/03/2023	1:40:00 PM			Dry												
OH1125 (3)	14/04/2023	10:00:00 AM			Dry												
OH1125 (3)	24/05/2023	12:00:00 PM			Dry												
OH1125 (3)	6/06/2023	1:30:00 PM			Dry												
OH1125 (3)	21/07/2023	10:45:00 AM			24.29												
OH1125 (3)	24/08/2023	12:10:00 PM			Dry												
OH1125 (3)	12/09/2023	1:10:00 PM			Dry												
OH1125 (3)	4/10/2023	1:10:00 PM			Dry												
OH1125 (3)	16/11/2023	12:10:00 PM			Dry												
OH1125 (3)	1/12/2023	10:10:00 AM			Dry												
OH1126	30/03/2023	12:00:00 PM			Obstructed												
OH1126	29/06/2023	1:30:00 PM			Obstructed												
OH1126	12/09/2023	1:50:00 PM			Obstructed												
OH1126	1/12/2023	10:30:00 AM			Obstructed												
OH1127	31/03/2023	2:25:00 PM			Blocked												
OH1127	14/06/2023	1:35:00 PM			Blocked												
OH1127	20/09/2023	10:30:00 AM			Blocked												
OH1127	1/12/2023	11:40:00 AM			Blocked												
OH1137	30/03/2023	11:20:00 AM	12,460	7.10	Top RL not provided	20.7											
OH1137	29/06/2023	9:45:00 AM			Obstructed												
OH1137	20/09/2023	8:50:00 AM	14,050	7.00	Top RL not provided	21.6											
OH1137	1/12/2023	10:50:00 AM	13,940	7.00	Top RL not provided	24.2											
OH1138 (1)	18/01/2023	1:55:00 PM	15,130	6.30	62.5	21.4	12,100	<1	<1	526	526		409	5,610	203	583	2,380
OH1138 (1)	27/02/2023		15,280	6.40	57.61	20.9											
OH1138 (1)	23/03/2023	12:40:00 PM	14,630	6.40	62.12	21.6											
OH1138 (1)	14/04/2023	9:30:00 AM	15,320	6.40	62.36	19.9											
OH1138 (1)	31/05/2023	11:50:00 AM	15,750	6.50	62.19	19.6											
OH1138 (1)	29/06/2023	11:05:00 AM	17,950	6.30	62.05	19.1	11,800	<1	<1	338	338		407	6,790	191	706	2,700
OH1138 (1)	21/07/2023	12:05:00 PM	17,140	6.10	62.32	19.5											
OH1138 (1)	24/08/2023	11:45:00 AM	17,350	6.21	62.1	20.3											
OH1138 (1)	12/09/2023	1:30:00 PM	17,060	6.22	61.82	20											
OH1138 (1)	4/10/2023	1:35:00 PM	17,270	6.15	62.12	20											
OH1138 (1)	16/11/2023	12:35:00 PM	18,970	6.20	62.04	21.4											
OH1138 (1)	1/12/2023	11:50:00 AM	18,210	6.10	61.86	21.9											
OH1138 (2)	18/01/2023	2:25:00 PM	11,830	6.60	57.56	22.2	10,900	<1	<1	751	751		553	4,210	508	422	1,650
OH1138 (2)	27/02/2023		12,190	6.70	35.82	21.4											
OH1138 (2)	23/03/2023	12:10:00 PM	11,740	6.70	57.7	22.8											
OH1138 (2)	14/04/2023	9:45:00 AM	11,730	6.50	57.71	19.8											
OH1138 (2)	31/05/2023	12:00:00 PM	12,000	6.70	57.74	19.7											
OH1138 (2)	29/06/2023	10:40:00 AM	12,440	6.70	55.77	16	8,560	<1	<1	682	682		527	4,350	495	438	1,650
OH1138 (2)	21/07/2023	11:15:00 AM	11,580	6.60	57.82	19.6											
OH1138 (2)	24/08/2023	11:00:00 AM	11,450	6.65	58.57	20.7											
OH1138 (2)	19/09/2023	12:50:00 PM	12,070	6.60	57.85	20.5											
OH1138 (2)	4/10/2023	1:45:00 PM	11,320	6.61	57.85	20.6											
OH1138 (2)	16/11/2023	12:20:00 PM	12,450	6.60	57.81	22.2											
OH1138 (2)	1/12/2023	11:20:00 AM	11,590	6.50	57.8	21.9											
OH786	14/04/2023	10:50:00 AM	676	6.90	52.81	21.1											
OH786	21/06/2023	1:00:00 PM	568	7.30	54.21	18.9	307	<1	<1	91	91		25	97	19	12	57

Table E 1 Annual groundwater quality laboratory results - 2023 Continued

Sample Point	Date	Time	K - Total (mg/l)	Al - Total (mg/l)	As - Total (mg/l)	Cd - Total (mg/l)	Cu - Total (mg/l)	Pb - Total (mg/l)	Ni - Total (mg/l)	Se (mg/l)	Zn - Total (mg/l)	B (mg/l)	Hg - Total (mg/l)	Mo (mg/l)	V (mg/l)	Cr (mg/l)	Total anions	Total Cations	Ionic Balance
OH1122 (1)	19/09/2023	8:30:00 AM																	
OH1122 (1)	1/12/2023	9:35:00 AM																	
OH1125 (1)	23/03/2023	1:45:00 PM																	
OH1125 (1)	6/06/2023	1:35:00 PM	24	0.11	0.002	<0.0001	0.009	0.001	0.002	<0.01	0.021	0.16	<0.0001	0.005	<0.01	<0.001	157	158	0.43
OH1125 (1)	20/09/2023	9:25:00 AM																	
OH1125 (1)	1/12/2023	10:00:00 AM																	
OH1125 (3)	18/01/2023	2:40:00 PM																	
OH1125 (3)	27/02/2023																		
OH1125 (3)	23/03/2023	1:40:00 PM																	
OH1125 (3)	14/04/2023	10:00:00 AM																	
OH1125 (3)	24/05/2023	12:00:00 PM																	
OH1125 (3)	6/06/2023	1:30:00 PM																	
OH1125 (3)	21/07/2023	10:45:00 AM																	
OH1125 (3)	24/08/2023	12:10:00 PM																	
OH1125 (3)	12/09/2023	1:10:00 PM																	
OH1125 (3)	4/10/2023	1:10:00 PM																	
OH1125 (3)	16/11/2023	12:10:00 PM																	
OH1125 (3)	1/12/2023	10:10:00 AM																	
OH1126	30/03/2023	12:00:00 PM																	
OH1126	29/06/2023	1:30:00 PM																	
OH1126	12/09/2023	1:50:00 PM																	
OH1126	1/12/2023	10:30:00 AM																	
OH1127	31/03/2023	2:25:00 PM																	
OH1127	14/06/2023	1:35:00 PM																	
OH1127	20/09/2023	10:30:00 AM																	
OH1127	1/12/2023	11:40:00 AM																	
OH1137	30/03/2023	11:20:00 AM																	
OH1137	29/06/2023	9:45:00 AM																	
OH1137	20/09/2023	8:50:00 AM																	
OH1137	1/12/2023	10:50:00 AM																	
OH1138 (1)	18/01/2023	1:55:00 PM	53	0.16	<0.001	0.001	<0.001	<0.001	0.008	<0.01	0.009	<0.05	<0.0001				177	163	4.2
OH1138 (1)	27/02/2023																		
OH1138 (1)	23/03/2023	12:40:00 PM																	
OH1138 (1)	14/04/2023	9:30:00 AM																	
OH1138 (1)	31/05/2023	11:50:00 AM																	
OH1138 (1)	29/06/2023	11:05:00 AM	54	1.42	0.001	0.0007	0.002	0.002	0.011	<0.01	0.018	<0.05	0.0009				207	186	5.16
OH1138 (1)	21/07/2023	12:05:00 PM																	
OH1138 (1)	24/08/2023	11:45:00 AM																	
OH1138 (1)	12/09/2023	1:30:00 PM																	
OH1138 (1)	4/10/2023	1:35:00 PM																	
OH1138 (1)	16/11/2023	12:35:00 PM																	
OH1138 (1)	1/12/2023	11:50:00 AM																	
OH1138 (2)	18/01/2023	2:25:00 PM	23	0.02	0.001	<0.0001	<0.001	<0.001	0.001	<0.01	<0.005	<0.05	<0.0001				145	132	4.62
OH1138 (2)	27/02/2023																		
OH1138 (2)	23/03/2023	12:10:00 PM																	
OH1138 (2)	14/04/2023	9:45:00 AM																	
OH1138 (2)	31/05/2023	12:00:00 PM																	
OH1138 (2)	29/06/2023	10:40:00 AM	20	1.14	0.004	<0.0001	0.005	0.004	0.002	<0.01	0.04	<0.05	<0.0001				147	133	5.09
OH1138 (2)	21/07/2023	11:15:00 AM																	
OH1138 (2)	24/08/2023	11:00:00 AM																	
OH1138 (2)	19/09/2023	12:50:00 PM																	
OH1138 (2)	4/10/2023	1:45:00 PM																	
OH1138 (2)	16/11/2023	12:20:00 PM																	
OH1138 (2)	1/12/2023	11:20:00 AM																	
OH786	14/04/2023	10:50:00 AM																	
OH786	21/06/2023	1:00:00 PM	7	0.12	<0.001	<0.0001	0.002	<0.001	0.011	<0.01	0.069	<0.05	<0.0001				5.07	4.59	4.97

Table E 1 Annual groundwater quality laboratory results - 2023 Continued

Sample Point	Date	Time	EC Field (uS/cm)	pH Field	RL Standing Water Level (m)	Water Temp (Deg C)	TDS - Total (mg/l)	Hydroxide Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Bicarbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Acidity as CaCO3	SO4 - Total (mg/l)	Cl- (mg/l)	Ca - Total (mg/l)	Mg - Total (mg/l)	Na - Total (mg/l)
OH786	11/09/2023	1:05:00 PM	1,067	7.60	48.87	20.4											
OH786	1/12/2023	1:15:00 PM	484	6.80	49.78	19.7											
OH787	24/03/2023	2:00:00 PM			Not accessible												
OH787	6/06/2023	9:40:00 AM			Not accessible												
OH787	11/09/2023	12:45:00 PM	15,560	8.30	36.83	20.6											
OH787	1/12/2023	12:50:00 PM	17,410	7.60	36.91	21.2											
OH788	22/03/2023	1:40:00 PM	12,200	6.90	37.11	22.9											
OH788	21/06/2023	11:10:00 AM	12,930	6.90	37.05	19.8	7,640	<1	<1	1,340	1340		359	3,940	101	305	2,500
OH788	11/09/2023	11:00:00 AM	9,670	7.00	36.96	20.6											
OH788	30/11/2023	10:15:00 AM	10,430	7.10	36.88	21											
OH942	24/03/2023	1:15:00 PM	24,000	6.70	46.75	23.4											
OH942	21/06/2023	1:20:00 PM	24,300	6.70	46.72	20.2	16,400	<1	<1	719	719		1,260	8,280	164	762	4,630
OH942	11/09/2023	12:00:00 PM	21,900	6.70	46.67	23.3											
OH942	30/11/2023	1:00:00 PM	24,700	6.80	46.65	23.3											
OH943	21/06/2023	12:20:00 PM	4,740	7.50	37.14	18.6	2,730	<1	<1	660	660		255	1,080	33	69	971
OH943	11/09/2023	11:15:00 AM	5,410	7.60	37.05	19.8											
OH943	1/12/2023	2:10:00 PM	6,590	7.40	36.94	23.4											
OH944	24/03/2023	12:15:00 PM			Dry												
OH944	6/06/2023	9:20:00 AM			Dry												
OH944	6/09/2023	12:40:00 PM			Dry												
OH944	30/11/2023	12:10:00 PM			Dry												
PZ7D	28/02/2023	2:00:00 PM			Not accessible												
PZ7D	1/05/2023	1:35:00 PM			Not accessible												
PZ7D	23/08/2023	11:50:00 AM	1,559	7.60	53.68	20.1	904	<1	1	542	543		28	229	29	21	320
PZ7D	20/11/2023	12:20:00 PM	1,565	7.60	53.24	20.3											
PZ7S	28/02/2023	2:00:00 PM			Not accessible												
PZ7S	1/05/2023	1:35:00 PM			Not accessible												
PZ7S	23/08/2023	12:20:00 PM	909	6.60	54.39	19.7	564	<1	<1	299	299		15	139	39	29	113
PZ7S	20/11/2023	12:00:00 PM	1,273	6.50	53.71	19.5											
PZ8D	23/03/2023	10:45:00 AM	8,460	7.30	53.07	21											
PZ8D	23/06/2023	12:30:00 PM	8,380	7.20	60.36	19.1	4,760	<1	<1	1,860	1860		<10	1,850	32	40	2,010
PZ8D	11/09/2023	9:15:00 AM	8,290	7.40	60.7	20.6											
PZ8D	19/12/2023	1:15:00 PM	8,420	7.40	59.79	21.4											
PZ8S	22/03/2023	11:45:00 AM	13,260	6.50	61.62	19.8											
PZ8S	23/06/2023	12:50:00 PM	13,610	6.70	61.32	18.5	7,970	<1	<1	634	634		515	4,330	116	278	2,630
PZ8S	11/09/2023	8:45:00 AM	13,040	6.70	61.07	19											
PZ8S	1/12/2023	9:50:00 AM	13,350	6.70	60.92	19.8											
PZ9D	23/03/2023	12:40:00 PM	9,900	6.90	49.38	21.3											
PZ9D	21/06/2023	10:25:00 AM	9,820	7.00	49.28	18.3	5,900	<1	<1	973	973		416	2,860	172	291	1,700
PZ9D	11/09/2023	10:00:00 AM	9,570	7.00	48.93	19.2											
PZ9D	19/12/2023	1:30:00 PM	10,070	7.00	48.67	20.9											
PZ9S	22/03/2023	12:25:00 PM			60.63												
PZ9S	21/06/2023	10:00:00 AM	13,180	6.90	60.33	18.4	7,080	<1	<1	663	663		549	3,900	83	369	2,210
PZ9S	11/09/2023	9:45:00 AM	13,640	7.00	60.15	18.3											
PZ9S	19/12/2023	1:40:00 PM	12,540	6.90	60	19.8											
WD622P	16/02/2023	10:50:00 AM	9,110	7.30	36.42	22.1											
WD622P	9/05/2023				Decommissioned												
WD625P	4/05/2023	11:30:00 AM	11,810	7.10	57	20.5											
WD625P	18/08/2023	9:30:00 AM	12,010	7.10	57.28	20.7	6,840	<1	<1	1,310	1310		238	3,760	179	224	2,470
WD625P	28/11/2023	9:30:00 AM	11,450	7.20	57.2	19.6											
WOH2139A	17/02/2023	2:00:00 PM			Decommissioned												
WOH2139A	9/05/2023				Decommissioned												
WOH2141A	28/02/2023	1:15:00 PM	10,080	7.60	46.46	23.6											
WOH2141A	9/05/2023	9:30:00 AM	9,970	7.70	46.38	19.6											
WOH2141A	22/08/2023	1:00:00 PM	10,710	7.67	45.97	22	5,870	<1	40	1,290	1330		<1	2,970	39	19	2,340
WOH2141A	23/11/2023	9:20:00 AM	10,210	7.70	46.41	21.9											

Table E 1 Annual groundwater quality laboratory results - 2023 Continued

Sample Point	Date	Time	K - Total (mg/l)	Al - Total (mg/l)	As - Total (mg/l)	Cd - Total (mg/l)	Cu - Total (mg/l)	Pb - Total (mg/l)	Ni - Total (mg/l)	Se (mg/l)	Zn - Total (mg/l)	B (mg/l)	Hg - Total (mg/l)	Mo (mg/l)	V (mg/l)	Cr (mg/l)	Total anions	Total Cations	Ionic Balance
OH786	11/09/2023	1:05:00 PM																	
OH786	1/12/2023	1:15:00 PM																	
OH787	24/03/2023	2:00:00 PM																	
OH787	6/06/2023	9:40:00 AM																	
OH787	11/09/2023	12:45:00 PM																	
OH787	1/12/2023	12:50:00 PM																	
OH788	22/03/2023	1:40:00 PM																	
OH788	21/06/2023	11:10:00 AM	49	0.01	0.02	<0.0001	<0.001	<0.001	<0.001	<0.01	0.006	0.11	<0.0001				145	140	1.84
OH788	11/09/2023	11:00:00 AM																	
OH788	30/11/2023	10:15:00 AM																	
OH942	24/03/2023	1:15:00 PM																	
OH942	21/06/2023	1:20:00 PM	41	0.09	0.001	<0.0001	<0.001	<0.001	0.004	<0.01	<0.005	0.06	<0.0001	<0.001	<0.01	0.002	274	273	0.15
OH942	11/09/2023	12:00:00 PM																	
OH942	30/11/2023	1:00:00 PM																	
OH943	21/06/2023	12:20:00 PM	9	0.1	<0.001	<0.0001	0.002	<0.001	0.002	<0.01	0.014	0.06	<0.0001				49	49.8	0.84
OH943	11/09/2023	11:15:00 AM																	
OH943	1/12/2023	2:10:00 PM																	
OH944	24/03/2023	12:15:00 PM																	
OH944	6/06/2023	9:20:00 AM																	
OH944	6/09/2023	12:40:00 PM																	
OH944	30/11/2023	12:10:00 PM																	
PZ7D	28/02/2023	2:00:00 PM																	
PZ7D	1/05/2023	1:35:00 PM																	
PZ7D	23/08/2023	11:50:00 AM	5	0.02	<0.001	<0.0001	0.009	<0.001	0.001	<0.01	<0.005	0.12	<0.0001				17.9	17.2	1.91
PZ7D	20/11/2023	12:20:00 PM																	
PZ7S	28/02/2023	2:00:00 PM																	
PZ7S	1/05/2023	1:35:00 PM																	
PZ7S	23/08/2023	12:20:00 PM	8	0.21	<0.001	<0.0001	0.009	0.002	0.003	<0.01	0.009	<0.05	<0.0001				10.2	9.45	3.84
PZ7S	20/11/2023	12:00:00 PM																	
PZ8D	23/03/2023	10:45:00 AM																	
PZ8D	23/06/2023	12:30:00 PM	9	<0.01	0.002	<0.0001	0.004	<0.001	0.003	<0.01	0.007	0.24	<0.0001				89.3	92.5	1.76
PZ8D	11/09/2023	9:15:00 AM																	
PZ8D	19/12/2023	1:15:00 PM																	
PZ8S	22/03/2023	11:45:00 AM																	
PZ8S	23/06/2023	12:50:00 PM	9	0.74	0.001	<0.0001	0.012	<0.001	0.004	<0.01	<0.005	<0.05	<0.0001				146	143	0.77
PZ8S	11/09/2023	8:45:00 AM																	
PZ8S	1/12/2023	9:50:00 AM																	
PZ9D	23/03/2023	12:40:00 PM																	
PZ9D	21/06/2023	10:25:00 AM	25	0.01	<0.001	<0.0001	0.001	<0.001	<0.001	<0.01	<0.005	0.08	<0.0001				109	107	0.77
PZ9D	11/09/2023	10:00:00 AM																	
PZ9D	19/12/2023	1:30:00 PM																	
PZ9S	22/03/2023	12:25:00 PM																	
PZ9S	21/06/2023	10:00:00 AM	47	0.82	0.002	<0.0001	0.409	0.004	0.016	<0.01	0.014	<0.05	<0.0001				135	132	1.07
PZ9S	11/09/2023	9:45:00 AM																	
PZ9S	19/12/2023	1:40:00 PM																	
WD622P	16/02/2023	10:50:00 AM																	
WD622P	9/05/2023																		
WD625P	4/05/2023	11:30:00 AM																	
WD625P	18/08/2023	9:30:00 AM	15	1.89	0.001	<0.0001	0.012	0.002	0.121	<0.01	0.034	0.18	<0.0001				137	135	0.74
WD625P	28/11/2023	9:30:00 AM																	
WOH2139A	17/02/2023	2:00:00 PM																	
WOH2139A	9/05/2023																		
WOH2141A	28/02/2023	1:15:00 PM																	
WOH2141A	9/05/2023	9:30:00 AM																	
WOH2141A	22/08/2023	1:00:00 PM	8	0.04	<0.001	<0.0001	<0.001	<0.001	0.003	<0.01	0.051	0.19	<0.0001				110	105	2.25
WOH2141A	23/11/2023	9:20:00 AM																	

Table E 1 Annual groundwater quality laboratory results - 2023 Continued

Sample Point	Date	Time	EC Field (uS/cm)	pH Field	RL Standing Water Level (m)	Water Temp (Deg C)	TDS - Total (mg/l)	Hydroxide Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Bicarbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Acidity as CaCO3	SO4 - Total (mg/l)	Cl- (mg/l)	Ca - Total (mg/l)	Mg - Total (mg/l)	Na - Total (mg/l)
WOH2153A	17/02/2023	11:45:00 AM	2,800	7.80	49.38	22.9											
WOH2153A	9/05/2023	11:40:00 AM	4,670	7.50	44.67	20.6											
WOH2153A	22/08/2023	11:40:00 AM	2,780	7.85	48.2	21.3	1,660	<1	59	1,170	1230		10	259	4	2	692
WOH2153A	1/11/2023	10:10:00 AM	2,790	7.90	47.75	21.9											
WOH2153B	17/02/2023	11:45:00 AM	1,557	7.10	55.38	21.4											
WOH2153B	9/05/2023	11:50:00 AM	1,521	7.30	56.21	20.3											
WOH2153B	22/08/2023	11:50:00 AM	1,527	7.18	56.91	20.6	1,120	<1	<1	586	586		32	210	28	19	306
WOH2153B	1/11/2023	10:30:00 AM	1,546	7.10	56.96	21.6											
WOH2154A	17/02/2023	11:15:00 AM	4,600	7.50	45.56	21.5											
WOH2154A	9/05/2023	12:50:00 PM	2,470	7.80	49.69	19.3											
WOH2154A	22/08/2023	10:40:00 AM	4,720	7.39	44.55	20.4	2,750	<1	29	1,070	1100		108	944	8	5	988
WOH2154A	1/11/2023	11:40:00 AM	4,710	7.50	44.13	22.5											
WOH2154B	17/02/2023	10:25:00 AM	8,160	7.30	56.13	20.8											
WOH2154B	9/05/2023	1:00:00 PM	8,410	7.30	57.35	20.5											
WOH2154B	22/08/2023	10:50:00 AM	8,410	7.30	56.7	20.7	5,310	<1	<1	1,050	1050		583	1,760	110	158	1,650
WOH2154B	1/11/2023	11:55:00 AM	8,830	7.20	56.64	23.2											
WOH2155A	17/02/2023	10:05:00 AM	8,140	7.10	41.73	23.3											
WOH2155A	9/05/2023	1:35:00 PM	8,020	6.90	40.98	20.5											
WOH2155A	22/08/2023	9:30:00 AM	7,820	7.00	39.89	19.2	4,730	<1	<1	958	958		240	2,470	47	71	1,690
WOH2155A	1/11/2023	1:00:00 PM	7,900	7.00	38.95	23.5											
WOH2155B	17/02/2023	9:45:00 AM	7,010	7.40	57.85	20.9											
WOH2155B	9/05/2023	1:45:00 PM	6,740	7.40	57.59	19.9											
WOH2155B	22/08/2023	10:00:00 AM	7,020	7.33	57.45	20.2	3,900	<1	<1	1,030	1030		344	1,600	89	52	1,410
WOH2155B	1/11/2023	1:10:00 PM	7,550	7.20	57.11	21.5											
WOH2156A	16/02/2023	11:20:00 AM	14,460	7.00	39.74	22.1											
WOH2156A	9/05/2023	2:15:00 PM	14,350	7.00	38.96	21.1											
WOH2156A	15/08/2023	12:50:00 PM	13,840	7.14	37.14	19.2	8,420	<1	<1	1,290	1290		867	3,760	179	246	3,180
WOH2156A	28/11/2023	8:50:00 AM	13,790	7.10	35.71	21.3											
WOH2156B	16/02/2023	11:35:00 AM	13,410	7.10	72.87	22											
WOH2156B	9/05/2023	2:25:00 PM	13,400	7.10	72.51	20.2											
WOH2156B	15/08/2023	12:30:00 PM	13,610	7.25	72.59	19.8	8,330	<1	<1	1,490	1490		826	3,370	57	30	3,210
WOH2156B	28/11/2023	9:10:00 AM	13,330	7.30	71.14	20.4											

Table E 1 Annual groundwater quality laboratory results - 2023 Continued

Sample Point	Date	Time	K - Total (mg/l)	Al - Total (mg/l)	As - Total (mg/l)	Cd - Total (mg/l)	Cu - Total (mg/l)	Pb - Total (mg/l)	Ni - Total (mg/l)	Se (mg/l)	Zn - Total (mg/l)	B (mg/l)	Hg - Total (mg/l)	Mo (mg/l)	V (mg/l)	Cr (mg/l)	Total anions	Total Cations	Ionic Balance
WOH2153A	17/02/2023	11:45:00 AM																	
WOH2153A	9/05/2023	11:40:00 AM																	
WOH2153A	22/08/2023	11:40:00 AM	5	0.44	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.01	0.054	0.21	<0.0001				32.1	30.6	2.39
WOH2153A	1/11/2023	10:10:00 AM																	
WOH2153B	17/02/2023	11:45:00 AM																	
WOH2153B	9/05/2023	11:50:00 AM																	
WOH2153B	22/08/2023	11:50:00 AM	5	119	0.014	0.0003	0.092	0.221	0.065	0.03	0.349	0.17	<0.0001				18.3	16.4	5.47
WOH2153B	1/11/2023	10:30:00 AM																	
WOH2154A	17/02/2023	11:15:00 AM																	
WOH2154A	9/05/2023	12:50:00 PM																	
WOH2154A	22/08/2023	10:40:00 AM	6	0.14	<0.001	0.0002	0.007	<0.001	0.001	<0.01	0.12	0.12	<0.0001				50.8	43.9	7.3
WOH2154A	1/11/2023	11:40:00 AM																	
WOH2154B	17/02/2023	10:25:00 AM																	
WOH2154B	9/05/2023	1:00:00 PM																	
WOH2154B	22/08/2023	10:50:00 AM	18	13.5	0.004	<0.0001	0.006	0.015	0.008	<0.01	0.041	0.14	<0.0001				82.8	90.7	4.59
WOH2154B	1/11/2023	11:55:00 AM																	
WOH2155A	17/02/2023	10:05:00 AM																	
WOH2155A	9/05/2023	1:35:00 PM																	
WOH2155A	22/08/2023	9:30:00 AM	14	0.1	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.01	<0.005	0.13	<0.0001				93.8	82	6.68
WOH2155A	1/11/2023	1:00:00 PM																	
WOH2155B	17/02/2023	9:45:00 AM																	
WOH2155B	9/05/2023	1:45:00 PM																	
WOH2155B	22/08/2023	10:00:00 AM	10	64.6	0.022	0.0007	0.042	0.375	0.028	0.03	0.321	0.25	<0.0001				72.9	70.3	1.79
WOH2155B	1/11/2023	1:10:00 PM																	
WOH2156A	16/02/2023	11:20:00 AM																	
WOH2156A	9/05/2023	2:15:00 PM																	
WOH2156A	15/08/2023	12:50:00 PM	24	0.02	<0.001	<0.0001	<0.001	<0.001	0.002	<0.01	0.036	0.14	<0.0001				150	168	5.73
WOH2156A	28/11/2023	8:50:00 AM																	
WOH2156B	16/02/2023	11:35:00 AM																	
WOH2156B	9/05/2023	2:25:00 PM																	
WOH2156B	15/08/2023	12:30:00 PM	19	1.58	<0.001	<0.0001	0.004	0.003	0.012	<0.01	0.328	0.18	<0.0001				142	145	1.18
WOH2156B	28/11/2023	9:10:00 AM																	

Appendix 7:

Annual Rehabilitation Report

Annual Rehabilitation Report - 2023

Mount Thorley Warkworth

DOCUMENT CONTROL

Version	Date	Revision Description	Author	Approver
1.0	28/03/2024	ARR document prepared to satisfy new Standard Conditions on Mining Leases	Bill Baxter Environmental Specialist - Rehabilitation	Gary Mulhearn Environment & Community Manager

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DEFINITIONS / ABBREVIATIONS

BBAM - BioBanking Assessment Method
CCC – Community consultative Committee
CCL – Consolidated Coal Lease
CL – Coal Lease
EL – Exploration Licence
EPBC - Environment Protection and Biodiversity Conservation Act
EPA – NSW Environment and Protection Authority
EPL – Environment Protection Licence
ML – Mining Lease
MTO - Mount Thorley Operations
MTW - Mount Thorley Warkworth Coal Mine (combined operations)
RML - Radiation Management Licence
RMP – Rehabilitation Management Plan
ROBJ – Rehabilitation Objectives
TSF – Tailings Storage Facility
VENM - Virgin Excavated Natural Material
WML - Warkworth Mining Limited

Name of mine:	Mount Thorley Warkworth	
Annual Rehabilitation Report Period:	**START DATE:**	**END DATE:**
	1 January 2023	31 December 2023
Annual Rehabilitation Report revision dates and version numbers:	Version 1.0 - 28 March 2024	
Mining leases	**No**	**Expiry**
	CL 219	23 September 2044
	ML 1752	17 March 2038
	CCL 753	17 February 2034
	ML 1412	11 January 2038
	ML 1590	26 February 2028
	ML 1751	17 March 2038
	ML 1828	25 February 2043
Name of Lease holder(s)	Mt Thorley Operations Pty Ltd Warkworth Mining Limited Mount Thorley Coal Loading Ltd	
Date of Submission	28 MARCH 2024	

1.0 MINING DETAILS

1.1 PROJECT DESCRIPTION

Mount Thorley Warkworth (MTW) is an integrated operation of two open cut mines, Warkworth Mining Limited (WML) and Mount Thorley Operations (MTO), managed by Coal & Allied (NSW) Pty Ltd, a wholly owned subsidiary of Yancoal Australia Limited (Yancoal). MTW is located 14 km south west of Singleton in the Hunter Valley region of New South Wales.

Development Consent for the Warkworth Continuation Project (SSD-6464) and Mount Thorley Operations 2014 Project (SSD-6465) was granted on 26 November 2015. A modification to the Warkworth Continuation Project (SSD-6464 MOD2) was granted on 27 May 2022.

The Projects are described in detail in the Environmental Impact Statements and supporting documents (EMGA Mitchell McLennan, June 2014), and the Modification Report (SSD-6464 MOD 2, September 2021).

1.2 CURRENT DEVELOPMENT CONSENTS, LEASES, AND LICENCES

Environment Protection Licence (EPL): EPL 24, EPL 1976, EPL 1376.

Environment Protection and Biodiversity Conservation (EPBC) Act Approval: EPBC 2002/629, EPBC 2009/5081.

General Water Licences: WAL963, WAL10543, WAL18233, WAL18558, WAL19022, WAL39798, WAL40464, WAL40465, WAL43056, WAL43057, 20BL168821, 20BL171729, 20BL171841, 20BL171842, 20BL171843, 20BL171844, 20BL171845, 20BL171846, 20BL171847, 20BL171848, 20BL171849, 20BL171850, 20BL171891, 20BL171892, 20BL171893, 20BL171894, 20BL172272, 20BL172273, 20BL173065, 20BL173276.

Development Consents: SSD-6464, SSD-6465, DA 177/94.

Radiation Management License: RML 5061110, RML 5061122.

Prospecting and Coal Mining: CL 219, (Part) ML 1547 (Sublease), ML 1752, EL7712, EL 8824, CCL 753, ML 1412, ML1590, ML 1751, ML 1828.

Store Explosives License: XSTR100160.

In 2023, a change to EPL 1976 (Mount Thorley) was approved to: 1) change the premises boundary to allow emplacement of overburden across the mining lease boundary to construct the approved final landform; 2) include the Scheduled Activity: Crushing, Grinding, or Separating which occurs at MTO; 3) update the Waste section to generally align the EPL conditions with the Warkworth Coal Mine Premises for which EPL 1376 is held; 4) refer to a new datum – GDA2020 MGA Zone 56 and update all coordinates noted in EPL 1976 accordingly; and 5) remove the requirement to monitor blast overpressure at Point 5 (Warkworth Village) as there are no residences on privately owned land at this location.

1.3 LAND OWNERSHIP AND LAND USE

There was no change to land ownership for MTW in the reporting period.

2.0 COMPLAINTS

No complaints related to rehabilitation received in 2023.

3.0 STAKEHOLDER CONSULTATION

Table 1: Stakeholder Consultation 2023

Date	Stakeholder	Consultation Forms	Matters	Actions
February 2023	Community Consultative Committee (CCC)	CCC Meeting	Rehabilitation and disturbance forecasts for 2023	No actions required
May 2023	Community Consultative Committee	CCC Meeting	YTD progress against rehabilitation and disturbance targets for 2023. Final landform and drainage from FLRP	No actions required
May 2023	NSW Environment Protection Authority (EPA)	HRSTS Operations Committee Meeting	Request for review of saline water definition to allow runoff from stabilised rehabilitation catchments to be discharged off site outside of the HRSTS scheme.	To be considered by EPA in HRSTS Regulation review
August 2023	Community Consultative Committee	CCC Meeting	YTD progress against rehabilitation and disturbance targets for 2023. EPL Variation (approved June 2023) to allow emplacement of overburden across the Bulga Coal Operations mining lease boundary	No actions required
November 2023	Community Consultative Committee	CCC Meeting	YTD progress against rehabilitation and disturbance targets for 2023. EPL variation submitted November 2023 due to cross mining lease overburden emplacement completed.	No actions required

4.0 SURFACE DISTURBANCE AND REHABILITATION ACTIVITIES

Surface disturbance activities included:

- Progression of mining in North Pit and West Pit areas, including associated water management infrastructure (98.4ha)
- Rehabilitation disturbance in South Pit to allow construction of approved final landform (7.9ha)
- Construction of light vehicle access in South Pit to improve light vehicle/heavy vehicle interaction (0.2ha)

The disturbance in this reporting period was 106.5ha. The disturbance ahead of mining conducted in 2023 was forecast in the Forward Program apart from approximately 7.6ha of additional disturbance in West Pit associated with water management infrastructure ahead of mining.

Rehabilitation activities included:

- Rehabilitation of overburden emplacements in North Pit (18.4ha), Centre Dump (CD) (32.9ha), Mount Thorley (32.8ha) and South Pit (0.7ha).
- Rehabilitation of Tailings Dam 1 (6.6ha)
- Rehabilitation of topsoil stockpile bases after use of stockpile material in North Pit (0.3ha) and Mount Thorley (1.9ha).
- Topsoil was not used on some rehabilitation areas in CD (3.7ha). Mine spoil ameliorated with compost (100t/ha) and gypsum (10t/ha) was used as the growth medium.

The rehabilitation (Ecosystem and Land Use Establishment) undertaken in this reporting period was 93.6ha. The bulk of the rehabilitation completed in the reporting period was in North Pit, CD and Mount Thorley.

Progressive rehabilitation commitments are outlined in the Warkworth Continuation 2014 and Mt Thorley Operations 2014 Environmental Impact Statements. These documents modelled a total of 1,607.8 ha of rehabilitation to be completed by the end of 2023. At the end of the reporting period there had been 1,383.1 hectares of rehabilitation completed across Warkworth and Mount Thorley, 224.7ha behind the EIS forecast for the end of 2023.

Rehabilitation Planning Activities

The MTW final landform design was updated for submission of the Final Landform and Rehabilitation Plan in August 2023. The final landform of MTW has been designed using a geomorphological landform design approach based on alluvial analogues. The landform design work was undertaken using an external specialist consultant (WSP Australia) and an erosional risk analysis has been conducted to determine areas that require rock lining for erosion protection.

The landform design work included the sizing and positioning of a temporary stockpile of capping material for the Loders Pit Tailings Storage Facility (TSF). The Loders Pit TSF will be used for tailings deposition through to the closure of MTW. Sufficient material will be needed to be stockpiled adjacent to this facility during the operational phase of the mine to facilitate capping at closure. Further studies will be

undertaken to reduce the amount of capping material required to be stockpiled by potentially reducing the footprint of the TSF.

Surface soils from 10ha of stripping area ahead of mining in North Pit were assessed and classified in accordance with the NSW EPA requirements for classifying excavated materials as Virgin Excavated Natural Material (VENM). The stripped soil is proposed for off-site re-use in revegetation activities at MTW's Northern Biodiversity Area.

Subsidence Repair Undertaken

As MTW is an open cut operation, subsidence has been regarded as a negligible risk. Regardless, mine subsidence was examined and risk-ranked in the Rehabilitation Management Plan (RMP) Risk Assessment. No subsidence incidents have been recorded at MTW. As such this RMP does not introduce measures and methods to address subsidence impacts to rehabilitation during the active phase of mining.

Rehabilitation Management and Maintenance Activities

The following weed management activities were conducted across rehabilitation areas at MTW:

- Boom spraying of various exotic grasses and broadleaf weeds (14.7ha);
- Weed wiping of *Acacia saligna* shrubs and various exotic grasses (18.2ha);
- Selective spraying (backpack) of various exotic grasses and broadleaf weeds (164.4ha); and
- Manual removal (Cut and Paint) of *Acacia saligna* shrubs (92.9ha)

Rehabilitation areas with poor germination results (12.8ha) were re-spread with soil ameliorants and re-seeded with native seed mixes. Areas affected by erosion (0.8ha) had repair work undertaken and were re-seeded with native seed mixes. Coir logs were installed in rehabilitation areas in North Pit to assist with temporary stabilisation of slopes. Silt was cleaned out using a small excavator from coir logs in Centre Dump rehabilitation area.

Two 1080 ground baiting programmes utilising meat baits and ejector baits were undertaken during autumn and spring to target wild dogs and foxes. The program consisted of approximately 60 bait sites across MTW, including rehabilitation areas.

A feral pig trapping programme was carried out across MTW in winter that resulted in 27 feral pigs being controlled.

Rehabilitation Actions

Resubmission of updated Rehabilitation Objectives and Final Landform Rehabilitation Plan spatial data in August 2023. Request from Resources Regulator for further information for applications ROBJ0001178 and FLRP0001145.

Design of temporary capping material stockpile for Loders Pit TSF undertaken as part of final landform design work. Further investigations to be undertaken during 2024 reduce the amount of capping material required for the closure of the Loders Pit TSF. Recommendation from Targeted Assessment Program – Landform Establishment (May 2021).

Initial meeting undertaken with external consultancy firm and provision of high resolution scan data and lower resolution Lidar data for the assessment of the long-term stability of the final landform using

Landform Evolution Models. Recommendation from Targeted Assessment Program – Landform Establishment (May 2021).

Importation of rock for use on rock-lined drains in Geofluv landform areas Targeted Assessment Program – Landform Establishment (May 2021).

Rehabilitation Areas That Have Achieved the Final Land Use

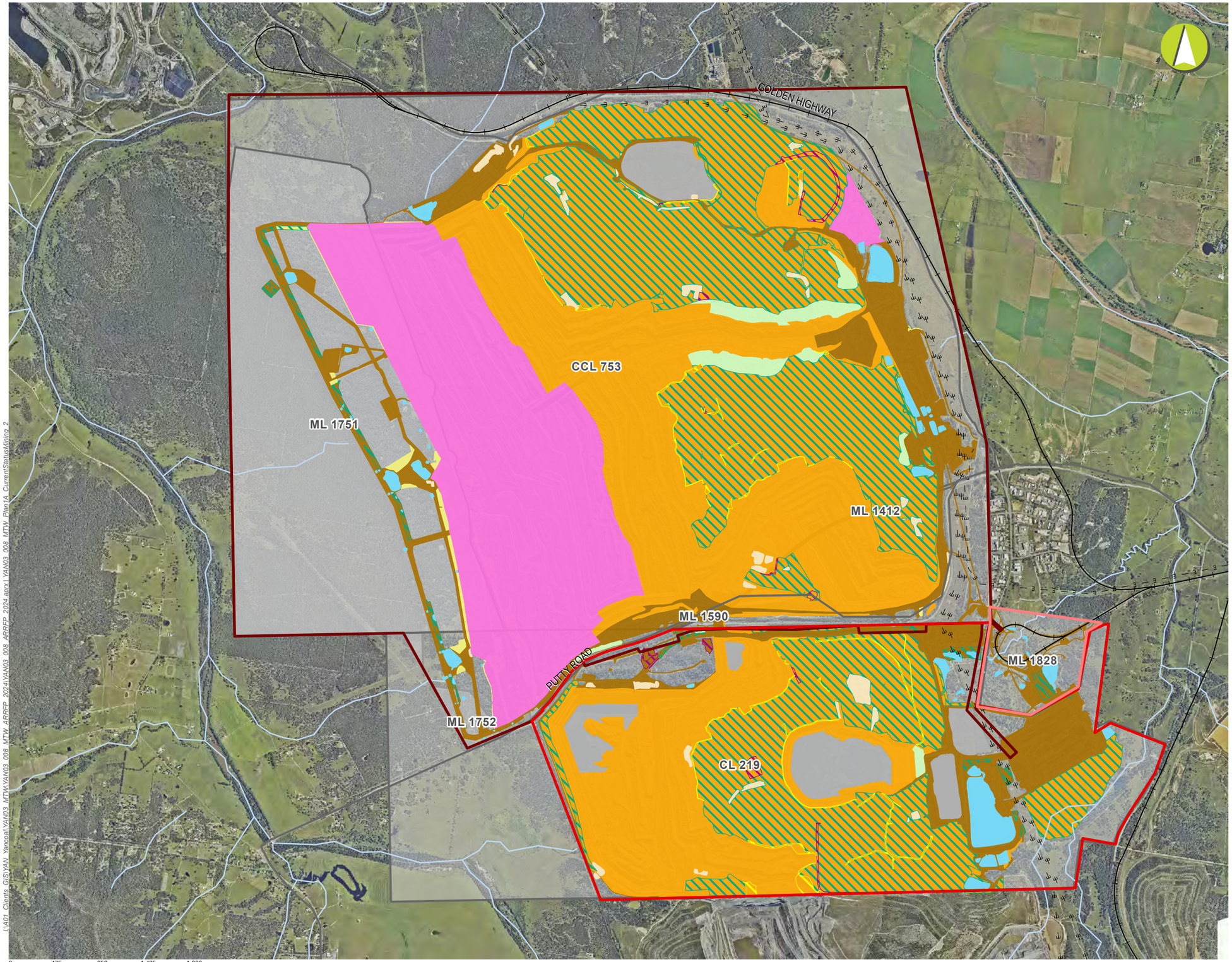
No areas achieved final land use during the 2023 reporting period.

Key Production Milestones

Table 2: Key Production Milestones Calendar Year 2023

Material	Unit	Year 1 2023 Forward Program	This report
Stripped topsoil	m3	90,683	106,500
Rock / Overburden	m3	113,846,797	112,161,283
Ore	Mt	20.35	17.23
Reject Material (Includes coarse rejects, tailings and any other wastes resulting from beneficiation)	Mt	5.2	5.76
Product	Mt	11.22	11.26

Figure 1: Plan 1A - Current Status of Mining and Rehabilitation



LEGEND

Project Approval Number
- SSD 6464 - Warkworth
- SSD 6465 - Mount Thorley
- ML 1828 - Mount Thorley Coal Loader
- Railway
- Major Road
- Waterways
- Electricity Transmission Line

Current Authorisations
- Relevant Mining Title

Rehabilitation Phase
- Landform Establishment
- Growth Media Development
- Ecosystem and Land Use Establishment

Mining Domain Type
- Domain 1: Infrastructure Area
- Domain 2: Tailings Storage Facility
- Domain 3: Water Management Area
- Domain 4: Overburden Emplacement Area
- Domain 5: Active Mining Area (Open cut void)
- Domain 8a: Other - Topsoil Stockpile
- Domain 8b: Other - Topsoil Stripped
- Domain 8c: Other - Temporary Rehabilitation

0 475 950 1,425 1,900 m

Scale: 1:40,000

Sheet Size : A3

INTEGRATED ENVIRONMENTAL MANAGEMENT AUSTRALIA
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YANCOAL 兖煤澳大利亚有限公司
MT THORLEY WARKWORTH

Source: Project Approval Boundary, rehabilitation, disturbance, watercourses and Current Authorisations from Yancoal (2023). Aerial imagery from Yancoal (2023).

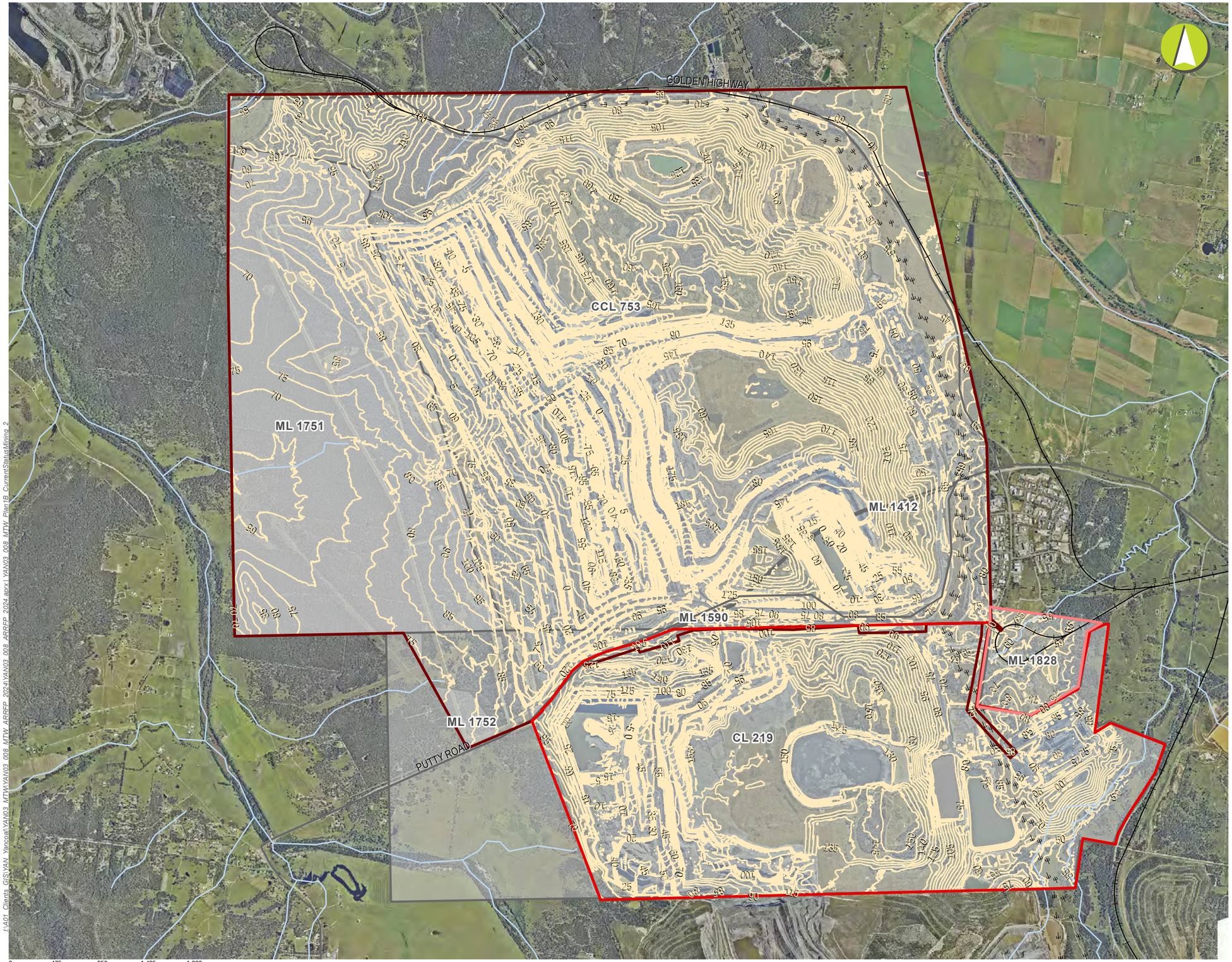
Mount Thorley Warkworth Complex

Current Status Mining and Rehabilitation
PLAN 1A

Mine name	Mount Thorley Warkworth Complex
Plan name	Mount Thorley Warkworth ARR
Year of anticipated relinquishment	To be determined closer to closure
Data theme submission ID No.	TBD
Spatial Reference	GDA2020 MGA Zone 56
Plan date (date created)	28/03/2024

I:\401_Clients_GIS\YAN_Yancoal\YAN03_MTW\YAN03_008_MTW_ARRFP_2024\YAN03_008_ARRFP_2024.aprx\ YAN03_008_MTW_Plan1A_CurrentStatusMining_2

Figure 2: Plan 1B - Current Landform Contours



LEGEND

Project Approval Number
- SSD 6464 - Warkworth
- SSD 6465 - Mount Thorley
- ML 1828 - Mount Thorley Coal Loader

Current Landform Contours (5m)
Railway
Major Road
Major Waterways
Electricity Transmission Line

Current Authorisations
- Relevant Minerals Title

0 475 950 1,425 1,900 m

Scale: 1:40,000

Sheet Size : A3

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MT THORLEY WARKWORTH

Source: Project Approval Boundary, contours, watercourses and Current Authorisations from Yancoal (2023).
Roads, electricity transmission lines and railways from LPI (2021).
Aerial imagery from Yancoal (2023).

Mount Thorley Warkworth Complex

Current Landform Contours
PLAN 1B

Mine name	Mount Thorley Warkworth Complex
Plan name	Mount Thorley Warkworth ARR
Year of anticipated relinquishment	To be determined closer to closure
Data theme submission ID No.	TBD
Spatial Reference	GDA2020 MGA Zone 56
Plan date (date created)	12/03/2024

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Disturbance and Rehabilitation Statistics

Table 3: Current Disturbance and Rehabilitation Progression Calendar Year 2023

	Annual Reporting Period	This report
A	Total disturbance footprint – surface disturbance	4165.76
B	Total active disturbance (Ha)	2746.52
C	Rehabilitation – land preparation (Ha)	37.97
D	Ecosystem and land use establishment (Ha)	1381.28
E	Ecosystem and land use development (Ha)	0
F	Rehabilitation completion (Ha)	0

Table 4: Rehabilitation key Performance Indicators (KPI's) Calendar Year 2023

	Annual Reporting Period	This report
G	Total active disturbance during reporting period (Ha)	106.5
H	Area of land proposed for active rehabilitation during reporting period (Ha)	93.6
I	Established rehabilitation (Ha)	0
J	Annual rehabilitation to disturbance ratio	0.88
K	Ecosystem and land use development (Ha) % Rehabilitation land to total mine footprint	0

Table 5: Progressive Achievement of Established Rehabilitation Calendar Year 2023

	Annual Reporting Period	This report
L	Established rehabilitation for agricultural final land uses (%)	0
M	Established rehabilitation for native ecosystem final land uses (%)	0
N	Established rehabilitation for other/ non-vegetated final land uses (%)	0

4.1 VARIATION TO THE REHABILITATION SCHEDULE

Identify the components of the most recent forward program that were not achieved.

The rehabilitation forecast in the 2023 Forward Program was 90.01ha and the amount of rehabilitation (Ecosystem and Land Use Establishment) undertaken during the reporting period was 93.6ha.

The disturbance forecast in the 2023 Forward Program was 90.68ha and the amount of disturbance undertaken during the reporting period was 106.5ha.

The quantity and location of rehabilitation and disturbance was generally consistent with the Forward Program projections.

Key factors that have delayed the progressive rehabilitation.

None required.

Outline actions to minimise disturbance and undertake progressive rehabilitation.

Dump scheduling has been undertaken by Medium Term Planning team to identify the timing of dump releases for the Forward Program period. Carryover of dump release and bulk shaped areas is planned each year to provide rehabilitation crews with consistent work through the year.
New disturbance is planned by Medium Term Planning team to minimise disturbance while supporting mine progression.

5.0 REHABILITATION MONITORING AND RESEARCH FINDINGS

5.1 REHABILITATION MONITORING

No rehabilitation monitoring was conducted during 2023 due to due to Rehabilitation Objectives (ROBJ's) for MTW awaiting approval. The MTW ROBJ's were approved by Resources Regulator in December 2023 and this prompted the preparation of an updated RMP to incorporate the approved ROBJ's. The proposed Performance Criteria associated with these ROBJ's were also included in the updated RMP and these will form the basis of the rehabilitation monitoring that will be undertaken in 2024.

A total of 76 rehabilitation inspections were undertaken during 2023 to determine maintenance requirements related to vegetation establishment, weed management, water management and other management (i.e. disturbance, rubbish, vertebrate pest management etc.). These inspections were used to guide rehabilitation maintenance activities undertaken during 2023.

5.2 STATUS OF PERFORMANCE AGAINST REHABILITATION OBJECTIVES AND REHABILITATION COMPLETION CRITERIA

Previous monitoring methods incorporated and addressed the requirements specified in MTW RMP (2022). This included: a combination of plot-based monitoring in accordance with the NSW BioBanking Assessment Method (BBAM) (to assess native vegetation) together with walkover inspections of

rehabilitation areas to detect potential issues occurring at the broader scale; Landscape Functional Analysis; soil assessment (chemical/nutrition and microbial); and native canopy development.

Are all rehabilitation areas in the Landform Establishment phase or higher represented in the monitoring program

Yes

Include an appraisal of whether rehabilitation is moving towards achieving the proposed rehabilitation objectives, rehabilitation completion criteria and final landform and rehabilitation plan

Ecological monitoring reports from 2022 indicate that recent rehabilitation at the Northern area at MTW is progressing towards the target vegetation communities, with no evidence of disease or die-back recorded. Species richness was recorded as moderate to low in the Central rehabilitation area, with MTW to increase rehabilitation efforts in this area to achieve the target vegetation communities required.

Most of the Southern area provided moderate to high native species richness with one site exceeding the benchmark value providing evidence of good potential resilience through a diversity of native species and good native ground cover. One site provided the lowest native species richness score, due to the area being established within 12 months. This site is likely to improve over time with appropriate weed control. The canopy cover was low at all sites which is expected in early-stage rehabilitation.

A total of 229 plant species were recorded across all monitoring sites in 2022, including 175 native species and 54 weed species. The most speciose family was Poaceae (grasses) with 53 species recorded, followed by Fabaceae (including subf. Faboideae (peaflowers) and subf. Mimosoideae (wattles)) with 33 species and Asteraceae with 31 species.

Please select the best description of the appraisal

Regulator Portal Options	**MTW Selection**
Rehabilitation is moving towards achieving the final land use as soon as reasonably practicable.	
There are performance issues preventing rehabilitation moving towards achieving the final land use as soon as reasonably practicable.	X

Summarise the findings of the Rehabilitation Monitoring Program,

A total of 43 flora monitoring sites were assessed between the Northern, Central and Southern Rehabilitation Areas. The rehabilitation sites in the northern area generally provided evidence of good resilience through high diversity of native species and good native ground cover in many of the areas surveyed. This is a good indicator of the ability of the sites monitored in 2022 to progress towards the target vegetation community.

The central area provided moderate native ground cover (grasses, shrubs and other) for most sites. This shows good potential resilience following control of invasive grass species.

All sites provided poor native canopy cover; however, tree species were recorded between two and seven species at each plot. This indicates that a canopy is likely to establish over time at most sites. The mid-layer (shrubs) are developing in the southern area with seven sites achieving a higher shrub cover than the average of the reference sites. The shrub layer cover is likely to improve over time with appropriate weed control.

Based on collected monitoring results and observations, management recommendations have been suggested to improve the condition of rehabilitation areas and ensure they are trending towards the defined final land use objectives.

Identify any performance issues

The rehabilitation monitoring report (2022) outlines the following:

- Appropriate weed management of invasive grassland species and appropriate cover in shrub and canopy layer will allow site to progress towards target vegetation community;
- High Threat Exotic (HTE) weed species pose a significant threat to the development of the target vegetation community.
- Thinning should be undertaken surrounding NPN202001 due to the dense cover of spotted gum.
- Create a fallen timber corridor through the rehabilitation areas, this will provide refuge and potential habitat for mammals, reptiles, and frogs across the rehabilitation area.
- Review the seed mix used to ensure that appropriate species and rates are being applied to new rehabilitation area.

5.3 OUTCOMES OF REHABILITATION RESEARCH AND TRIALS

Table 6: List of Active Rehabilitation Research and Trials

No.	Project/Trial Name	Objective of Trial Project	Methodology	Expected Date of Completion
2	Compost Type Trial (Spoil/Compost Application)	Rehabilitation trials to test if different types of compost result in improved native vegetation establishment in spoil/compost applications	Application of 3 types of compost: Remondis (coarse), Remondis (with fines), Bettergrow (with Biosolids) to a rehabilitation area with mine spoil as growth medium. Trial areas seeded with diverse native seed mix and monitored to detect differences in native vegetation establishment.	30/06/2024

Table 7: List of Inactive Rehabilitation Research and Trials

No.	Project/Trial Name	Objective of Trial Project	Methodology	Expected Date of Completion
1	Bursaria spinosa Germination trial	Germination testing: 1) if freezing pre-treatment of seed improves germination rates; and 2) if germination rates in MTW topsoil's and spoils are comparable to seed raising mix.	Subject seed to freezing temps pre-treatment and run a germination trial with the following treatments: Provenance 1(Hunter Valley) control/seed raising mix; Prov. 1 freeze treatment/seed raising mix; Prov. 1 freeze treatment/typical MTW topsoil; Prov. 1 freeze treatment/typical MTW spoil/ameliorant. Provenance 2(Coonabarabran) control/seed raising mix; Prov. 2 freeze treatment/seed raising mix; Prov 2 freeze treatment/typical MTW topsoil; Prov. 2 freeze treatment/typical MTW spoil/ameliorant.	30/11/2023

Appendix 8:

Local and Regional Biodiversity Areas Annual Compliance Reports

Local Biodiversity Areas

Annual Report 2023

Annual report for the period from January to December 2023, for activities described in the Management Plans for all Local Warkworth Mining Limited offsets including:

- Southern Biodiversity Area (including the Putty Road Offset Area)
- Northern Biodiversity Area

Table of Contents

Revision

Version No.	Version Details	Document Status	Date
1.0	**Environment and Community Advisor**	**Final**	**28/03/2024**

1 INTRODUCTION

This annual report is a requirement of the management plans for all Local Warkworth Mining Limited offsets for the 2023 reporting period (1 January 2023 to 31 December 2023).

The report provides a summary of the key management activities completed across the biodiversity offset located within the Southern (includes the Putty Road Offset Area) and Northern Biodiversity Areas (BAs).

The management plans describe the conservation management strategies and monitoring to achieve, and measure improvement and protection of the offset's biodiversity values. It is a compliance requirement of the Commonwealth and NSW environmental approvals to implement the management plans.

The Local OMP (November 2014) was prepared to satisfy the consent requirements for the New South Wales (NSW) Warkworth Mine Development Approval (DA 300-9-2002i) and replaces the former *Flora and Fauna Management Plan* and *Warkworth Sands Woodland (WSW) Offset Area OMP*. In November 2015 the NSW Warkworth Continuation Project Approval (SSD-6464) was granted providing both NSW and Commonwealth approval for the same disturbance area. Phase 2 of the EPBC2009/5081 action also commenced on 16 February 2016. In response to the granting of these new approvals, new Management Plans for the Southern and Northern BA have been prepared to satisfy the Commonwealth approval EPBC2009/5081 and the NSW consent (SSD-6464), replacing both the Local and Putty Road OMPs.

The Biodiversity Offset Portal contains the supporting documentation for this report, including photo point monitoring. Access to the portal is restricted, relevant regulators have been provided with login details; please contact Mount Thorley Warkworth should you require assistance.

2 LOCATION AND LANDHOLDER DETAILS

The locations of the local BAs are shown in **Figure 1**, **Figure 2** and **Figure 3**, details are provided in **Table 1**.

Table 1 Local Biodiversity Areas

Biodiversity Area	Land Owner	Area (ha)	Offset Area (ha)	Location
Northern BA	Coal & Allied Operations Pty Ltd	344	341	Approximately 7km north of the Warkworth Mining Lease and in close proximity to the Hunter Valley Operations. Accessed via Comleroi Road.
Southern BA (including the Putty Road Offset)	Coal & Allied Operations Pty Ltd Miller Pohang Coal Company Pty Ltd Warkworth Mining Limited	1,023	986	Immediately west and north of Warkworth Mine. Intersected by Putty Road in the south, and Wallaby Scrub Road and the Golden Highway in the north.

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Location of the Warkworth Mining Limited Biodiversity Areas

Annual Compliance Report

Figure 1

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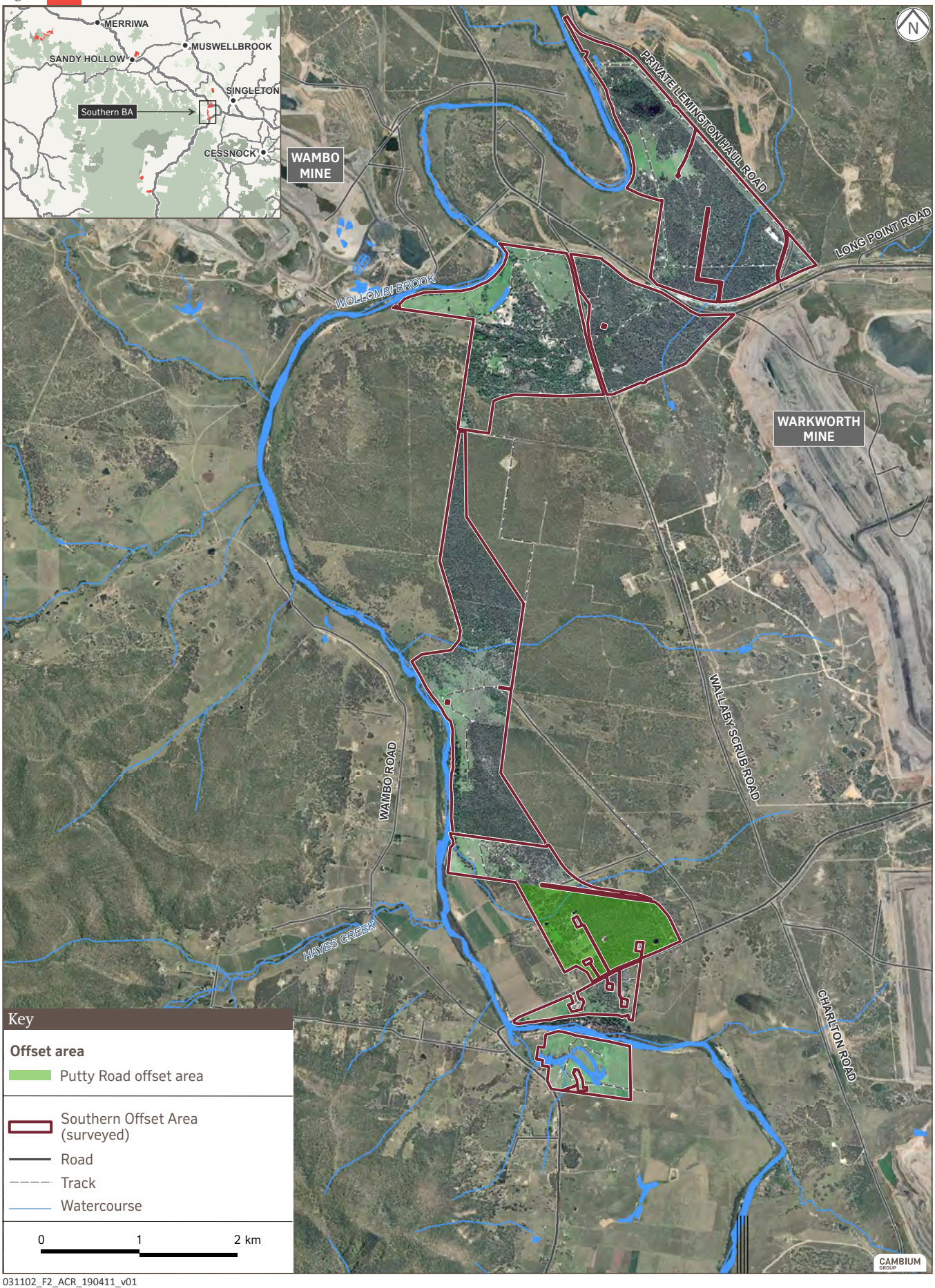
Southern Biodiversity Area - Putty Road offset area

Annual Compliance Report

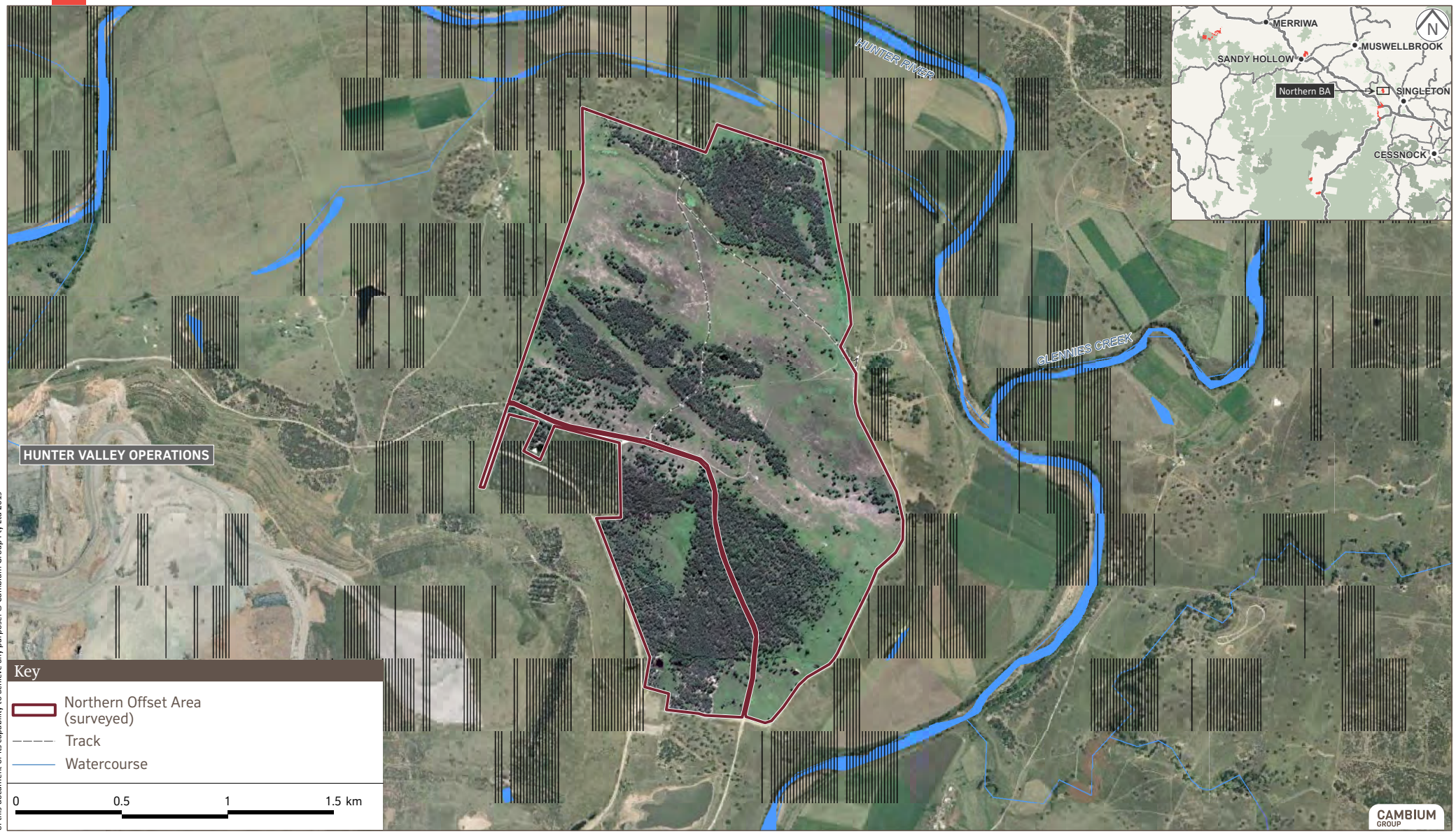
Figure 2



Northern Biodiversity Area

Annual Compliance Report

Figure 3



3 SUMMARY OF ACTIVITIES – 2023

Table 2 provides a summary of the activities undertaken during the reporting period (Year 7) and the progress in attaining the Performance Criteria for the key Conservation Management Strategies in the management plans.

3.1 Summary of climatic conditions

Figure 4 and **Figure 5** show the monthly actual rainfall compared to the long-term average for the Northern BA and Southern BA for the reporting period. In 2023, rainfall was above average for March and December with minimal rainfall in May, June, July and September. The Southern BA received ~560mm of rainfall which was 138mm below the long-term average and the Northern BA received ~525mm which was 150mm below the long-term average. The low rainfall was a significant factor that needed to be accounted for to help ensure the survival of the Warkworth Sands Woodland tube stock planted in May 2023 i.e. through sufficient follow up watering.

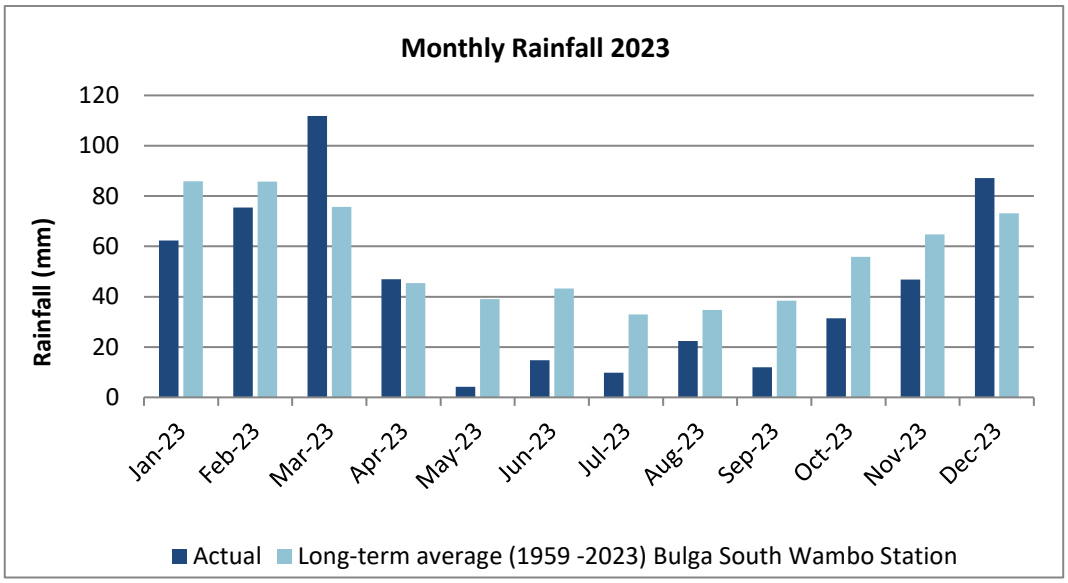


FIGURE 4 MONTHLY RAINFALL – NORTHERN BA

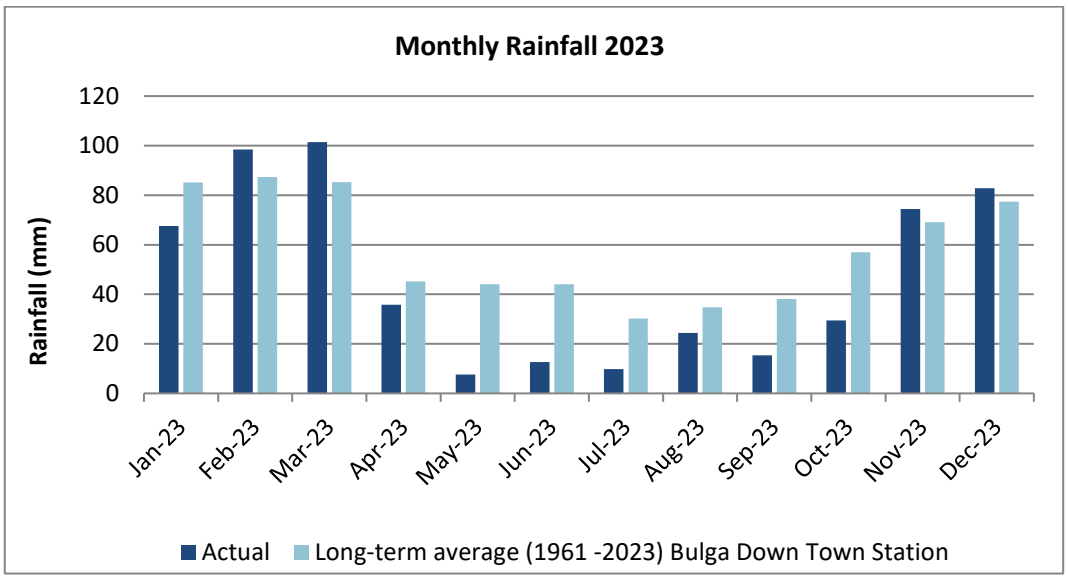


FIGURE 5 MONTHLY RAINFALL –SOUTHERN BA

Table 2 Summary of progress against Performance Criteria

Conservation Actions	Year 1 to Year 5	Year 6 to Year 10 (2023 is Year 7)	Completion Criteria	Actions 2024
ACTIVE RESTORATION				
Southern BA WSW planting (40ha)				
Performance Criteria	*Collection of seed. Plant propagation. Tubestock planted.* *Completed survival assessment.*	*Biennial ecological monitoring completed*	*Ecological monitoring demonstrates a trajectory toward the reference site or the benchmark values for HU872 for all attributes measured over the three consecutive assessments (the average of all plots).*	
Activity / Progress	Seed collection and plant propagation was undertaken. In 2017 1ha of WSW tubestock was planted in the Southern BA. In 2018 14 ha of WSW tubestock was planted in the Southern BA including replanting the sand quarry and old orchard areas. In 2019 maintenance of planting areas was undertaken and included infill planting of over 9,000 tubestock. In 2020 maintenance of planting areas was undertaken and included infill planting of over 2,000 tubestock. Survival assessments were completed for all planting areas.	Seed collection and plant propagation was undertaken. In 2022 planting of tubestock included 3,000 WSW tubestock in the grassland area of Southern BA1 and infill planting of 4,400 tubestock throughout the Southern BA. Ecological monitoring undertaken in 2022. In 2023 planting of tubestock included 800 WSW tubestock in the grassland area of Southern BA1. Survival assessment completed for planting areas.		Propagate plants. Undertake survival assessments. Undertake infill planting to restore Warkworth Sands Woodland in the Southern BA. Undertake Ecological monitoring.

Conservation Actions	Year 1 to Year 5	Year 6 to Year 10 (2023 is Year 7)	Completion Criteria	Actions 2024
Southern BA CHGBIW planting (240ha)				
Performance Criteria	*Collection of seed. Plant propagation. Tubestock planted.* *Completed survival assessment.*	*Biennial ecological monitoring completed.*	*Ecological monitoring demonstrates a trajectory toward the reference site or the NSW Biometric HU817 for all attributes measured over three consecutive assessments (the average of all plots).*	
Activity / Progress	Seed collection and plant propagation was undertaken. Restoration activities included tubestock planting of Central Hunter Grey Box – Ironbark Woodland in the Southern BA. In 2017, 89 ha of the Southern BA was planted with over 13,000 tubestock planted into rip lines. In 2018 118 ha of the Southern BA was planted with over 20,000 tubestock planted into rip lines. In 2019 maintenance of planting areas was undertaken and included infill planting of over 10,000 tubestock. In 2020 maintenance of planting areas was undertaken and included infill planting of over 3,800 tubestock. In 2021 maintenance of planting areas was undertaken and included infill planting of 9,000 tubestock. The site preparation for these sites included ripping by dozer and weed control. To mimic nature the tree species were planted at a spacing of 5 -10m and shrubs species planted in clumps as commonly found with understory species within this vegetation type. All plants were watered, fertilised and protected with a tree guard. Survival Assessments were completed for all planting areas.	Seed collection and plant propagation was undertaken. In 2022 maintenance of planting areas was undertaken and included infill planting of 7,000 tubestock. Ecological monitoring undertaken in 2022.		Propagate plants. Undertake survival assessments. Undertake infill planting of Central Hunter Grey Box – Ironbark Woodland in the Southern BA. Undertake Ecological monitoring.

Conservation Actions	Year 1 to Year 5	Year 6 to Year 10 (2023 is Year 7)	Completion Criteria	Actions 2024
Southern BA ROF planting (26ha)				
Performance Criteria	*Collection of seed. Plant propagation. Tubestock planted.* *Completed survival assessment.*		*Survival assessment greater than 70%*	
Activity / Progress	Seed collection and plant propagation was undertaken. Restoration activities included planting River Oak Forest in the Southern BA. In 2018, 11ha of the Southern BA was planted with over 2,000 tubestock planted into rip lines. In 2019 maintenance of planting areas was undertaken and included infill planting of over 800 tubestock. In 2020 maintenance of planting areas was undertaken and included infill planting of 3,200 tubestock. In 2021 maintenance of planting areas was undertaken and included infill planting of 4,000 tubestock. The site preparation for this site included ripping by dozer and weed control. To mimic nature the tree species were planted at a spacing of 5 -10m and shrubs species planted in clumps as commonly found with understory species within this vegetation type. All plants were watered, fertilised and protected with a tree guard. Survival Assessments were completed for all planting areas.	In 2022 maintenance of planting areas was undertaken and included infill planting of 5,000 tubestock. Seed collection and plant propagation was undertaken. .		Propagate plants. Undertake survival assessments. Undertake infill planting of River Oak Forest in the Southern BA. Undertake Ecological monitoring.
Northern BA WSW planting (195ha)				
Performance Criteria	*Collection of seed. Plant propagation. Tubestock planted.* *Completed survival assessment.*	*Biennial ecological monitoring completed.*	*Ecological monitoring demonstrates a trajectory toward the reference site or the benchmark values for HU872 for all attributes measured over three consecutive assessments (the average of all plots).*	

Activity / Progress	Seed collection and plant propagation was undertaken. Restoration activities included planting Warkworth Sands Woodland in the Northern BA. In 2014 work commenced to restore over 80 hectares of Warkworth Sands Woodland, this involved the planting of seedlings and the relocation of sand salvaged ahead of mining activities. In 2017, 10,800 tubestock were planted into 44 50x50m patches. Topsoil from ahead of mining operations at MTW was salvaged and hauled to the Biodiversity Area prior to planting commencing. In total Ten patches received 50mm of topsoil over the whole patch, two received 50mm of topsoil over half the patch, 12 received 25mm of topsoil over the patch and ten received no topsoil. Holes were dug for tubestock, either by hand or auger and all plants were watered, fertilised and protected with a tree guard. In 2018 maintenance of planting areas was undertaken and included infill planting of over 8,000 tubestock. In 2019 maintenance of planting areas was undertaken and included infill planting of over 3,000 tubestock. In 2020 planting progressed at the Northern BA with 9,112m³ of WSW sand stripped ahead of mining at MTW and hauled to the Northern Biodiversity Area. 5,480m³ of this WSW sand was spread into strips and seeded with native grasses to increase the groundcover diversity then planted with 4,500 tubestock In 2021 WSW planting progressed with 3,632 m³ of sand from ahead of mining at MTW spread into strips and seeded with native grasses then planted with 1,500 tubestock. Survival Assessments were completed for all planting areas A separate Ecological monitoring program was undertaken in 2021 to capture the WSW planting areas.	Seed collection and plant propagation was undertaken. In 2022 maintenance of planting areas was undertaken and included infill planting of 3,400 WSW tubestock. Ecological monitoring undertaken in 2022. Planting of 10,000 Warkworth Sands Woodland tube stock was delayed due to access issues transporting sand into the planting areas, this was rescheduled for 2023. In 2023, WSW planting progressed with ~5000 m³ of WSW sand stripped from ahead of mining at MTW and hauled to the Northern Biodiversity Area. This WSW sand was spread into strips and more broadly in some areas, seeded with native grasses and then 10,000 WSW tubestock were planted into the planting areas. Survival Assessments were completed for planting areas.	Propagate plants. Undertake survival assessments Undertake track maintenance to allow sand to be transported to the planting areas. Spread topsoil from ahead of mining operations at MTW into the Northern BA planting areas. Undertake planting of 14,000 Warkworth Sands Woodland tube stock, which was delayed from 2023 . Undertake survival assessments. Undertake Ecological monitoring.

Conservation Actions	Year 1 to Year 5	Year 6 to Year 10 (2023 is Year 7)	Completion Criteria	Actions 2024
Northern BA CHGBIW planting (23ha)				
Performance Criteria	*Collection of seed. Plant propagation. Tubestock planted.* *Completed survival assessment.*	*Biennial ecological monitoring completed.*	*Ecological monitoring demonstrates a trajectory toward the reference site or the NSW Biometric HU817 for all three attributes measured over three consecutive assessments (the average of all plots).*	
Activity / Progress	Restoration activities included tubestock planting of Central Hunter Grey Box – Ironbark Woodland in the Northern BA. In 2017, 6ha of the Northern BA was planted with 2,780 tubestock planted into rip lines. The site preparation for this site included ripping by dozer and weed control. To mimic nature the tree species were planted at a spacing of 5 -10m and shrubs species planted in clumps as commonly found with understory species within this vegetation type. All plants were watered, fertilised and protected with a tree guard. In 2018 maintenance of planting areas was undertaken and included infill planting. Survival Assessments were completed for all planting areas.	Ecological monitoring undertaken in 2022.		Undertake Ecological monitoring.

Conservation Actions	Year 1 to Year 5	Year 6 to Year 10 (2023 is Year 7)	Completion Criteria	Actions 2024
PASSIVE RESTORATION				
Weed control and monitoring				
Performance Criteria	*At least two weed control events each year for species listed in Table 14 of Management Plans* *and other weeds recorded from monitoring activities.* *All actions recorded in Annual Report.* *Complete Rapid Condition Assessments and* *Property Inspections.*	*At least one weed control event each year for species listed in Table 14 of Management Plans and other weeds recorded from monitoring activities.* *All actions recorded in Annual Report.* *Complete Rapid Condition Assessments and Property Inspections.*	*Ecological monitoring data indicates a trajectory for reduction in exotic plant cover over three consecutive assessments.*	

Conservation Actions	Year 1 to Year 5	Year 6 to Year 10 (2023 is Year 7)	Completion Criteria	Actions 2024
Activity / Progress	Weed contractor engaged to undertake weed control activities at the Northern and Southern BA throughout the year. Rapid Condition Assessment and Property Inspections were completed.	In 2023 weed control targeted the following species: African boxthorn (*Lycium ferocissimum),* African lovegrass *(Eragrostis curvulva),* African olive (*Olea europaea),* Bidens (*Bidens pilosa),* Blue and Scarlet Pimpernel (*Anagallis arvensis* sp.), Blue heliotrope *(Heliotropium amplexicaule),* Brazilian nightshade (*Solanum seaforthianum),* Bridal creeper (*Asparagus asparagoides),* Coolatai grass (*Hyparrhenia hirta),* Evening Primrose (*Oenothera stricta),* Galenia (*Galenia pubescens),* Golden wreath wattle (*Acacia saligna),* Green cestrum (*Cestrum parqui),* Groundsel Bush (*Baccharis halimifolia),* Inkweed (*Phytolacca octandra),* Lantana *(Lantana camara),* Mexican Poppy (*Argemone mexicana),* Moth vine (*Araujia sericifera),* Mother of millions (*Bryophyllum delagoense),* Paterson's Curse (*Echium plantagineum),* Prickly pear (*Opuntia stricta),* Prickly Poppy (*Argemone ochroleuca),* Red Natal Grass (*Melinis repens),* Sheep Sorrel (*Rumex acetosella),* Silky oak *(Grevillea robusta),* Stinking roger (*Tagetes minuta),* Telegraph weed *(Heterotheca grandiflora),* Tiger Pear (*Opuntia aurantiaca),* Twiggy Mullein (*Verbascum virgatum),* Vipers Bugloss (*Echium vulgare),* Whisky Grass (*Andropogon virginicus).* Rapid condition assessments and property inspections were completed.		Control noxious species and stop weeds spreading into previously un-infested areas. Undertake Rapid Condition Assessments. Undertake Property Inspections.

Conservation Actions	Year 1 to Year 5	Year 6 to Year 10 (2023 is Year 7)	Completion Criteria	Actions 2024
Pest control and monitoring				
Performance Criteria	*At least two control events each year for species listed in Table 20 of Management Plans, and any other species recorded from monitoring activities.* *Active participation in programme coordinated by Hunter Local Land Service (HLLS), this may include local control actions.* *Complete biannual inspection and report all works completed and actions for next year.*	*At least one control events each year for species listed in Table 17 of Management Plans, and any other species recorded from monitoring activities.* *Active participation in programme coordinated by HLLS, this may include local control actions.* *Complete biannual inspection and report all works completed and actions for next year.*	*No observed vertebrate pest or damage.* *Ecological monitoring demonstrates a trajectory to benchmark values for all attributes measured over three consecutive assessments (the average of all plots).*	
Activity / Progress	Vertebrate pest contractor was engaged to undertake programmes across the Southern and Northern BA. Biannual property inspections were undertaken.	In 2022 a vertebrate pest contractor was engaged to undertake programmes across the Southern and Northern BA. In 2023, 1080 ground baiting programmes were undertaken targeting wild dogs and foxes in autumn and spring, across the Southern and Northern BA. Both programmes were coordinated with HLLS and neighbouring landholders across the broader Hunter Valley area. In 2023, a trapping program was undertaken targeting pigs in Spring, across MTW and the Southern BA. Biannual property inspections were undertaken.		Undertake vertebrate pest management including 1080 ground baiting programmes scheduled for autumn and spring to target wild dogs and foxes. Undertake biannual property Inspections.
Grazing				
Performance Criteria	*Grazing is conducted in accordance with the Management Plan.* *Boundary fences maintained.* *Complete Rapid Condition Assessment and Property Inspections.*			

Conservation Actions	Year 1 to Year 5	Year 6 to Year 10 (2023 is Year 7)	Completion Criteria	Actions 2024
Activity / Progress	No strategic grazing was undertaken in the BAs in 2023. Boundary fence repairs/replacements undertaken in the Southern and Northern BA. Property Inspections and Rapid Condition Assessments were undertaken in 2023.			Undertake Property Inspections. Undertake Rapid Condition Assessments. Maintain boundary fences.
Bushfire Management Plan (BFMP), Ecological burn and monitoring				
Performance Criteria	*Actions implemented.* *Review and revise if required.* *Complete Rapid Condition Assessments and* *Property Inspections.*	*Actions implemented.* *Review and revise if required.* *Complete Rapid Condition Assessments and Property Inspections.* *Completed ecological fire management plan for MZ1, MZ3, MZ5, MZ7, MZ8 and MZ9.*	*All required actions of BFMP have been implemented.* *BFMP has been reviewed annually and revised if required.*	
Activity / Progress	BFMP reviewed. Firebreaks were slashed. Property Inspections and Rapid Condition Assessments were undertaken.	BFMP reviewed. Firebreaks were slashed at the Southern BA in 2023. Areas were also slashed at Northern BA related to planting preparation activities but which also served as firebreaks. Property Inspections and Rapid Condition Assessments were undertaken in 2023.		Review BFMP. Undertake Property Inspections. Undertake Rapid Condition Assessments. Undertake fuel load assessments. Slash firebreaks.
Infrastructure Improvements and monitoring				
Performance Criteria	*Completed GDP for all infrastructure improvement actions.* *Maintenance of tracks and fences completed at least every 3 years.* *Property Inspections undertaken.*			.
Activity / Progress	GDP completed for WSW planting programs in the Southern and Northern BA in 2023. Boundary fences maintained, and Property Inspections undertaken in 2023.			Maintain tracks and boundary fences. Undertake Property Inspections
Erosion monitoring inspections and reports				
Performance Criteria	*Complete Rapid Condition Assessment and Property Inspections*			

Conservation Actions	Year 1 to Year 5	Year 6 to Year 10 (2023 is Year 7)	Completion Criteria	Actions 2024
Activity / Progress	Rapid Condition Assessments and Property Inspections undertaken in 2023. An erosion area was identified at the Southern BA and repair works required have been assessed.			Undertake Rapid Condition Assessments. Undertake Property Inspections. Monitor/repair erosion area identified in SBA5
Dam conversion and rehabilitation and monitoring				
Performance Criteria	*Prepare dam conversion plan.* *Dam conversion complete and rehabilitation has stabilised the site.* *Property inspections.*	*Observed natural flow regime and no erosion.* *Property inspections.*	*All works completed.*	
Activity / Progress	Property inspections undertaken. Dam conversion plan prepared.	Property inspections undertaken in 2023.		Implement actions from dam conversion plan. Undertake Property Inspections.
Natural Regeneration and monitoring				
Performance Criteria	Annual weed control, vertebrate pest and fire management actions implemented as per management plans. *Complete Rapid Condition Assessments and Property Inspections.*		*Ecological monitoring demonstrates a trajectory to benchmark values for all attributes measured over three consecutive assessments (the average of all plots).*	
Activity / Progress	Actions implemented in 2023 as per management plans. Rapid Condition Assessments and Property Inspections undertaken in 2023.			Undertake Property Inspections. Undertake annual weed control. Undertake Rapid Condition Assessments.

Conservation Actions	Year 1 to Year 5	Year 6 to Year 10 (2023 is Year 7)	Completion Criteria	Actions 2024
Controlled Activities				
Performance Criteria	*No reported incidents of prohibited actions undertaken Yancoal, contractors, consultants or other agents of Yancoal.* *Any clearing of vegetation reported in Annual Report.* *Signage and locks (where required) maintained.* *Complete risk assessment for any recreation activities.* *All occupants of residents compliant with requirements of the MP.* *No Cultural Heritage sites knowingly disturbed and any protective barricading maintained.* *Damaged and unwanted fences removed.* *All Property Inspections completed.*			
Activity / Progress	In 2017 trespassing and illegal tree clearing and timber getting within the Southern Biodiversity Area resulted in felling approximately 40 full sized trees and 100 small trees. This unauthorised activity was reported to both Department of Environment and Energy and Department of Planning and Environment in October 2017. Internal fences and waste were removed from the Southern BA areas to be planted in 2018 and sections of boundary fence at the Northern BA and Southern BA were repaired and replaced where needed. New Biodiversity Area signs were installed in 2017. Regular property inspections were undertaken. In 2023 there were no reported incidents or prohibited actions undertaken on the Biodiversity Areas. In 2023, sections of boundary fence at the Northern BA and Southern BA were repaired and replaced where needed.			Undertake Property Inspections.

4 MONITORING ACTIVITIES

The following table provides a summary of the monitoring activities undertaken as detailed in the MP. Monitoring reports and results are available on the Biodiversity Offset Portal.

Table 3 Monitoring Activity Summary

Monitoring	2023	Date/s	Completed by
Bird Assemblage	X	July – October 2022, next due July – October 2024	ANU Enterprise
Habitat Restoration	X	September - November 2022, next due September – November 2024	Mosaic Ecology and Cumberland Plain Seeds
Rapid Condition Assessment	X	November and December 2023, next due September – November 2024	Franks Fencing (Land Management Advisor)
Property Inspection	X	April/November/December 2023, next due April/November 2024	Mosaic Ecology Environment Advisor

4.1 Bird assemblages monitoring

Bird assemblage monitoring was not required to be undertaken during 2023. The results from the 2022 bird assemblage monitoring were presented in the 2022 Annual Report for Local Offsets.
The next bird assemblage monitoring is scheduled for July 2024.

4.2 Habitat restoration monitoring

Habitat restoration monitoring was not required to be undertaken during 2023. The results from the last round of habitat restoration monitoring conducted in 2022 were presented in the 2022 Annual Report for Local Offsets.
The next habitat restoration monitoring is scheduled for September 2024.

5 PROGRESS IN ATTAINING CONSERVATION OBJECTIVES AGAINST KEY PERFORMANCE INDICATORS

The primary conservation objectives for the local offset areas (including the Putty Road Offset) are to:

- enhance biodiversity values across the BAs;
- protect the WSW Offset Area and Putty Road Offset Area under a legally binding conservation covenant;
- increase the condition of WSW and Ironbark EECs and observe a transition from grassland to woodland;
- enhance habitat and foraging opportunities for the woodland birds; and
- contribute to and enhance the existing network of protected vegetation within the Hunter Valley.

Table 2 indicates the progress in attainment of the long-term conservation objectives, the ecological monitoring data supports the continued implementation of the conservation management strategies.

6 ADAPTIVE MANAGEMENT

No new environmental risks have been identified during the reporting period.

Table 4 Local Offset Areas Biodiversity Values and Key Performance Indicators

Area	Biodiversity Value	Description and baseline metric	KPI	Progress comment
Southern BA	Ironbark Woodland	Total area: 446.7ha RCA Average Health rating 18/20 (MZ1)	Extent and condition of woodland over 10 years.	RCA results: 2014 – 18/20 2015 – 18/20 2016 – 18/20 2017 – 18.5/20 2018 – 18.5/20 2019 – 18/20 2020 – 17.5/20 2021 – 17.5/20 2022 – 18/20 2023 – 18/20 Area and health maintained.
	Ironbark Grassland	Total area: 258.4ha	Transition of grassland to woodland.	2023 monitoring supports continued implementation of the conservation management strategies.

Area	Biodiversity Value	Description and baseline metric	KPI	Progress comment
	WSW	Total area: 137ha RCA Average Health rating 17.8/20 (MZ3)	Extent and condition of woodland over 10 years.	RCA results: 2014 – 16/20 2015 – 18/20 2016 – 17/20 2017 – 18/20 2018 – 18/20 2019 – 18/20 2020 – 17/20 2021 – 17/20 2022 – 16/20 2023 – 16/20 Area and health maintained.
	WS Grassland	Total area:40.3ha	Transition of grassland to woodland.	

Area	Biodiversity Value	Description and baseline metric	KPI	Progress comment
	Hunter Lowland Red Gum Forest	Total area: 32.4ha RCA Average Health rating 18.6/20 (MZ5)	Extent and condition over 10 years.	RCA results: 2014 – 17/20 2015 – 19/20 2016 – 19/20 2017 – 19/20 2018 – 18.5/20 2019 – 18.5/20 2020 – 19/20 2021 - * 2022 - * 2023 – 18/20 *Sites were inaccessible due to flooding
	Fauna Habitat	Low potential habitat	Observe maintenance or increase habitat condition rating over 10 years	2023 monitoring supports continued implementation of the conservation management strategies.
Northern BA	Ironbark Woodland	Total area: 103.6ha RCA Average Health rating 18.6/20 (MZ1)	Extent and condition of woodland over 10 years.	RCA results: 2014 – 18/20 2015 – 18.5/20 2016 – 19.5/20 2017 – 19.5/20 2018 – 18/20 2019 – 18/20 2020 – 19/20 2021 – 19/20 2022 – 18.5/20 2023 - 18.5/20 Area and health maintained.

Area	Biodiversity Value	Description and baseline metric	KPI	Progress comment
	Ironbark Grassland	Total area: 23.1ha	Transition of grassland to woodland.	
	WSW	Total area: 19.5ha RCA Average Health rating 18.5/20 (MZ3)	Maintain woodland extent over 10 years.	RCA results: 2014 – 17.5/20 2015 – 18/20 2016 – 19/20 2017 – 19/20 2018 – 18.5/20 2019 – 18.5/20 2020 – 19/20 2021 – 18.5/20 2022 – 18.5/20 2023 – 18.5/20 Area and health maintained.
	WS Grassland	Total area: 194.5	Transition of grassland to woodland	2023 monitoring supports continued implementation of the conservation management strategies.
	Fauna Habitat		Observe maintenance or increase habitat condition rating over 10 years	2023 monitoring supports continued implementation of the conservation management strategies.

Regional Biodiversity Areas

Annual Report 2023

Annual report for the period from January to December 2023, for activities described in the Management Plans for all regional Warkworth Mining Limited offsets including:

- Goulburn River Biodiversity Area
- Seven Oaks Biodiversity Area
- Bowditch Biodiversity Area
- Putty Biodiversity Area
- Condon View Biodiversity Area
- North Rothbury Biodiversity Area

Note that a portion of Condon View Biodiversity Area is an offset for Hunter Valley Operations to satisfy conditions of the Commonwealth approval EPBC 2016-760.

Table of Contents

Revision

Version No.	Version Details	Document Status	Date
1.0	**Environment and Community Advisor**	**Final**	**28/03/2024**

1 INTRODUCTION

This annual report is a requirement of the Management Plans for all regional Warkworth Mining Limited offsets for the 2023 reporting period from 1 January through to 31 December 2023.

The annual report provides a summary of the key management activities completed across the biodiversity offsets located within the Goulburn River, Seven Oaks, Bowditch, Putty, Condon View and North Rothbury Biodiversity Areas (BAs).

The management plans describe the conservation management strategies and monitoring to achieve, and measure improvement and protection of the offset's biodiversity values. It is a compliance requirement of the Commonwealth and NSW environmental approvals to implement the management plans.

The Regional Offset Management Plan (ROMP) was prepared to satisfy the consent requirements for the New South Wales (NSW) Hunter Valley Operations (HVO) South Project Approval (PA 06_0261) and the Warkworth Mine Commonwealth EPBC 2002/629 Approval. In November 2015, the NSW Warkworth Continuation Project Approval (SSD-6464) was granted providing both NSW and Commonwealth approval for the same disturbance area. Phase 2 of the EPBC2009/5081 action also commenced on 16 February 2016. In response to the granting of these new approvals, new Management Plans for the Bowditch and Goulburn River BA's have been prepared to satisfy the Commonwealth approval EPBC2009/5081 and the NSW consent (SSD-6464), replacing the ROMP. On 10 October 2016 HVO was granted approval (EPBC2016/7604), The Condon View BA provides 168ha of suitable direct offset to be compliant with this approval. Management Plans have also been prepared and submitted for the new regional BAs: Seven Oaks, Putty, Condon View and North Rothbury.

The Biodiversity Offset Portal contains all the supporting documentation for this report, including photo point monitoring. Access to the portal is restricted, relevant regulators have been provided with login details; please contact Mount Thorley Warkworth should you require assistance.

2 LOCATION AND LANDHOLDER DETAILS

The locations of the regional BAs are shown in **Figure 1**, further details are provided in **Table 1**. The land is owned by Warkworth Mining Limited (WML). The Goulburn River and Condon View BAs are owned by Warkworth Mining Limited and have a portion of the total area designated as an offset for Hunter Valley Operations (HVO). Details of the Warkworth Offset and HVO Offset areas are in **Table 2 and Figure 1, 2 and 3**.

Table 1 Regional Biodiversity Areas

Biodiversity Area	Local Government Area	Land Owner	Area (ha)	Offset Area (ha)	Location
Goulburn River	Upper Hunter / Mid-Western	Warkworth Mining Limited	1,539	1,206	'The Rivers' 30km west of Merriwa, via Dulhunty Road, Comialla Road and Golden Hwy.
Bowditch	Muswellbrook	Warkworth Mining Limited	607	602	3km north of Sandy Hollow, 3450 Wybong Road, via Golden Hwy.
Seven Oaks	Mid-Western	Warkworth Mining Limited	521	519	35km west of Merriwa via Ulan Road, Summer Hill Road, Durridgerie Road and Smedes Road.
Condon View	Singleton	Warkworth Mining Limited	553	345	5km west of Putty via Box Tree Clearing Trail off Putty Valley Road.
Putty	Singleton	Warkworth Mining Limited	386	383	5km south of Putty via Box Gap Road.
North Rothbury	Cessnock	Warkworth Mining Limited	41	41	1km south of North Rothbury via Wine Country Drive.

Table 2 Goulburn River and Condon View Biodiversity Areas

Biodiversity Area	Land Owner	Area (ha)	Warkworth Offset Area (ha)	HVO Offset Area (ha)
Goulburn River	Warkworth Mining Limited	1,539	1,066	140
Condon View	Warkworth Mining Limited	553	345	168

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Location of the Warkworth Mining Limited Biodiversity Areas

Annual Compliance Report

Figure 1

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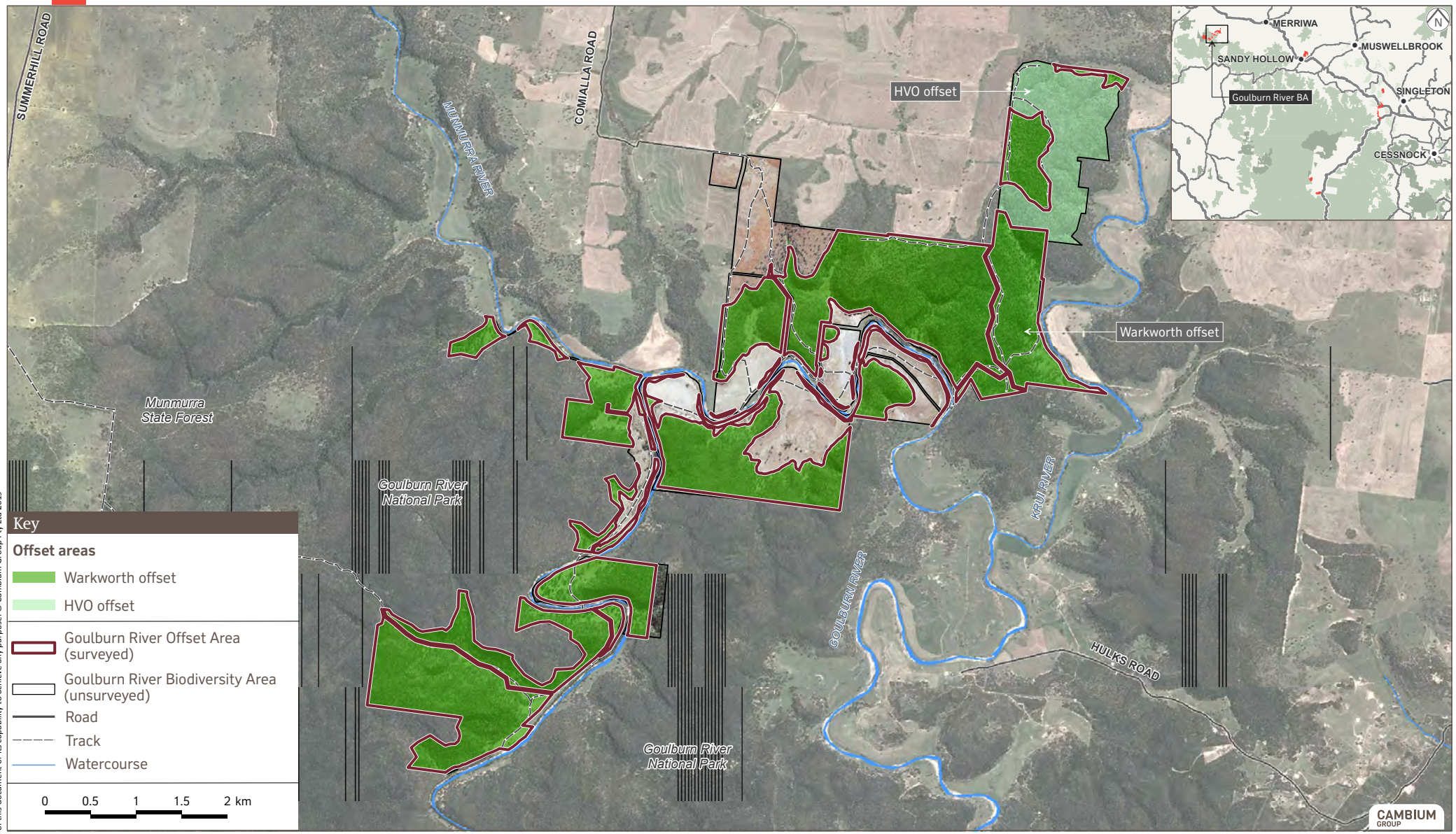
YANCOAL 兖煤澳大利亚有限公司

Offset areas at the Goulburn River Biodiversity Area

Annual Compliance Report

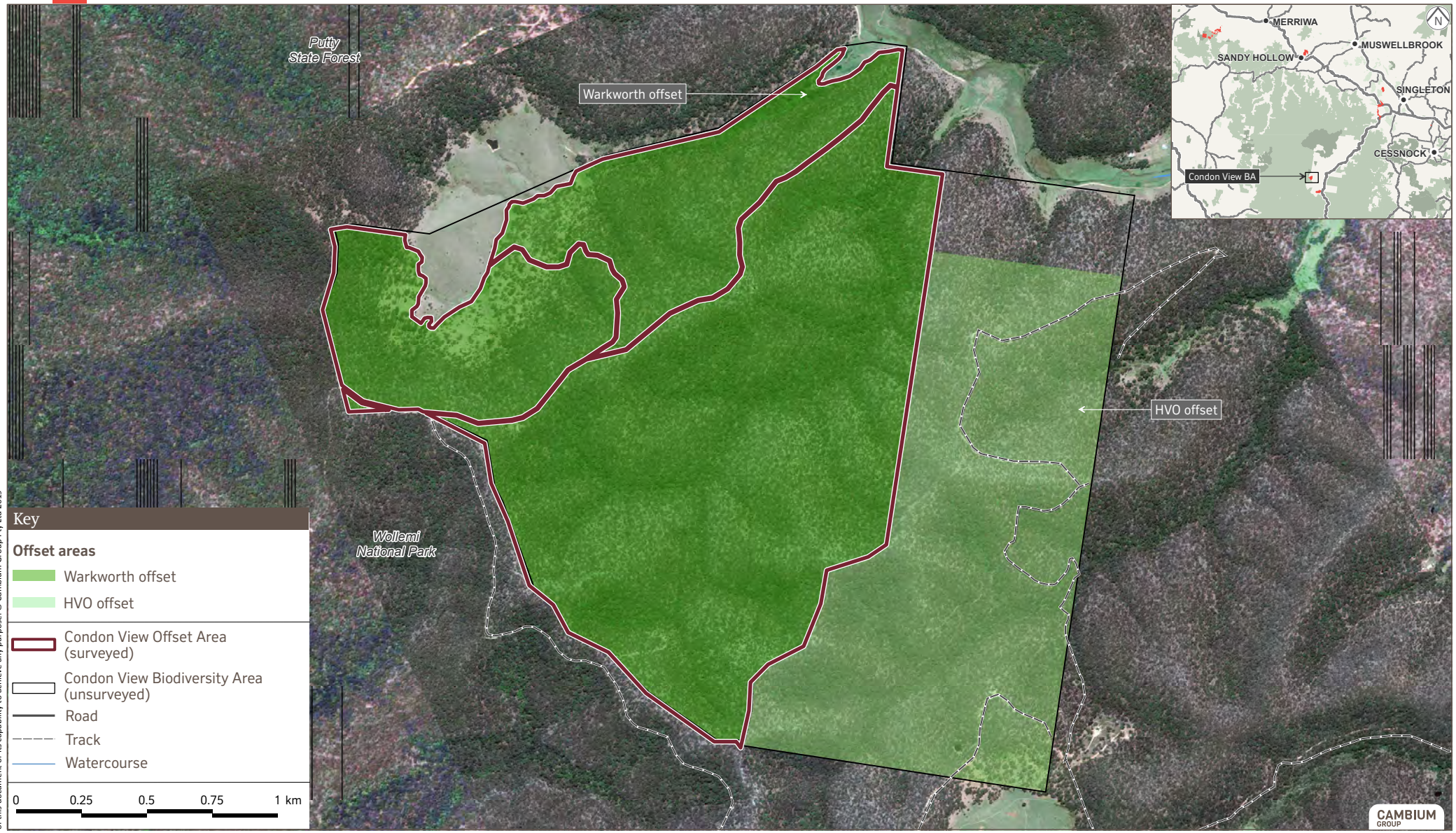
Figure 2



Offset areas at the Condon View Biodiversity Area

Annual Compliance Report

Figure 3



3 SUMMARY OF ACTIVITIES – 2023

Table 3 provides a summary of the activities undertaken during the reporting period (Year 7) and the progress in attaining the Performance Criteria for the key Conservation Management Strategies in the management plans.

3.1 Summary of climatic conditions

Figure 4 shows the monthly actual rainfall compared to the long-term average for the regional Biodiversity Areas for the reporting period. In 2023, monthly rainfall was generally below the long term average. The Putty region received 431mm which was 306mm below the long-term average. North Rothbury received 638mm, 97mm below the long-term average. Sandy Hollow received 378mm which was 210mm below the long-term average and the Merriwa region received 368mm, 229mm below the long-term average.

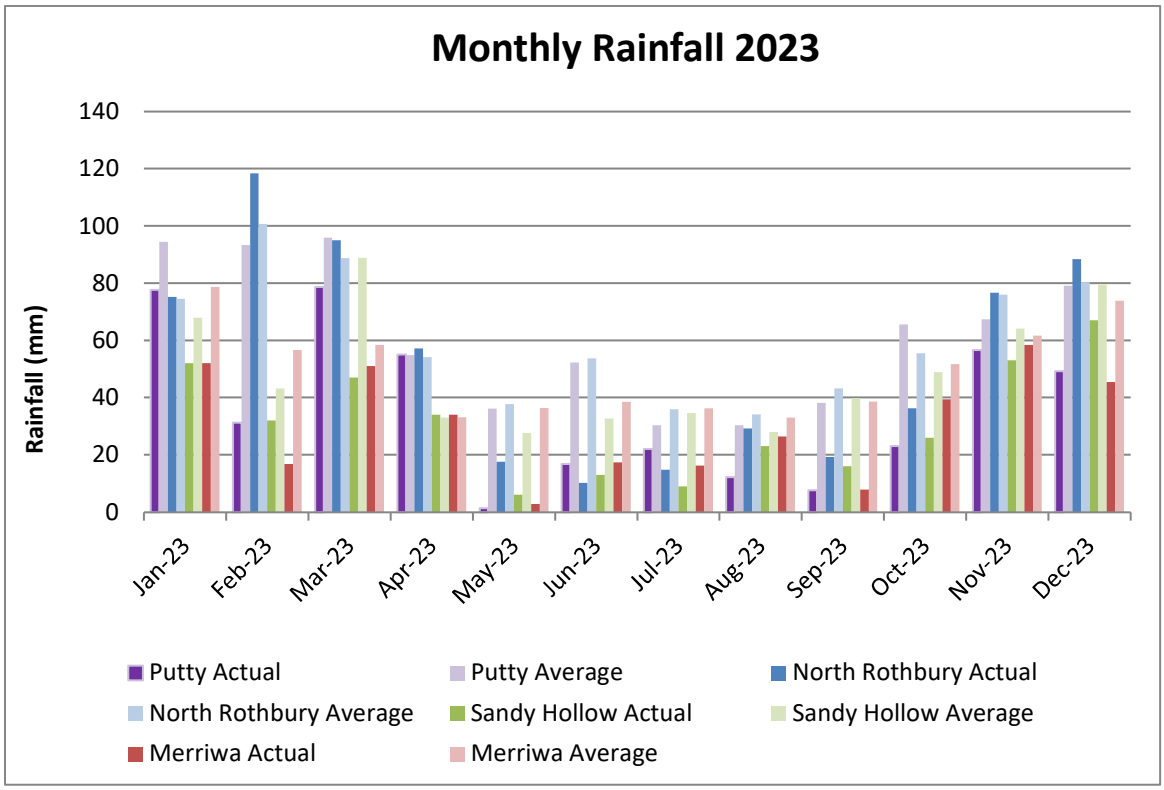


FIGURE 4 MONTHLY RAINFALL - 2023

Table 3 Summary of progress against Performance Criteria

Conservation Actions	Year 1 to Year 4	Year 5 to Year 10 (2023 is Year 7)	Completion Criteria	Actions 2024
ACTIVE RESTORATION				
Goulburn River BA Yellow Box – Grey Box – Red Gum grassy woodland (21.5ha) and River Oak riparian woodland (24.2ha)				
Performance Criteria	*Collection of seed. Plant propagation. Tubestock planted.* *Completed survival assessment.*		*Planting achieves above 70% survival.*	
Activity / Progress	Seed collection was undertaken at the Goulburn River BA in 2021. In 2019 17,000 tube stock was planted into 21.5ha of Yellow Box-Red Gum grassy woodland and 24.2ha of River Oak riparian woodland. The site preparation for these sites included ripping by dozer and weed control. To mimic nature the tree species were planted at a spacing of 5 -30m. All plants were watered, fertilised and protected with a tree guard. In 2020 maintenance of planting areas was undertaken and included infill planting of 12,000 tubestock. Survival assessments undertaken.	In 2021 maintenance of planting areas was undertaken and included infill planting of 12,000 tubestock into areas that could be accessed. In 2022 planting of 10,000 tube stock was delayed due access issues crossing the Goulburn River. In 2023 maintenance of planting areas was undertaken and included infill planting of 10,000 tubestock into areas that could be accessed.		Propagate plants. Undertake survival assessments.
All Regional Bas				
Performance Criteria	*Review monitoring data to identify areas that require re-planting.* *If re-planting is identified, develop a re-establishment plan and implement within 12 months*			
Activity / Progress	Ecological monitoring results have identified infill planting requirements in the River Oak riparian areas of the Goulburn River BA. Infill planting of these areas is scheduled for 2025.			

Conservation Actions	Year 1 to Year 4	Year 5 to Year 10 (2023 is Year 7)	Completion Criteria	Actions 2024
PASSIVE RESTORATION				
Weed control and monitoring				
Performance Criteria	*At least two weed control events each year for species listed in Table 14 of Management Plans and other weeds recorded from monitoring activities.* *Complete Ecological Monitoring, Rapid Condition Assessments and Property Inspections.*	*At least one weed control event each year for species listed in Table 14 of Management Plans and other weeds recorded from monitoring activities.* *Complete Ecological Monitoring, Rapid Condition Assessments and Property Inspections.*	*Ecological monitoring data indicates a trajectory for reduction in exotic plant cover over three consecutive assessments.*	
Activity / Progress		Weed contractor engaged to undertake weed control activities across all Regional BAs throughout the year to control noxious species and stop weeds spreading into previously un-infested areas. In 2023 weed control targeted the following species: African lovegrass *(Eragrostis curvula),* African olive *(Olea europaea),* Bridal creeper *(Asparagus asparagoides),* Farmers friends (*Bidens Pilosa),* Fireweed (*Senecio madagascariensis),* Fleabane (*Conyza bonariensis),* Blackberry *(Rubus fruticosus),* Blue heliotrope (*Heliotropium amplexicaule),* Coolatai grass *(Hyparrhenia hirta),* Creeping pear *(Opuntia humifusa),* Crofton weed (*Ageratina Adenophora),* Green cestrum *(Cestrum parqui),* Inkweed (*Phytolacca octandra),* Lantana *(Lantana camara),* Paddy's lucerne (*Sida rhombifolia),* Moth vine *(Araujia sericifera),* Narrow-leaf cotton bush *(Gomphocarpus fruticosus),* Noogoora burr (*Xanthium occidentale),* Prickly pear (*Opuntia stricta*), Purpletop (*Verbena bonariensis),* Ragwort (*Senecio jacobaea),* Schinus mole *(Pepper tree),* St John's wort (Herpercium perforatum), Sticky nightshade *(Solanum sisymbriifolium),* Telegraph weed *(Heterotheca grandiflora),* Thistles (*Various spp.),* Tree of heaven (*Ailanthus altissima)*, Whiskey grass *(Andropogon virginicus).* Rapid Condition Assessments and Property Inspections were completed in 2023.		Control noxious species and stop weeds spreading into previously un-infested areas. Undertake Rapid Condition Assessments. Undertake Property Inspections. Undertake Ecological Monitoring

Conservation Actions	Year 1 to Year 4	Year 5 to Year 10 (2023 is Year 7)	Completion Criteria	Actions 2024
Pest control and monitoring				
Performance Criteria	*At least two control events each year for species listed in Management Plans, and any other species recorded from monitoring activities.* *All actions recorded in the Annual Report.* *Active participation in programme coordinated by Hunter Local Land Service (HLLS), this may include local control actions.* *Complete Rapid Condition Assessments and Property Inspections.*	*At least one control event each year for species listed in Management Plans, and any other species recorded from monitoring activities.* *All actions recorded in the Annual Report.* *Active participation in programme coordinated by HLLS, this may include local control actions.* *Complete Rapid Condition Assessments and Property Inspections.*	*No observed vertebrate pest or damage.* *Ecological monitoring demonstrates a trajectory to benchmark values for all attributes measured over three consecutive assessments (the average of all plots).*	
Activity / Progress		In 2023 vertebrate pest contractors were engaged to undertake programmes across all Regional BAs. Two 1080 ground baiting programmes targeting wild dogs and foxes were undertaken in autumn and spring in conjunction with neighbouring landholders and HLLS. A ground shooting program was undertaken at the Goulburn River BA in March controlling 18 feral pigs, 9 fallow deer and 4 foxes. A ground shooting program was undertaken at the Bowditch BA in April controlling 11 feral deer and one feral cat. Noisy Miner ground shoots were undertaken at the Goulburn River and the Bowditch BA in August under a Licence to Harm Protected Animals (Biodiversity Conservation Act 2016). The programmes aim to assist the survivability of the Regent Honeyeater. The Goulburn River BA programme which is in its seventh consecutive year resulted in the control of 167 Noisy Miners over four days. The Bowditch BA programme resulted in the control of 116 Noisy Miners over four days. This is the second Noisy Miner programme undertaken on this offset and will continue in 2024. Aerial shoots conducted by NPWS at the Goulburn River and Seven Oaks BA's in May controlled 14 pigs and in October controlled 15 pigs. Rapid Condition Assessments and Property Inspections were completed in 2023.		Participate in HLLS and NPWS Aerial Baiting/shooting programmes. Undertake shooting and baiting programmes. Undertake a control programme for noisy miners in the Regent Honeyeater breeding area at GRBA. Undertake a control programme for noisy miners at the Bowditch BA. Undertake Rapid Condition Assessments. Undertake Property Inspections. Undertake Ecological Monitoring
Grazing				

Conservation Actions	Year 1 to Year 4	Year 5 to Year 10 (2023 is Year 7)	Completion Criteria	Actions 2024
Performance Criteria	*Grazing is conducted in accordance with the Management Plan.* *Boundary fences maintained.* *Complete Rapid Condition Assessment and Property Inspections.*			
Activity / Progress	Cattle excluded from all BAs. Rapid Condition Assessment and Property Inspections were completed in 2023. Boundary fences repaired at North Rothbury and Putty BA in 2023.			Undertake Rapid Condition Assessments. Undertake Property Inspections. Maintenance of boundary fences.
Regional BA Bushfire Management Plan (BFMP) and monitoring				
Performance Criteria	*Actions implemented.* *Review and revise if required.* *Complete Rapid Condition Assessments and Property Inspections*	*Actions implemented.* *Review and revise if required.* *Complete Rapid Condition Assessments and Property Inspections.* *Completed ecological fire management plan.*	*All required actions of BFMP have been implemented.* *BFMP has been reviewed annually and revised if required.*	
Activity / Progress		BFMP reviewed. Fuel load assessments were undertaken on Putty, Condon View, North Rothbury, Seven Oaks, Goulburn River and Bowditch BA's in 2023. A hazard reduction burn for the Seven Oaks BA was undertaken in May 2023, which treated approximately 90 Ha and reducing the fuel load to low. A Hazard Reduction Burn for North Rothbury BA was approved however conditions were outside the prescribed limits, so the burn was rescheduled for 2024. Slashing of fire breaks was undertaken at North Rothbury, Goulburn River and Seven Oaks BAs. Rapid Condition Assessments and Property Inspections were completed in 2023.		Review BFMP. Implement a bushfire fuel hazard reduction programme. Undertake annual fuel load assessments on all Regional BAs. Undertake the Hazard Reduction Burn at North Rothbury BA. Undertake Rapid Condition Assessments. Undertake Property Inspections.
Erosion monitoring inspections and reports				
Performance Criteria	*Complete Rapid Condition Assessment and Property Inspections*			

Conservation Actions	Year 1 to Year 4	Year 5 to Year 10 (2023 is Year 7)	Completion Criteria	Actions 2024
Activity / Progress	Erosion areas identified at North Rothbury, Bowditch, Goulburn River and Condon View BA's. Rapid Condition Assessment and Property Inspections were completed in 2023.			Undertake Rapid Condition Assessment. Undertake Property Inspections. Inspect/monitor erosion areas identified at North Rothbury, Bowditch, Goulburn River and Condon View BA's
Dam conversion and rehabilitation and monitoring				
Performance Criteria	*Prepare dam conversion plan.* *Dam conversion complete and rehabilitation has stabilised the site.* Property inspections.	*Observed natural flow regime and no erosion.* *Property inspections.*	*All works completed.*	
Activity / Progress		Property inspections undertaken in 2023. A dam conversion plan was prepared in 2021.		Implement the dam conversion plan. Undertake Property Inspections.
Natural Regeneration and monitoring				
Performance Criteria	*Annual weed control, vertebrate pest and fire management actions implemented as per management plans.* *Complete Rapid Condition Assessment and Property Inspections.*		*Ecological monitoring demonstrates a trajectory to benchmark values for all attributes measured over three consecutive assessments (the average of all plots).*	
Activity / Progress	Rapid Condition Assessment and Property Inspections undertaken in 2023. Actions implemented as per management plans – see above.			Implement actions as per Management plans. Undertake Rapid Condition Assessment. Undertake Property Inspections.
Controlled Activities				

Conservation Actions	Year 1 to Year 4	Year 5 to Year 10 (2023 is Year 7)	Completion Criteria	Actions 2024
Performance Criteria	*No reported incidents of prohibited actions undertaken by Yancoal, contractors, consultants or other agents of Yancoal.* *Any clearing of vegetation reported in Annual Report.* *Signage and locks (where required) maintained.* *Complete risk assessment for any recreation activities.* *All occupants of residents compliant with requirements of the MP.* *No Cultural Heritage sites knowingly disturbed and any protective barricading maintained.* *Damaged and unwanted fences removed.* *All Property Inspections completed.*			
Activity / Progress	No reported incidents of prohibited actions undertaken in 2023. Cultural Heritage sites are barricaded. Signage and locks are maintained. Regular property inspections were undertaken in 2023.			Undertake Property Inspections. Repair Cultural Heritage barricading where required.

4 MONITORING ACTIVITIES

The following table provides a summary of the monitoring activities undertaken as detailed in the management plans. Monitoring reports and results are available on the Biodiversity Offset Portal.

Table 4 Monitoring Activity Summary

Monitoring	2023	Date/s	Completed by
Bird Assemblage	X	July – October 2022, next due July – October 2024	ANU Enterprise
Habitat Restoration	X	September – November 2022, next due September – November 2024	Mosaic Ecology and Cumberland Plain Seeds
Rapid Condition Assessment	X	November/December 2023 next due September – November 2024	Franks Fencing (Land Management Advisor)
Property Inspection	X	April/May/October/November 2023, next due April/November 2024	Mosaic Ecology

4.1 Bird assemblages monitoring

Bird assemblage monitoring was not required to be undertaken during 2023. The results from the 2022 Bird Assemblage monitoring were presented in the 2022 Annual Report for Regional Offsets. The next Bird Assemblage monitoring is scheduled for July 2024.

4.2 Habitat restoration monitoring

Habitat Restoration monitoring was not required to be undertaken during 2023. The results from the last round of Habitat Restoration monitoring conducted in 2022 were presented in the 2022 Annual Report for Regional Offsets. The next Habitat Restoration monitoring is scheduled for September 2024.

5 PROGRESS IN ATTAINING CONSERVATION OBJECTIVES AGAINST KEY PERFORMANCE INDICATORS

The primary conservation objectives for the Regional BAs are to:

- enhance landscape connectivity within the surrounding landscape;
- improve fauna movement and flora dispersal opportunities within the surrounding landscape;
- increased condition and area of suitable habitats for threatened fauna species within protected reserves, specifically for the Regent Honeyeater and Swift Parrot;
- provide refuge and habitat for local fauna populations and transient species, particularly threatened species; and
- enhance network of protected vegetation within the Hunter Valley.

Table 3 details the progress in attainment of the long-term conservation objectives. The baseline data presented is from the first monitoring completed in 2014. The Rapid Condition Assessment (RCA) monitoring results indicate that the vegetation and habitat health is being maintained in comparison to the baseline data **Table 5 – Table 10**.

6 ADAPTIVE MANAGEMENT

No new environmental risks have been identified during the reporting period.

Table 5 Goulburn River BA: Biodiversity Values and KPIs

Biodiversity Value	Nested Conservation Value(s)	Description and baseline metric	KPI	Progress comment
Woodland (MZ2, MZ3, MZ4, MZ5 and MZ7)		Total area: 1,169ha RCA Average Health rating 17.6/20	Maintain or increase area, connectivity and habitat condition over 10 years	RCA Average health rating 2015 – 17/20 2016 – 17.1/20
	Fauna Habitat	Moderate potential habitat for Swift Parrot and Regent Honeyeater	improved habitat condition over 10 years	2017 – 17.1/20 2018 - 18.1/20 2019 – 18.4/20 2020 - *17.5/20 2021 - *17.4/20 2022 - *18.2/20 2023 – 17.8/20 Area and health maintained *Some sites were inaccessible due to high water levels in the Goulburn River.

Table 6 Bowditch BA: Biodiversity Values and KPIs

Biodiversity Value	Nested Conservation Value(s)	Description and baseline metric	KPI	Progress comment
Woodland (MZ1, MZ2 and MZ4)		Total area: 602ha RCA Average Health rating 18/20	Observed and measured increase or maintained RCA scores over 10 years	RCA Average Health rating 2015 – 18/20 2016 – 18.4/20
	Fauna Habitat	Moderate potential habitat for Swift Parrot and Regent Honeyeater	Maintain or increase the condition and extent of habitat and bird usage over 10 years	2017 – 17.1/20 2018 – 17.7/20 2019 – 17.7/20 2020 – 18.1/20 2021 – 18.3/20 2022 – 18.7/20 2023 – 18.3/20 Area and health maintained

Table 7 Seven Oaks BA: Biodiversity Values and KPIs

Biodiversity Value	Nested Conservation Value(s)	Description and baseline metric	KPI	Progress comment
Woodland (MZ3, MZ4 and MZ5)		Total area: 519ha RCA Average Health rating 17.9/20	Observe an increase in area, connectivity and habitat condition over 10 years	RCA Average Health rating 2016 – 18/20

Fauna Habitat	Moderate potential habitat for Swift Parrot and Regent Honeyeater	Maintain or increase the condition and extent of habitat and bird usage over 10 years	2017 – 17.3/20 2018 – 17.6/20 2019 – 17.6/20 2020 - 18.2/20 2021 – 18.2/20 2022 – 18.2/20 2023 – 18/20 Area and health maintained

Table 8 Condon View BA: Biodiversity Values and KPIs

Biodiversity Value	Nested Conservation Value(s)	Description and baseline metric	KPI	Progress comment
Woodland (MZ2 and MZ4)		Total area: 515ha RCA Average Health rating 19.1/20	Maintain or increase area, connectivity and habitat condition over 10 years	RCA Average Health rating 2016 – 20/20 2017 – 18.2/20
	Fauna Habitat	Moderate potential habitat for Swift Parrot and Regent Honeyeater	Maintain or increase the condition and extent of habitat and bird usage over 10 years	2018 – 18.6/20 2019 – 18.6/20 2020 – 19/20 2021 – 19.3/20 2022 – 19.3/20 2023 – 19.7/20 Area and health maintained

Table 9 Putty BA: Biodiversity Values and KPIs

Biodiversity Value	Nested Conservation Value(s)	Description and baseline metric	KPI	Progress comment
Woodland (MZ2, MZ3 and MZ4)		Total area: 383ha RCA Average Health rating 17/20	Observe an increase in area, connectivity and habitat condition over 10 years	RCA Average Health rating 2016 – 17.3/20 2017 – 17.6/20
	Fauna Habitat	Moderate potential habitat for Swift Parrot and Regent Honeyeater	Maintain or increase the condition and extent of habitat and bird usage over 10 years	2018 – 17.8/20 2019 – 15.6/20 2020 – 16.2/20 2021 – 16.8/20 2022 – 17/20 2023 – 17.3/20 (Bushfire in July and December 2019 reduced the health rating)

Table 10 North Rothbury BA: Biodiversity Values and KPIs

Biodiversity Value	Nested Conservation Value(s)	Description and baseline metric	KPI	Progress comment
Woodland (MZ1 and MZ2)		Total area: 41ha RCA Average Health rating 18.7/20	Observe an increase in area, connectivity and habitat condition over 10 years	RCA Average Health rating 2016 – 18/20 2017 – 18.2/20
	Fauna Habitat	Moderate potential habitat for Swift Parrot and Regent Honeyeater	Maintain or increase the condition and extent of habitat and bird usage over 10 years	2018 – 19/20 2019 – 18.7/20 2020 – 19/20 2021 – 19/20 2022 – 19/20 2023 – 18.75/20 Area and health maintained

Appendix 9:

IEA Action Status Table

Mount Thorley Warkworth Complex (SSD-6464 and SSD-6465) – Independent Environmental Audit 2023 – Progress with Audit Recommendations

NON-COMPLIANCE RECOMMENDATIONS AND RESPONSES				
Ref	**Compliance Requirement**	**Independent Audit Finding**	**Independent Audit Recommendation**	**MTW Response / Progress**
SSD 6464				
S2 C9	By the end of January 2017, unless the Planning Secretary agrees otherwise, the Applicant must surrender the existing development consent (DA-300-9-2002-i) for the Warkworth mine in accordance with Section 104A of the EP&A Act. Following the commencement of development under this consent, the conditions of this consent shall prevail to the extent of any inconsistency with the conditions of DA-300-9-2002-i.	Reported as non-compliant in the 2020 Annual Review. No documentation was available to the auditor that confirmed that the existing consents had been surrendered.	Work with DPE is close out the surrender of the development consents.	This is noted in the audit report as an administrative non-compliance. An application to surrender the development consent DA 300-9-20020i was submitted in June 2017 and progressed with correspondence with DPE up to 2021. MTW will continue to work with DPE to progress surrender of the relevant consent during the 2024 Annual Review period.
S3 C5	From 1 January 2017, except for the land in Table 1, the Applicant must ensure that the noise generated by the Development does not exceed the noise criteria in Table 3 at any residence on privately owned land.	Section 6.2.2/3 of each Annual Review presents the results of the noise monthly noise monitoring undertaken by independent consultants. A summary of compliance is as follows: 2020 – no non compliances reported 2021 - no non compliances reported 2022 – six exceedances of the noise criteria were recorded One hundred and fifty-seven (157) noise complaints were received during the audit period. This consisted of 98 complaints in 2020, 49 in 2021, 47 in 2022 and 11 in 2023 (to the end of April. The Auditor notes that that 112 of the 162 (69%) noise complaints were from five residents. While there has been an improvement over the life of the project in the number of complaints (325 recorded in 2016), a contributing factor to the higher number of complaints during the early operational stages may potentially be attributed to a higher proportion of activities closer to ground level, with improvements achieved over the project life due to attenuation provided by the pit depth, mine walls and in acoustic vehicle technology.	Review current predictive tools and processes against available models that are currently being utilised in both the mining and construction industries with the objective of: • Identifying areas on site that have the potential to impact noise sensitive receivers; • Provides a Noise Impact Prediction Model that can be used by MTW to plan works in those areas with the objective to proactively ensure that noise from plant and equipment does not cause annoyance to local community and exceed the relevant criteria.	Completed. MTW has an existing predictive noise enhancement tool to identify potential noise enhancement at the various directions surrounding the mine, and additionally already implements the rigorous planning, noise monitoring and management measures described in the Noise Management Plan. In response to the audit recommendation, MTW has reviewed two alternative predictive noise tools (models), and additionally a weather enhancement tool used at MTW that has initially been developed to predict blast overpressure enhancement, which has progressed to have the capability for hourly updates on enhancement conditions in 2023. In the interest of continuous improvement, MTW will consider whether these types of tools could complement current noise management effort.

NON-COMPLIANCE RECOMMENDATIONS AND RESPONSES				
Ref	**Compliance Requirement**	**Independent Audit Finding**	**Independent Audit Recommendation**	**MTW Response / Progress**
		Prior to each shift, a predictive tool is utilised to assess potential impacts taking into account the prevailing meteorological conditions. MTW implements noise management and monitoring methods to identify if there is a potential issue and takes rectification action to modify operations where indicated. Following the receipt of noise complaints, a CRO is deployed to make observations and measure noise levels (5-minute sample). In many instances the CROs observations have verified the complaint and the noise readings have indicated that the noise levels from the mine were exceeding the relevant criteria. Where these potential exceedances are identified, MTW review the works being undertaken at the likely exceedance source and make changes to those works to reduce noise emissions. The Auditor understands that noise modelling of future works that may impact sensitive receivers is not routinely undertaken.		
S3 C19a and c	The Applicant must: a) implement all reasonable and feasible measures to minimise the: • odour, fume and dust emissions of the development; and • release of greenhouse gas emissions from the development; c) minimise the air quality impacts of the development during adverse meteorological conditions and extraordinary events (see note d to Tables 5-7 above);	Fifty-eight dust-related complaints were received during the audit period. No exceedances in dust criteria were reported during the audit period. Significant areas of the site have been cleared and progressive rehabilitation works are behind schedule. The Auditor also observed significant areas, that while not ready for final rehabilitation, would benefit from temporary stabilisation to help reduce dust emissions during adverse wind conditions.	Increase the rate of progressive rehabilitation works with the objective of meeting the established progressive rehabilitation targets. Prepare and implement a program for the stabilisation of unsealed / disturbed areas of the site including stockpiles, finished landforms, and disturbed areas that are not currently being actively worked / filled). The program should identify and classify all areas of the site that are currently disturbed according to the dust generation potential of those areas and establish clear targets for the stabilisation of those areas (either permanent or temporary) with the objective of meeting the requirements of the Blue Book.	MTW notes that the audit found there were no exceedances in dust criteria reported during the audit period. MTW has a well developed and implemented Air Quality Management Plan and considers that reasonable and feasible controls are being implemented. In relation to rehabilitation progression, MTW acknowledges the benefit rehabilitation progress has for minimising air quality impacts, and undertakes progressive rehabilitation as part of normal mine operations. MTW completed 93.6 Ha of rehabilitation in 2023, which is slightly greater than the planned 90 Ha in the 2023 Forward Program. MTW is preparing an updated rehabilitation Forward Program, as required by the conditions of mining leases, to be submitted to the Resources Regulator in March 2024, which identifies rehabilitation progression for the upcoming 3 years. Refer to SSD-6464 S3 C57 for rehabilitation progression response. The Air Quality Management Plan for MTW includes as a control measures to undertake interim stabilisation works. In addition to completed rehabilitation works, during 2023, MTW identified further areas for interim stabilisation, which resulted in stabilisation treatment works including: -aerial seeding of 71Ha in December 2023 to an exotic pasture grass and legume mix suitable for summer sowing. Fertiliser was mixed with the seed prior to loading to provide sufficient nutrients for plant growth.

NON-COMPLIANCE RECOMMENDATIONS AND RESPONSES				
Ref	**Compliance Requirement**	**Independent Audit Finding**	**Independent Audit Recommendation**	**MTW Response / Progress**
				-North Pit North endwall soil batter. Application of binding polymer to exposed sandy soils. -Watts Track – application of road surface polymer to reduce potential for dust from infrequently used track.
S3 C24	Unless an EPL or the EPA authorises otherwise, the Applicant must ensure that all surface water discharges from the site comply with the: a) discharge limits (both volume and quality) set for the development in any EPL; and	The Annual Returns prepared for the Environment Protection Licence 1376 noted several non-compliances with this condition. Refer to audit schedule for EPL 1376 for details.	A risk assessment and review of the storage capacity of the retention dams be undertaken that takes into account the increasing risk of extreme weather events, including extended duration wet weather patterns.	Completed. MTW undertook a review and update of a risk assessment for all water storage dams at MTW in October 2023. This review included consideration of overtopping potential for the specific dams.
S3 C26 (Table 8)	Design, install and/or maintain mine water storage infrastructure to ensure no discharge of mine water off-site (except in accordance with condition 24) On-site storages (including mine infrastructure dams and treatment dams) are suitably designed, installed and/or maintained to minimise permeability Maintain adequate freeboard within the pit void at all times to minimise the risk of discharge to surface waters	This commitment is included in Table 5.1 of the WMP. There have been two incidents that resulted in the discharge of mine-water. The incident on 4/1/21 was from a water equipment park up area has spilled from a dam into a water course reporting into Wollombi Brook, the incident resulted penalty notices issued by both the DPE and EPA. In response to the Penalty notices, WML prepared an action plan which includes several actions relating to detailed engineering assessment, design and construction of civil infrastructure for improved surface water drainage infrastructure at WML North Pit North. Correspondence from DPE and WML confirms that the detailed design works for the North Pit North drainage improvements were completed in October 2021. The incident on 4/7/22 was reported as an overtopping event during a greater than design rainfall event. It was reported that samples were collected with no environmental harm caused. No further actions to prevent recurrence were proposed by WML.	In relation to the incident on the 4/7/21, no further actions are recommended over and above the actions taken by WML in response to the incident. In response to the incident on the 4/7/22, it is recommended that a risk assessment and review of the storage capacity of the retention dams be undertaken that takes into account the increasing risk of extreme weather events, including extended duration wet weather patterns.	Completed. Refer to response to SSD-6464 S3 C24.

NON-COMPLIANCE RECOMMENDATIONS AND RESPONSES				
Ref	**Compliance Requirement**	**Independent Audit Finding**	**Independent Audit Recommendation**	**MTW Response / Progress**
S3 C28	Within 3 years of the date of commencement of development under this approval, the applicant will retire biodiversity credits of a class and number specified in Tables 9 and 10 below to the satisfaction of BCD.	DPE has yet to approve the retirement of biodiversity credits. However, it is acknowledged that some components such as the provision of supplementary measures (such as funding of research) have been met.	As the retirement of requisite credits is now over 4 years overdue, it is recommended that negotiations with the Department/BCD/BCT to reach an agreeable solution are given priority.	This is noted in the audit report as an administrative non-compliance. Warkworth Mining Ltd (WML) lodged a modification application for development consent SSD6464 (MOD1) in April 2021 to clarify biodiversity offset requirements for WML and to facilitate in-perpetuity conservation of biodiversity offset land. During 2023, WML has continued in dialogue with DPE and BCS regarding this matter, who have advised that a Biodiversity Stewardship Agreement (BSA) is the only mechanism acceptable to the NSW Government for in-perpetuity security of biodiversity offset land. BCS is currently finalising an equivalence assessment associated with MTW's biodiversity offset land. Once the credit equivalence has been finalised, BSAs for each offset area will be progressed. The equivalent credit values established for each BSA will then be retired upon execution of the BSAs.
S3 C30	Within 3 years of the date of commencement of the development under this consent, the Applicant must secure offset areas listed in Table 12 under an in-perpetuity conservation mechanism such as entering into a biobank agreement, in accordance with the relevant provisions of the TSC Act. The direct land-based offsets may be used as offsets for any approval required under the EPBC Act for this development.	Date of commencement was 15 Feb 2016, therefore offset areas were to be secured under an in-perpetuity mechanism 14 February 2019 (i.e. within 3 years of commencement). Despite documentation/correspondence between WML, the Department and BCD since 2018, which has included submission of a modification application to DPE (SSD-6464 MOD1) to address securing of the offsets, this item remains incomplete. Actions are currently still being undertaken to reach an agreeable resolution with BCD and the department. However, no written correspondence between WML and the Department/BCD has been sited since the February 2022 correspondence.	As the securing of offset areas under an appropriate mechanism is now over 4 years overdue, it is recommended that negotiations with the Department/BCD/BCT to reach an agreeable solution are given priority.	This is noted in the audit report as an administrative non-compliance. Refer to response to SSD-6464 S3 C28.
S3 C34	Within 12 months of the commencement of the development under this consent, the Applicant must prepare an Integrated Management Plan for the Warkworth Sands Woodland EEC to the satisfaction of BCD. This plan must be prepared in consultation with the owners of Wambo and Bulga Mines and outline the measures that would be implemented to coordinate management and recovery efforts for the EEC.	Correspondence sighted confirmed that BCD had received the WSW IMP as submitted by WML. Correspondence from BCD confirmed that the review of the 2018 IMP was largely complete. However no subsequent correspondence sighted and no correspondence/documentation provided regarding approval of WSW IMP provided. It is noted that the WSW IMP has been prepared and provided to BCD. Non-compliance is mainly due to the document not yet being approved by BCD (i.e not approved within 12 months of the commencement of the development.	Work with BCD to progress the outstanding approval as a high priority.	This is noted in the audit report as an administrative non-compliance. MTW will work with BCS to progress toward approval of the WSW IMP during the 2024 Annual review period.

NON-COMPLIANCE RECOMMENDATIONS AND RESPONSES				
Ref	**Compliance Requirement**	**Independent Audit Finding**	**Independent Audit Recommendation**	**MTW Response / Progress**
S3 C51	The Applicant must: a) keep records of the amount of coal transported from the development in each calendar year; and b) make these records available on its website at the end of each calendar year.	The 2020 and 2021 Annual Reviews are publicly available on the MTW website; however, the 2022 Annual Review was not on the website at the time of this IEA. Therefore, the coal transport records for 2022 were not publicly available as required by this Condition. The Auditor notes that the 2022 Annual Review had been submitted to DPE but had not yet been approved.	Ensure that the coal transportation records are regularly updated.	Although this is noted in the audit report as an administrative non-compliance, MTW does not agree with this audit finding. Coal transportation records are included in the Annual Review report submitted to DPE. The 2022 Annual Review Report was approved by DPE 20/11/2023 and was immediately uploaded to the MTW website that day.
S3 C52 a and c	The Applicant must: a) implement all reasonable and feasible measures to minimise the visual off-site lighting impacts of the development, including lighting impacts on road users and impacts of mining voids; b) ensure that all external lighting associated with the development complies with Australian Standard AS4282 (/NT) 1997 - Control of Obtrusive Effects of Outdoor Lighting, or its latest	Environmental induction covers lighting. The Lighting review undertaken in 2020 confirms the offsite lighting impacts was meeting the requirements of this condition. However, 94 lighting complaints were received during the audit period, 75 of those complaints came from three residents. A review of the complaints indicates that the community impacts are from relocatable lighting and mobile plant, but that fixed lighting is not generating complaints. As part of the internal complaint investigations, CROs assess mobile lighting and arrange changes in light locations or direction and that the actions, in general resolve the issues. It is apparent that there is insufficient planning for the location and use of mobile lighting and therefore all reasonable and feasible mitigation measures have not been used.	Ensure that personnel responsible for planning and / or managing night works undertake proactive planning for all after hours works. The planning should identify the optimal lighting setup for those activities and that the implementation of the lighting plans be checked prior to undertaking those activities by CROs or other appropriately trained personnel.	As stated in the audit finding, a review of lighting was conducted in 2020 (by an environmental/engineering consultant) specifically against AS4282, which confirmed that offsite lighting impacts were meeting the requirements of development consent condition S3 C52. In relation to potential lighting impacts from lighting plant, MTW has developed and implements processes involved with the siting and set up of lighting plant designed to minimise the risk of intrusive light impacts. MTW also conducts an inspection of established lighting as part of a routine process by Community Response Officers (CROs) on night shift – this occurs each night as a routine inspection and feedback to operations to make adjustments where necessary, and also will occur in response to community complaint regarding lighting. This represents significant effort regarding management of potential lighting impacts. 17 lighting complaints were received in 2023, a reduction compared to previous years.
S3 C57	The Applicant must rehabilitate the site progressively, that is, as soon as reasonably practicable following disturbance. All reasonable and feasible measures must be taken to minimise the total area exposed for dust generation at any time. Interim rehabilitation strategies must be employed when areas prone to dust generation cannot yet be permanently rehabilitated.	Annual Review reports detail progress of mine rehabilitation progress against MOP plans. The net rehabilitation progress (i.e. rehabilitation minus rehabilitation disturbance) for the 2015 – 2021 period was 20.4 ha higher than targets. A total of 47.9ha of new rehabilitation was completed during 2022 against a Mining Operations Plan 2022 target of 35ha. 2022 annual report notes that rehabilitation and disturbance forecasts submitted to Resources Regulator (submitted in August 2022) are based on financial year periods and therefore don't align with the calendar year Annual Review reporting period and the misalignment is intended to be corrected in the Forward Program to be submitted in May 2023.	Increase the rate of progressive rehabilitation works with the objective of meeting the established progressive rehabilitation targets.	MTW does undertake progressive rehabilitation as reported in previous Annual Review Reports and as planned in previous Mining Operations Plans (now Rehabilitation Management Plan). MTW has submitted a Forward Program to the Resources Regulator (most recently 1 May 2023) which outlines the next 3 years rehabilitation progress. In 2023, MTW completed 93.6Ha of rehabilitation, which slightly exceeded the planned rehabilitation target of 90Ha for 2023. MTW continued proactive dump planning and review in 2023 and into 2024, with the resulting planned rehabilitation to be submitted with the updated Forward Program submission in March 2024.

NON-COMPLIANCE RECOMMENDATIONS AND RESPONSES				
Ref	**Compliance Requirement**	**Independent Audit Finding**	**Independent Audit Recommendation**	**MTW Response / Progress**
S3 C58 d, and h	d) Describe how the rehabilitation of the site would be integrated with the implementation of the biodiversity offset strategy; h) include interim rehabilitation where necessary to minimise the area exposed for dust generation;	The RMP does not address the integration of the mine site rehabilitation with the biodiversity off-set strategy. The RMP does not address the interim rehabilitation of the site to minimise dust generation.	Review and revise the plan to include the integration of the mine site rehabilitation with the biodiversity off-set strategy. Review and revise the plan to include the interim rehabilitation of the site to minimise dust generation.	Completed. The Rehabilitation Management Plan was updated (finalised 29 January 2024) and has addressed this IEA recommendations. RMP is available on the MTW website.
SSD-6465				
S3 C17 a and c	The Applicant must: a) implement all reasonable and feasible measures to minimise the: • odour, fume and dust emissions of the development; and • release of greenhouse gas emissions from the development; minimise the air quality impacts of the development during adverse meteorological conditions and extraordinary events (see note d to Tables 5-7 above); and	The Air quality management plan describes the air quality management system and procedures including the predictive tools. Fifty-eight dust-related complaints were received during the audit period. No exceedances in dust criteria were reported during the audit period. Areas of the site are being cleared in preparation for mining, and the disposal of overburden is progressing. The planned progressive rehabilitation works are, however, behind schedule. The Auditor also observed areas, that while not ready for final rehabilitation, would benefit from temporary stabilisation to help reduce dust emissions during adverse wind conditions	Increase the rate of progressive rehabilitation works with the objective of meeting the established progressive rehabilitation targets. Prepare and implement a program for the stabilisation of unsealed / disturbed areas of the site including stockpiles, finished landforms, and disturbed areas that are not currently being actively worked / filled). The program should identify and classify all areas of the site that are currently disturbed according to the dust generation potential of those areas and establish clear targets for the stabilisation of those areas (either permanent or temporary) with the objective of meeting the requirements of the Blue Book.	MTW notes that the audit found there were no exceedances in dust criteria reported during the audit period. MTW has a well developed and implemented Air Quality Management Plan and considers that reasonable and feasible controls are being implemented. Refer to response to SSD-6464 S3 C19.
S3 C22 a and b	Unless an EPL or the EPA authorises otherwise, the Applicant must ensure that all surface water discharges from the site comply with the: discharge limits (both volume and quality) set for the development in any EPL; and	The Annual Returns prepared for the Environment Protection Licence 1976 noted several non-compliances with this condition. • Dam 1S overtopped as a result of heavy or sustained rainfall which caused significant runoff (2023 AR) • Dam 1S overtopped as a result of heavy or sustained rainfall which caused significant runoff (2021 AR) • Discharge from 9S via spillway to Loders Creek (2021 AR)	A risk assessment and review of the storage capacity of the retention dams be undertaken that takes into account the increasing risk of extreme weather events, including extended duration wet weather patterns.	Completed. Refer to response to SSD-6464 S3 C24.

NON-COMPLIANCE RECOMMENDATIONS AND RESPONSES				
Ref	**Compliance Requirement**	**Independent Audit Finding**	**Independent Audit Recommendation**	**MTW Response / Progress**
	relevant provisions of the POEO Act or Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002	As reported in the 2021 Annual Return for EPL1976, Exceedance of the HRSTS hourly volume discharge limit during analysis of flow data following a discharge event. Note that this incident was not reported in the 2021 Annual Review.	The auditor understands that this discharge was an isolated event and has been investigated. No additional actions are required.	Noted
S3 C27	Within 3 years of the commencement of development under this consent, unless the Planning Secretary agrees otherwise, the Applicant must enter into a conservation agreement or agreements pursuant to section 698 of the National Parks and Wildlife Act 1974 relating to the Loaders Creek Aboriginal Cultural Heritage Conservation Area, recording the obligations assumed by the Applicant under the conditions of this consent in relation to the conservation area, and register the agreements pursuant to section 69F of the National Parks and Wildlife Act 1974.	The Department approved a request to extend the timeframe for completion of the agreement to the 15th of February 2020, however the agreement was not executed until the 3 November 2022. Whilst the conservation agreement has been entered into in November 2022, registration of the agreements has not been completed pursuant to s69F of the NPW Act.	Finalise the registration of the conservation agreement for Loders Creek.	This is noted in the audit report as an administrative non-compliance. The registration process for the Loders Creek Aboriginal Cultural Heritage Conservation Area conservation agreement that were executed on 3 November 2022 has progressed in 2023 with MTW and Heritage NSW but is not completed. This will continue in the 2024 Annual Review Period.
S3 C29 a and b	The Applicant must: a) keep records of the amount of coal transported from the development in each calendar year; and b) make these records available on its website at the end of each year.	The 2020 and 2021 Annual Reviews are publicly available on the MTW website; however, the 2022 Annual Review was not on the website at the time of this IEA. Therefore, the coal transport records for 2022 were not publicly available as required by this Condition. The Auditor notes that the 2022 Annual Review had been submitted to DPE but had not yet been approved.	Ensure that the coal transportation records are regulatory updated.	Although this is noted in the audit report as an administrative non-compliance, MTW does not agree with this audit finding. Coal transportation records are included in the Annual Review report submitted to DPE. The 2022 Annual Review Report was approved by DPE 20/11/2023 and was immediately uploaded to the MTW website that day.
S3 C30 a and c	The Applicant must: a) implement all reasonable and feasible measures to minimise the visual and off-site lighting impacts of the development, including lighting impacts on road users and impacts of mining voids; c) ensure that all external lighting associated with the development complies with Australian Standard AS4282 (/NT) 1997 - Control of Obtrusive Effects of Outdoor Lighting, or its latest version; and	Environmental induction covers lighting. The Lighting review undertaken in 2020 confirms the offsite lighting impacts was meeting the requirements of this condition. However, 94 lighting complaints were received during the audit period, 75 of those complaints came from three residents. A review of the complaints indicates that the community impacts are from relocatable lighting and mobile plant, but that fixed lighting is not generating complaints. As part of the internal complaint investigations, CROs assess mobile lighting and arrange changes in light locations or direction and that the actions, in general resolve the issues. It is apparent that there is insufficient planning for the location and use of mobile lighting and therefore all reasonable and feasible mitigation measures have not been used.	Ensure that personnel responsible for planning and / or managing night works undertake proactive planning for all after hours works. The planning should identify the optimal lighting setup for those activities and that the implementation of the lighting plans be checked prior to undertaking those activities by CROs or other appropriately trained personnel.	Refer to response to SSD-6464 S3 C52.

NON-COMPLIANCE RECOMMENDATIONS AND RESPONSES				
Ref	**Compliance Requirement**	**Independent Audit Finding**	**Independent Audit Recommendation**	**MTW Response / Progress**
S3 C36g	The RMP must: g) include interim rehabilitation where necessary to minimise the area exposed for dust generation;	The RMP does not address the interim rehabilitation of the site to minimise dust generation.	Review and revise the plan to include the interim rehabilitation of the site to minimise dust generation.	Completed. This is noted in the audit report as an administrative non-compliance. Temporary stabilisation of unused areas or dump slopes (foreshadowed to be inactive for 6 months or more) is described as a management strategy in the MTW Air Quality Management Plan. The Rehabilitation Management Plan was updated (finalised 29 January 2024) and has addressed this IEA recommendations. RMP is available on the MTW website.
EPL1376				
L1.1	Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.	The following non- compliances (generally associated with over topping of dams) were identified by the Annual Returns • WML Sediment Dams 53N, 54N and WML sump 5N overtopped as a result of heavy rainfall - 5 in total non-compliances reported (2022 AR) • WML Sediment Dams 53N, 54N, 55N, 46N SSD 09 - 4 in total (2021 AR) • WML sediment dames 50N and 53N overtopped as a result of heavy rainfall	A risk assessment and review of the storage capacity of the retention dams be undertaken that takes into account the increasing risk of extreme weather events, including extended duration wet weather patterns.	Completed. Refer to response to SSD-6464 S3 C24.
O3.1	The premises must be maintained in a condition which minimizes or prevents the emission of dust from the premises.	Fifty-eight dust-related complaints were received during the audit period. No exceedances in dust criteria were reported during the audit period. Significant areas of the site have been cleared and progressive rehabilitation works are behind schedule. The Auditor also observed significant areas, that while not ready for final rehabilitation, would benefit from temporary stabilisation to help reduce dust emissions during adverse wind conditions.	Increase the rate of progressive rehabilitation works with the objective of meeting the established progressive rehabilitation targets. Prepare and implement a program for the stabilisation of unsealed / disturbed areas of the site including stockpiles, finished landforms, and disturbed areas that are not currently being actively worked / filled). The program should identify and classify all areas of the site that are currently disturbed according to the dust generation potential of those areas and establish clear targets for the stabilisation of those areas (either permanent or temporary) with the objective of meeting the requirements of the Blue Book.	Refer to response to SSD-6464 S3 C19.

NON-COMPLIANCE RECOMMENDATIONS AND RESPONSES				
Ref	**Compliance Requirement**	**Independent Audit Finding**	**Independent Audit Recommendation**	**MTW Response / Progress**
M2.2	Air Monitoring Requirements: Continuous PM10 monitoring	As reported in the 2020, 2021 and 2022 Annual Returns, EPL 1376 requires continuous monitoring for EPA air monitoring Points 9, 10, 11 and 12. Monitoring data capture was >93%, but not continuous during the reporting period (4 occurrences)	Ensure that all continuous monitoring equipment is operational and well maintained.	Monitoring locations are subject to routine maintenance and calibration and system checks. Data capture from the monitors was greater than 93% for the reporting period(s). Unplanned outages can occur at times with all continuous monitoring equipment. Scheduled maintenance is undertaken which can take monitoring equipment offline for 10 minutes or more due to the nature of the maintenance. Calibrations need to continue to occur and so brief outages will happen from time to time. As the audit noted, this is reported in Annual Returns to EPA. No further action required.
M2.3	Water and/or Land Monitoring Requirements	As reported in the Annual Returns, EPL water monitoring Points 26, 27, 28 and 30 were unable to be sampled due to sample area either unsafe to access due to rain events resulting in flooding, or being dry at time of sampling (6 occurrences)	Access to the sampling sites was not possible due to adverse weather conditions. No further actions are recommended.	This is noted in the audit report as an administrative non-compliance. Noted.
M4.1	Meteorological Monitoring Requirements	As reported in the 2021 and 2022 Annual Returns, EPL 1376 requires continuous monitoring for Charlton Ridge Meteorological Station. Monitoring data capture was >99%, but not continuous during the reporting period.	Ensure that all continuous monitoring equipment is operational and well maintained.	This is noted in the audit report as an administrative non-compliance. Monitoring locations are subject to routine maintenance and calibration. Data capture from the Charlton Ridge met station was greater than 99% for the reporting period(s). Unplanned outages can occur at times with all continuous monitoring equipment. Scheduled maintenance is undertaken at the met station and this can take monitoring equipment offline for 10 minutes or more due to the nature of the maintenance, which for example necessitates periodic lowering of the mast on which the wind speed and direction sensor is located and changing out sensors/calibrating etc. Calibrations need to continue to occur and so brief outages will happen from time to time. As the audit noted, this is reported in Annual Returns to EPA. No further action required.
M9.3	The licence must mark monitoring point(s) 4, with a sign which clearly indicates the name of the licensee, whether the monitoring point is up or down stream of the discharge point(s) and that it is a monitoring point for the Hunter River Salinity Trading Scheme.	The required signage was not installed at the time of this IEA.	Ensure that signage for Monitoring Point 4 is installed.	Completed. Signage installed on 30 August 2023
EPL1976				
L1.1	Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.	The following non- compliances were identified by the Annual Returns • Dam 1S overtopped as a result of heavy or sustained rainfall which caused significant runoff (2023 AR) • Dam 1S overtopped as a result of heavy or sustained rainfall which caused significant runoff (2021 AR) • Discharge from 9S via spillway to Loders Creek (2021 AR)	A risk assessment and review of the storage capacity of the retention dams be undertaken that takes into account the increasing risk of extreme weather events, including extended duration wet weather patterns.	Completed. Refer to response to SSD-6464 S3 C24.

NON-COMPLIANCE RECOMMENDATIONS AND RESPONSES				
Ref	**Compliance Requirement**	**Independent Audit Finding**	**Independent Audit Recommendation**	**MTW Response / Progress**
L2.1	For each monitoring/ discharge point or utilisation area specified in the table/s below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.	One non-compliance was reported during the audit period. During 2021 one Grab Sample at Licensed Discharge and Monitoring Point 4 exceeded the upper 100 percentile limit for pH.	This single exceedance of the water quality criteria has been investigated. No systemic issues have been identified therefore no further actions are recommended.	Noted.
L2.2	Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges.	One non-compliance was reported during the audit period. During 2021 one Grab Sample at Licensed Discharge and Monitoring Point 4 exceeded the upper 100 percentile limit for pH.	This single exceedance of the water quality criteria has been investigated. No systemic issues have been identified therefore no further actions are recommended.	Noted.
03.1	The premises must be maintained in a condition which minimizes or prevents the emission of dust from the premises.	Fifty-eight dust-related complaints were received during the audit period. Significant areas of the site have been cleared and progressive rehabilitation works are behind schedule. The Auditor also observed areas, that while not ready for final rehabilitation, would benefit from temporary stabilisation to help reduce dust emissions during adverse wind conditions. While no exceedances in dust criteria were reported during the audit period, the number of dust related complaints and the Auditor's observations relating to rehabilitation and stabilisation indicate that nuisance dust emissions are being generated by the mine.	Increase the rate of progressive rehabilitation works with the objective of meeting the established progressive rehabilitation targets. Prepare and implement a program for the stabilisation of unsealed / disturbed areas of the site including stockpiles, finished landforms, and disturbed areas that are not currently being actively worked / filled). The program should identify and classify all areas of the site that are currently disturbed according to the dust generation potential of those areas and establish clear targets for the stabilisation of those areas (either permanent or temporary) with the objective of meeting the requirements of the Blue Book.	Refer to response to SSD-6464 S3 C19.
M2.1	For each monitoring/ discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns.	During 2021, 2022 and 2023 Table M2.2 requires continuous PM10 monitoring for EPA air monitoring points 10,11,13 and 19. Monitoring data capture was >98% but not continuous during the reporting period. During 2021, 2022 and 2023 Table M2.3 requires continuous monitoring for pH at Point 4 during Discharge Monitoring data capture was >99% but not continuous during the reporting period. During 2021, 2022 and 2023 Table M2.3 requires continuous monitoring for conductivity at Point 4 during Discharge Monitoring data capture was >99% but not continuous during the reporting period.	Ensure that all continuous monitoring equipment is operational and well maintained.	Monitoring locations are subject to routine maintenance and calibration. Data capture from the locations were found to be >98% in the for the reporting period(s). Unplanned outages can occur at times with all continuous monitoring equipment. Scheduled maintenance is undertaken at the continuous monitoring locations and this can take monitoring equipment offline for 10 minutes or more due to the nature of the maintenance. Calibrations need to continue to occur and so brief outages will happen from time to time. As the audit noted, this is reported in Annual Returns to EPA. No further action required.

NON-COMPLIANCE RECOMMENDATIONS AND RESPONSES				
Ref	**Compliance Requirement**	**Independent Audit Finding**	**Independent Audit Recommendation**	**MTW Response / Progress**
M4.1	Meteorological Monitoring Requirements	As reported in the 2021 and 2022 Annual Returns, EPL 1376 requires continuous monitoring for Charlton Ridge Meteorological Station. Monitoring data capture was >99%, but not continuous during the reporting period.	Ensure that all continuous monitoring equipment is operational and well maintained.	Monitoring locations are subject to routine maintenance and calibration. Data capture from the Charlton Ridge met station was greater than 99% for the reporting period(s). Unplanned outages can occur at times with all continuous monitoring equipment. Scheduled maintenance is undertaken at the met station and this can take monitoring equipment offline for 10 minutes or more due to the nature of the maintenance, which for example necessitates periodic lowering of the mast on which the wind speed and direction sensor is located and changing out sensors/calibrating etc. Calibrations need to continue to occur and so brief outages will happen from time to time. As the audit noted, this is reported in Annual Returns to EPA. No further action required.
M7.1	Requirement to monitor volume or mass.	Table M7.1 requires continuous monitoring for volumetric flow at Point 4 during discharge. During 2021 monitoring data capture was not continuous during the reporting period.	Ensure that all continuous monitoring equipment is operational and well maintained.	Data capture from the discharge point flow meter during discharge was greater than 99% for the reporting period(s). Daily system checks are undertaken on working days to identify and resolve any monitoring issues. The monitors also undergo routine maintenance. As the audit noted, this was reported in the 2021 Annual return to EPA. No further action required.
E1.3	The licensee must not exceed the hourly volume discharge limit calculated using the following formula, at all discharge point(s) on this licence titled "Discharge of saline water under the Hunter River Salinity Trading Scheme (HRSTS)". H = V/ RRT	As reported in the 2021 Annual Return an exceedance of the HRSTS hourly volume discharge limit occurred on 20 March 2021. This non-compliance was discovered during the preparation of the 2021 Annual Return. The exceedance event has been reviewed by MTW and the discharge rate modified. No further exceedances have been recorded.	The single volume exceedance has been investigated and appropriate actions taken to prevent future exceedances. No additional actions have been identified.	Noted.
Mining Lease Standard Conditions (from July 2022)				
D1 C4	The holder of a mining lease must take all reasonable measures to prevent, or if that is not reasonably practicable, to minimise, harm to the environment caused by activities under the mining lease.	During the audit period (2021) non-complying overflows / discharges of water occurred from dams on both the Mt Thorley and Warkworth mines. These pollution events resulted in the issue of Penalty Notices by the EPA and DPE. For further information refer to Section 7.3 and Condition L1.1 on the EPL Compliance Registers above.	A risk assessment and review of the storage capacity of the retention dams be undertaken that takes into account the increasing risk of extreme weather events, including extended duration wet weather patterns.	Completed. Refer to response to SSD-6464 S3 C24.
D1 C5	The holder of a mining lease must rehabilitate land and water in the mining area that is disturbed by activities under the mining lease as soon as reasonably practicable after the disturbance occurs.	This condition is considered to be non-compliant as the predicted/forecast target for 2020 was not met and it is predicted that the forecast for 2023 will not be met. It is acknowledged that several factors, including weather conditions, have resulted in lower rehabilitation than predicted. It is noted however that the MOP rehabilitation targets were exceeded in both 2021 and 2022.	Continue progressive rehabilitation works with the objective of meeting the established progressive rehabilitation targets	Refer to response to SSD-6464 S3 C57.

NON-COMPLIANCE RECOMMENDATIONS AND RESPONSES				
Ref	**Compliance Requirement**	**Independent Audit Finding**	**Independent Audit Recommendation**	**MTW Response / Progress**
ML 1412				
17	Minimise Dust	Fifty-eight dust-related complaints were received during the audit period. No exceedances in dust criteria were reported during the audit period. Significant areas of the site have been cleared and progressive rehabilitation works are behind schedule. The Auditor also observed significant areas, that while not ready for final rehabilitation, would benefit from temporary stabilisation to help reduce dust emissions during adverse wind conditions.	Increase the rate of progressive rehabilitation works with the objective of meeting the established progressive rehabilitation targets. Prepare and implement a program for the stabilisation of unsealed / disturbed areas of the site including stockpiles, finished landforms, and disturbed areas that are not currently being actively worked / filled). The program should identify and classify all areas of the site that are currently disturbed according to the dust generation potential of those areas and establish clear targets for the stabilisation of those areas (either permanent or temporary) with the objective of meeting the requirements of the Blue Book.	Refer to response to SSD-6464 S3 C19.
27	Environment Protection / Prevention of Pollution	The Annual Returns prepared for the Environment Protection Licence 1276 noted several non-compliances with this condition. Refer to audit schedule for EPL 1376 for details.	A risk assessment and review of the storage capacity of the retention dams be undertaken that takes into account the increasing risk of extreme weather events, including extended duration wet weather patterns.	Completed. Refer to response to SSD-6464 S3 C24.
CCL753				
2	Operate in accordance with the Mining Operations Plan	Annual Review reports detail progress of mine rehabilitation progress against MOP plans. The net rehabilitation progress (i.e. rehabilitation minus rehabilitation disturbance) for the 2015 – 2021 period was 20.4 ha higher than targets. A total of 47.9ha of new rehabilitation was completed during 2022 against a Mining Operations Plan 2022 target of 35ha. 2022 annual report notes that rehabilitation and disturbance forecasts submitted to Resources Regulator (submitted in August 2022) are based on financial year periods and therefore don't align with the calendar year Annual Review reporting period and the misalignment is intended to be corrected in the Forward Program to be submitted in May 2023.	Increase the rate of progressive rehabilitation works with the objective of meeting the established progressive rehabilitation targets.	Refer to response to SSD-6464 S3 C57.

NON-COMPLIANCE RECOMMENDATIONS AND RESPONSES				
Ref	**Compliance Requirement**	**Independent Audit Finding**	**Independent Audit Recommendation**	**MTW Response / Progress**
16	Minimise Dust	Fifty-eight dust-related complaints were received during the audit period. No exceedances in dust criteria were reported during the audit period. Significant areas of the site have been cleared and progressive rehabilitation works are behind schedule. The Auditor also observed significant areas, that while not ready for final rehabilitation, would benefit from temporary stabilisation to help reduce dust emissions during adverse wind conditions.	Increase the rate of progressive rehabilitation works with the objective of meeting the established progressive rehabilitation targets. Prepare and implement a program for the stabilisation of unsealed / disturbed areas of the site including stockpiles, finished landforms, and disturbed areas that are not currently being actively worked / filled). The program should identify and classify all areas of the site that are currently disturbed according to the dust generation potential of those areas and establish clear targets for the stabilisation of those areas (either permanent or temporary) with the objective of meeting the requirements of the Blue Book.	Refer to response to SSD-6464 S3 C19.
25	Environment Protection / Prevention of Pollution	The Annual Returns prepared for the Environment Protection Licence 1376 noted several non-compliances with this condition. Refer to audit schedule for EPL 1376 for details.	A risk assessment and review of the storage capacity of the retention dams be undertaken that takes into account the increasing risk of extreme weather events, including extended duration wet weather patterns.	Completed. Refer to response to SSD-6464 S3 C24.
ML1590				
2	Operate in accordance with the Mining Operations Plan	Annual Review reports detail progress of mine rehabilitation progress against MOP plans. The net rehabilitation progress (i.e. rehabilitation minus rehabilitation disturbance) for the 2015 – 2021 period was 20.4 ha higher than targets. A total of 47.9ha of new rehabilitation was completed during 2022 against a Mining Operations Plan 2022 target of 35ha. 2022 annual report notes that rehabilitation and disturbance forecasts submitted to Resources Regulator (submitted in August 2022) are based on financial year periods and therefore don't align with the calendar year Annual Review reporting period and the misalignment is intended to be corrected in the Forward Program to be submitted in May 2023.	Increase the rate of progressive rehabilitation works with the objective of meeting the established progressive rehabilitation targets.	Refer to response to SSD-6464 S3 C57.

NON-COMPLIANCE RECOMMENDATIONS AND RESPONSES				
Ref	**Compliance Requirement**	**Independent Audit Finding**	**Independent Audit Recommendation**	**MTW Response / Progress**
13	Rehabilitate the site in accordance with the MOP	Annual Review reports detail progress of mine rehabilitation progress against MOP plans. The net rehabilitation progress (i.e. rehabilitation minus rehabilitation disturbance) for the 2015 – 2021 period was 20.4 ha higher than targets. A total of 47.9ha of new rehabilitation was completed during 2022 against a Mining Operations Plan 2022 target of 35ha. 2022 annual report notes that rehabilitation and disturbance forecasts submitted to Resources Regulator (submitted in August 2022) are based on financial year periods and therefore don't align with the calendar year Annual Review reporting period and the misalignment is intended to be corrected in the Forward Program to be submitted in May 2023.	Increase the rate of progressive rehabilitation works with the objective of meeting the established progressive rehabilitation targets.	Refer to response to SSD-6464 S3 C57.
ML1751				
3	Operate in accordance with the Mining Operations Plan	Annual Review reports detail progress of mine rehabilitation progress against MOP plans. The net rehabilitation progress (i.e. rehabilitation minus rehabilitation disturbance) for the 2015 – 2021 period was 20.4 ha higher than targets. A total of 47.9ha of new rehabilitation was completed during 2022 against a Mining Operations Plan 2022 target of 35ha. 2022 annual report notes that rehabilitation and disturbance forecasts submitted to Resources Regulator (submitted in August 2022) are based on financial year periods and therefore don't align with the calendar year Annual Review reporting period and the misalignment is intended to be corrected in the Forward Program to be submitted in May 2023.	Increase the rate of progressive rehabilitation works with the objective of meeting the established progressive rehabilitation targets.	Refer to response to SSD-6464 S3 C57.
CL219				
2	Operate in accordance with the Mining Operations Plan	Annual Review reports detail progress of mine rehabilitation progress against MOP plans. The net rehabilitation progress (i.e., rehabilitation minus rehabilitation disturbance) for the 2015 – 2021 period was 20.4 ha higher than targets.	Increase the rate of progressive rehabilitation works with the objective of meeting the established progressive rehabilitation targets.	Refer to response to SSD-6464 S3 C57.

NON-COMPLIANCE RECOMMENDATIONS AND RESPONSES				
Ref	**Compliance Requirement**	**Independent Audit Finding**	**Independent Audit Recommendation**	**MTW Response / Progress**
		A total of 47.9ha of new rehabilitation was completed during 2022 against a Mining Operations Plan 2022 target of 35ha. 2022 annual report notes that rehabilitation and disturbance forecasts submitted to Resources Regulator (submitted in August 2022) are based on financial year periods and therefore don't align with the calendar year Annual Review reporting period and the misalignment is intended to be corrected in the Forward Program to be submitted in May 2023.		
17	Minimise Dust	Fifty-eight dust-related complaints were received during the audit period. No exceedances in dust criteria were reported during the audit period. Significant areas of the site have been cleared and progressive rehabilitation works are behind schedule. The Auditor also observed significant areas, that while not ready for final rehabilitation, would benefit from temporary stabilisation to help reduce dust emissions during adverse wind conditions.	Increase the rate of progressive rehabilitation works with the objective of meeting the established progressive rehabilitation targets. Prepare and implement a program for the stabilisation of unsealed / disturbed areas of the site including stockpiles, finished landforms, and disturbed areas that are not currently being actively worked / filled). The program should identify and classify all areas of the site that are currently disturbed according to the dust generation potential of those areas and establish clear targets for the stabilisation of those areas (either permanent or temporary) with the objective of meeting the requirements of the Blue Book.	Refer to response to SSD-6464 S3 C57.
25	Environment Protection / Prevention of Pollution	The Annual Returns prepared for the Environment Protection Licence 1976 noted several non-compliances with this condition. Refer to audit schedule for EPL 1976 for details. • Dam 1S overtopped as a result of heavy or sustained rainfall which caused significant runoff (2023 AR) • Dam 1S overtopped as a result of heavy or sustained rainfall which caused significant runoff (2021 AR) • Discharge from 9S via spillway to Loders Creek (2021 AR)	A risk assessment and review of the storage capacity of the retention dams be undertaken that takes into account the increasing risk of extreme weather events, including extended duration wet weather patterns.	Completed. Refer to response to SSD-6464 S3 C24.

CONTINUOUS IMPROVEMENT RECOMMENDATIONS		
Ref	**Independent Audit Recommendation**	**MTW Response / Progress**
SSD 6464 S3 C27 / SSD 6465 S3 C25	It is recommended that MTW review the water balance model to take into account the impacts of climate change, for example the impacts of higher-than-normal rainfall events due to more extreme La-Nina events.	At the next Water Balance Update, MTW will seek advice from water balance experts to review rainfall inputs to water balance model. Where an improved rainfall dataset/model inputs are available MTW will seek to incorporate in the next Water Balance update.
SSD 6464 S3 C27 / SSD 6465 S3 C25	That the Water Balance documented in the WMP is updated to reflect water volumes and quality from the STP, as well as any necessary treatment and/or testing of the waters discharged.	MTW has reviewed this recommendation and does not intend to implement this recommendation. On site sewage management (OSSM) is already approved and regulated by Singleton Council and is included on relevant Environment Protection Licences. The volumes from these systems is not large in the context of a mine water balance, so provide no improvement to water balance understanding.
SSD 6464 S3 C29 / SSD 6464 S3 C56	To improve the success of the rehabilitation works and to achieve the targets detailed in the Ecological monitoring reports, that: • More intensive weed control of High Threat Weeds be undertaken; • Control of overly dominant natives (e.g Corymbia maculate, Acacia species) via thinning or changes to seed mix; and • Widen the distribution of ground habitat features (such as logs);	Weed control works in rehabilitation areas is ongoing. MTW undertakes monitoring, rehabilitation inspections which then guide weed control effort in rehabilitation areas. Weed control in rehabilitation areas is currently constrained by available resources (land management crews). MTW has introduced an additional land management contractor to some land management aspects at MTW, which may alleviate resource constraints in future. Native seed mixes for MTW rehabilitation areas were reviewed in May 2020 to remove dominant species that are not considered to be a significant component of the target Grey Box – Ironbark Woodland (GBIBW) vegetation community. Relevant to this audit finding, the following species were changed to back-up species that would only be included in seed mixes if other GBIBW species were not available and at a reduced sowing rate when used: Corymbia maculata, Acacia crassa, Acacia elongata, and Acacia spectabilis. Acacia cultriformis has also been found to be dominant in some rehabilitation areas so the maximum sowing rate has also been reduced for this species. Thinning of Corymbia maculata will be conducted as required but may be intentionally delayed to allow sufficient tree growth to contribute towards the relevant habitat performance criteria (i.e. Length of Logs on the Ground (m) at least 10cm in diameter). The seed mix review recommendation was completed May 2020. The thinning recommendation is subject to ongoing review. Rehabilitation work program to increase distribution of ground habitat features through continued placement of salvaged logs in rehabilitation areas will continue in the next IEA period as an ongoing work item.
SSD 6464 S3 C29	That any future modification to the Approval consider seeking to remove specific mentions of the use of the NSW Biodiversity Offsets Policy for Major Projects as this is no longer available.	MTW agrees this would assist with clarity for Biodiversity descriptions in the consent, and is happy to engage with DPE on this matter for any future modifications for SSD 6464. It is noted that a modification is currently in progress (SSD 6464 MOD1) which seeks to address biodiversity offset conditions of the consent, given the change to biodiversity offset regulation.
SSD 6464 S3 C32	Warkworth Sands Woodland – Additional work is required to meet the final performance criteria, In particular it is recommended that consideration is given to amending seed mixes to include a higher diversity of non-grass native species to increase groundcover diversity. Restoration work scheduled for 2022 was delayed due to access issues associated with inclement weather and that works have been rescheduled for 2023. Based on the ecologist field observations, further active works, particularly in regard to increasing groundcover diversity, may be required to meet the required performance criteria by Year 15.	MTW will review understorey seed mix used in the Warkworth Sands Woodland revegetation areas to include a higher diversity of non-grass native species to increase ground cover diversity. Complete by June 2024.