YANCOAL
兖煤澳大利亚有限公司
MOOLARBEN COAL

MOOLARBEN COAL COMPLEX ANNUAL REVIEW 2019

Document	Version	Issue	Author	Approved
MCO_RPT_ANNUAL REVIEW 2019	1	Apr 2020	MCO	SA

Name of operation	Moolarben Coal Complex
Name of operator	Moolarben Coal Operations Pty Ltd
Development consent / project approval #	05_0117 and 08_0135
Name of holder of development consent / project approval	Moolarben Coal Mines Pty Limited
Mining lease #	ML 1605, 1606, 1628, 1691, 1715
Name of holder of mining leases	Moolarben Coal Mines Pty Ltd, Sojitz Moolarben Resources Pty Ltd and Kores Australia Moolarben Resources Pty Ltd
Water licence #	Refer Table 6
Name of holder of water licence	Moolarben Coal Operations Pty Ltd
MOP/RMP start date	1 January 2017
MOP/RMP end date	31 December 2019
Annual Review start date	1 January 2019
Annual Review end date	31 December 2019

I, Steve Archinal, certify that this audit report is a true and accurate record of the compliance status of Moolarben Coal Complex for the period January 1st 2019 to December 31 2019 and that I am authorised to make this statement on behalf of Moolarben Coal Operations.

Note.

a) The Annual Review is an 'environmental audit' for the purposes of section 9.39 of the Environmental Planning and Assessment Act 1979. Section 9.42 provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, $1 million and for an individual, $250,000.

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

Name of authorised reporting officer	Steve Archinal
Title of authorised reporting officer	General Manager
Signature of authorised reporting officer	
Date	28 April 2020

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1.0 STATEMENT OF COMPLIANCE

A summary of compliance with relevant approval conditions from 01 January 2019 to 31 December 2019 (the reporting period) is provided in **Table 1** and **Table 2**. A compliance table key is provided in **Table 3**.

Table 1: Statement of compliance

Approval	Compliance Status (Including Administrative Non-compliances)	Approval	Compliance Status (Including Administrative Non-compliances)
PA 05_0117	No	WAL36340	Yes
PA 08_0135	No	WAL37582	Yes
ML 1605	Yes	WAL37583	Yes
ML 1606	Yes	WAL39799	Yes
ML 1628	Yes	WAL41888	Yes
ML 1691	Yes	20BL173935	Yes
ML 1715	Yes	-	-

Table 2: Non-compliances

Approval	Condition Number	Condition description (summary)	Compliance status	Comment	Where addressed
PA 08_0135 PA05-0117	Sch. 3 C. 22	Air Quality Management Plan	Non-Compliant	Non-continuous TEOM monitoring	6.4 and 12.0

Table 3: Compliance Table Key

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

2.0 INTRODUCTION

The Moolarben Coal Complex (MCC) is located approximately 40 kilometres north of Mudgee in the Western Coalfield of New South Wales **(Figure 1)** within the Mid-Western Regional Local Government Area. Local relevant land ownership within the immediate vicinity of the MCC is provided in **Appendix 1**.

Moolarben Coal Operations Pty Ltd (MCO) is the operator of the Moolarben Coal Complex (MCC) on behalf of the Moolarben Joint Venture (Moolarben Coal Mines Pty Ltd [MCM], Sojitz Moolarben Resources Pty Ltd and a consortium of Korean power companies). MCO and MCM are wholly owned subsidiaries of Yancoal Australia Limited (Yancoal).

Current mining operations undertaken across the MCC have approval until 31 December 2038. All mining operations are conducted in accordance with NSW Project Approval (05_0117) (Moolarben Coal Project Stage 1) as modified, and NSW Project Approval (08_0135) (Moolarben Coal Project Stage 2) as modified.

The current mining operations are undertaken in accordance with Approval Decisions (EPBC 2007/3297), (EPBC 2013/6926), (EPBC 2008/4444) and (EPBC 2017/7974) under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act).

Current mining operations at the MCC are conducted in accordance with the requirements of the conditions of Mining Lease (ML) 1605, ML 1606, ML 1628, ML 1691, and ML1715 granted under the *Mining Act, 1992*.

2.1 SCOPE

This Annual Review (AR) has been prepared by MCO (with input from experienced and qualified experts) to satisfy the reporting requirements of NSW Project Approval (05_0117) (as modified), NSW Project Approval (08_0135) (as modified), mining leases ML 1605, ML 1606, ML1628, ML1691 and ML1715, and water licences. The report presents a summary of the regulatory compliance, environmental performance, and community engagement activities for MCO.

The following key agencies shall be provided with a copy of this report:

- NSW Department of Planning, Industry and Environment (DPIE);
- NSW Department of Planning, Industry and Environment – Resources Regulator (RR);
- NSW Department of Planning, Industry and Environment – Biodiversity and Conservation Division (BCD);
- NSW Department of Planning, Industry and Environment – Water (DPIE – Water)/Natural Resources Access Regulator (NRAR);
- NSW Environment Protection Authority (EPA);
- Mid-Western Regional Council (MWRC); and
- Members of the MCC Community Consultative Committee (CCC).

In addition, an electronic copy will be made publicly available on the Moolarben Coal website (http://www.moolarbencoal.com.au/) in accordance with Schedule 5, Condition 11 (a) of PA05_0117 and Schedule 6, Condition 11 (a) of PA08_0135.

2.2 STRUCTURE OF THIS ANNUAL REVIEW

The remainder of the AR is structured as follows and is based on the *Annual Review Guidelines – Post-approval requirements for State significant mining developments* (NSW Department of Planning and Environment, 2015):

Section 3: Outlines the relevant statutory approvals.

Section 4: Outlines the activities undertaken at Moolarben Coal Complex for the period and those proposed for the next period.

Section 5: Actions required from previous Annual Review.

Section 6: Outlines environmental performance including meteorological, noise, blasting, air quality, biodiversity, heritage, bushfire and waste.

Section 7: Outlines the water management performance.

Section 8: Outlines subsidence performance.

Section 9: Outlines the rehabilitation management performance

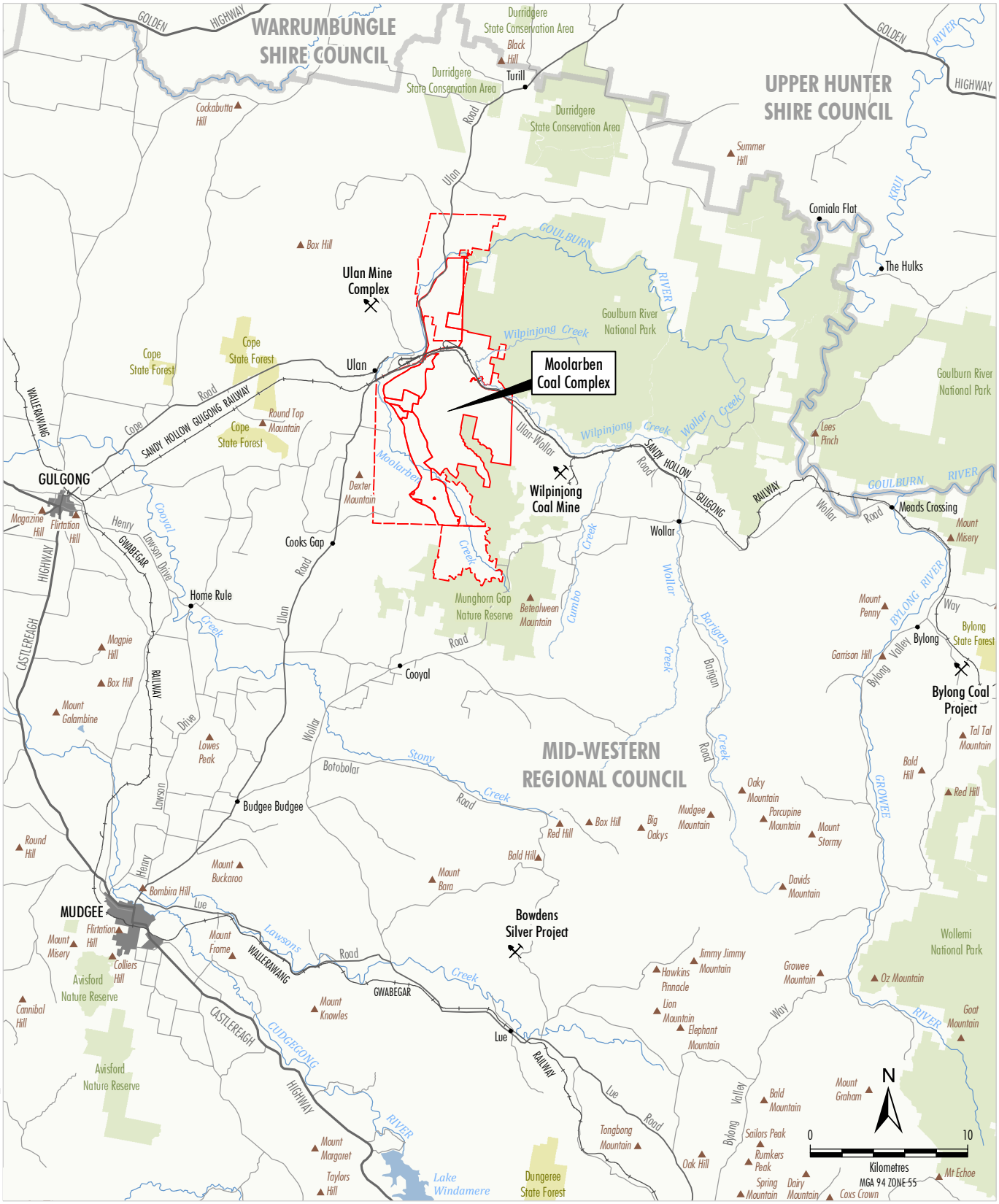
Section 10: Outlines the community performance.

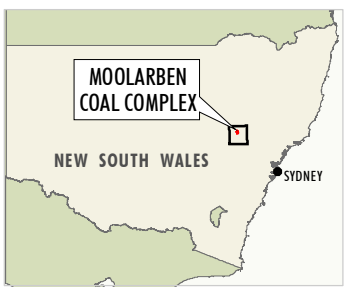
Section 11: Describes independent audit requirements.

Section 12: Provides a summary of incidents and non-compliances.

Section 13: Outlines activities to be completed in the next reporting period.

Appendices: Supporting information and monitoring data.





LEGEND
- State Forest
- NSW National Parks and Wildlife Service
- Local Government Boundary
- Exploration Licence Boundary
- Mining Lease Boundary
- Mining Operation

Source: NSW Land & Property Information (2017); NSW Department of Industry (2017); Office of Environment and Heritage NSW (2017)

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MOOLARBEN COAL COMPLEX

Regional Location

Figure 1

MCM-14-08 MCC EMP 2019 CF_201A

2.3 PROJECT DESCRIPTION

The MCC comprises the Moolarben Stage 1 and Stage 2 Projects. An overview of the complex is provided in **Figure 2**. The Stage 1 and Stage 2 operations are summarised in **Table 4** below.

Stage 1 at the Moolarben Coal Complex has been operating for several years and at full development will comprise three open cut mines (OC1, OC2, and OC3), a longwall underground mine (UG4), and mining related infrastructure (including coal processing and transport facilities).

Stage 2 at the Moolarben Coal Complex has commenced and at full development will comprise one open cut mine (OC4), two longwall underground mines (UG1 and UG2), and mining related infrastructure.

Table 4: Moolarben Coal Complex production overview

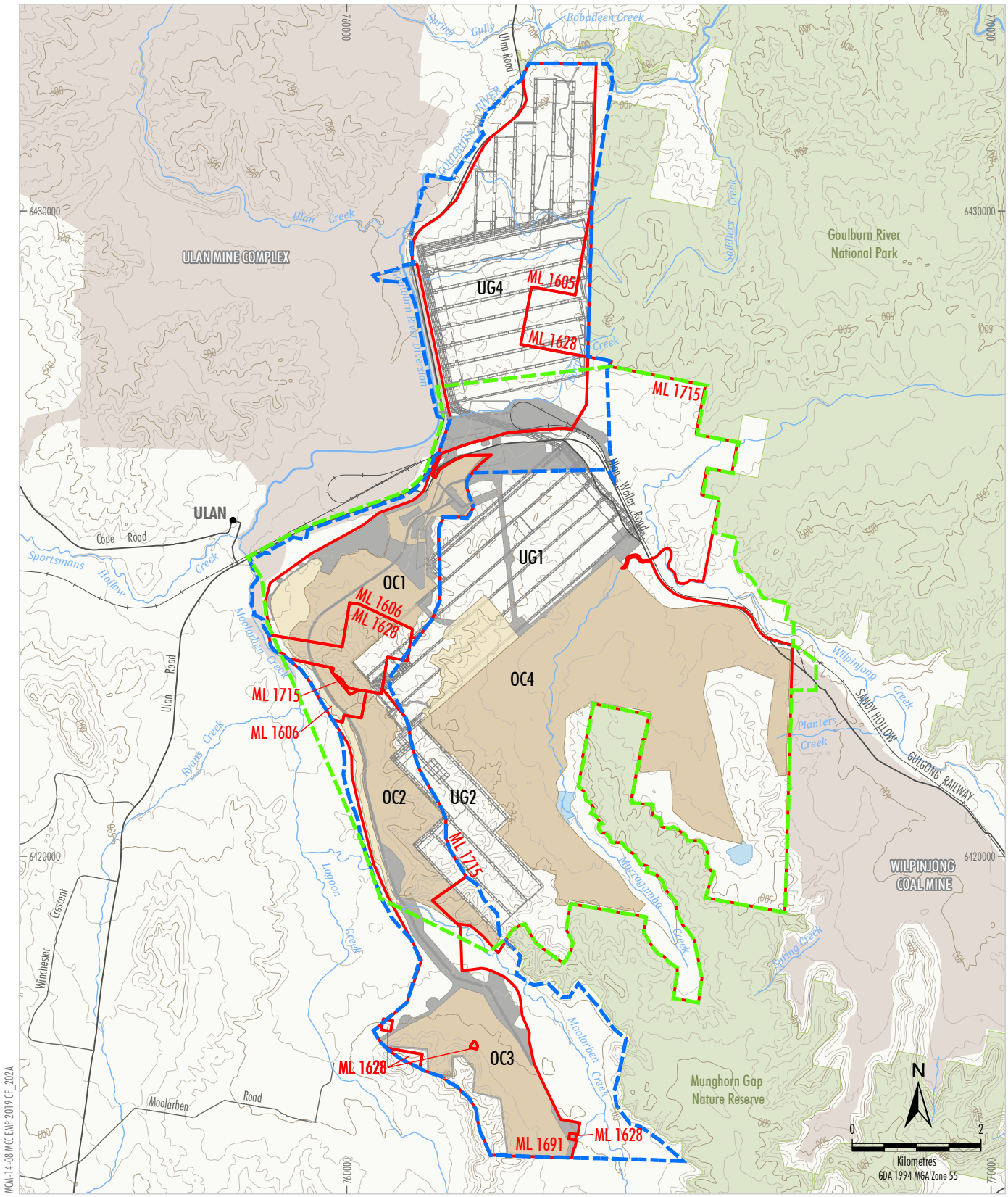
Relevant Approval Component	Moolarben Coal Project	
	Stage 1 **Project Approval (05_0117)**	**Stage 2** **Project Approval (08_0135)**
Operational Mine Life	Mining operations can be carried out until 31 December 2038.	
Hours of Operation	Mining operations can be carried out 24 hours a day, 7 days a week.	
Coal Extraction Limits	Up to 10 Mtpa of ROM coal can be extracted from the open cut mining operations in any calendar year from Stage 1.	Up to 16 Mtpa of ROM coal can be extracted from the open cut mining operations in any calendar year from Stage 2.
	Up to 8 Mtpa (total) of ROM coal can be extracted from the underground mining operations at the Moolarben Coal Complex in any calendar year.	
Coal Processing and Offsite Transport	Up to 16 Mtpa (total) of ROM coal from the Moolarben Coal Complex can be washed in the calendar year. Not more than 8 laden trains on average or 11 laden trains maximum to leave the complex per day.	
	All coal is to be transported from the Moolarben Coal Complex by rail.	All coal extracted from the site is sent to the Moolarben Stage 1 mine surface infrastructure area for processing and/or transport to market.

2.4 KEY MINE CONTACT PERSONNEL

The following table provides contact details for key personnel responsible for environmental management across the Moolarben Coal Complex.

Table 5: Mine Contact Personnel

Position/Area of Responsibility	Name	Contact Number(s)	Email Address
General Manager	Steve Archinal	02 6376 1500	steve.archinal@yancoal.com.au
Environment and Community Manager	Graham Chase	02 6376 1407	graham.chase@yancoal.com.au
Environment and Community Superintendent	Trent Cini	02 6376 1436	trent.cini@yancoal.com.au
Environment and Community Complaints Line	1800 556 484		
Postal Address	Locked Bag 2003, Mudgee, NSW, 2850		



LEGEND

- NSW National Parks and Wildlife Service
- Other Mining Operations
- Mining Lease Boundary

Existing/Approved Development

- Open Cut Mining Area
- Out-of-pit Emplacement
- Surface Infrastructure Area
- Clean Water Diversion Infrastructure
- Underground Longwall Layout
- Haul Road
- Road Realignment (not yet constructed)
- Approved Stage 1 Project Boundary
- Approved Stage 2 Project Boundary

Source: MCO (June 2017); NSW Dept of Industry (2017); NSW Land & Property Information (2017); Office of Environment and Heritage NSW (2017)

MCM-14-08 MCC EMP 2019 CF_202A

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MOOLARBEN COAL COMPLEX

Approved Moolarben Coal Project (Stage 1 and Stage 2) General Arrangement

Figure 2

3.0 APPROVALS

3.1 SUMMARY OF APPROVALS

Project Approvals, Mining Leases, and other Licences relevant to MCO are provided in **Table 6**. Current Project Approvals, EPBC Approvals, Exploration Licences, and Mining Leases are available at www.moolarbencoal.com.au.

Table 6: Relevant Approvals, Leases and Licences

Approval	Description	Expiry Date
Project Approval – NSW Department to Planning Industry and Environment		
05_0117	Stage 1 as modified	31 December 2038
08_0135	Stage 2 as modified	31 December 2038
Mining Lease – NSW Department of Planning, Industry Environment –Resources Regulator		
ML1605	Underground 4, CHPP and infrastructure areas	20 December 2028
ML1606	OC1, OC2, UG1 and associated infrastructure	20 December 2028
ML1628	OC1, OC2, OC3, UG1 and UG4	24 February 2030
ML1691	OC2, OC3, UG1, UG2 and associated infrastructure	23 September 2034
ML1715	OC2, OC4, UG1, UG2 and associated infrastructure	31 August 2036
Mining Operation Plan – NSW Department of Planning, Industry Environment –Resources Regulator		
MOP	Stage 1 and Stage 2 operations	31 December 2022
Exploration Licences – NSW Department of Planning, Industry Environment –Resources Regulator		
EL6288	Coal Exploration Licence	22 August 2017 (renewal pending)
EL7073	Coal Exploration Licence	12 February 2020 (renewal pending)
EL7074	Coal Exploration Licence	12 February 2020 (renewal pending)
Environmental Protection Licence – NSW Environment Protection Agency		
EPL12932	Licence authorising the carrying out of scheduled activities	N/A
Environment Protection and Biodiversity Conservation – Commonwealth Department of Agriculture, Water and the Environment		
2007/3297	Stage 1 coal mines and associated infrastructure	31 December 2027
2008/4444	Stage 2 coal mines	31 December 2065
2013/6926	Modify and extend the Stage 1 Moolarben Coal Project.	31 December 2064
2017/7974	Modify and extend the Stage 1 and Stage 2 Moolarben Coal Project	31 December 2050
Water Licences – NSW Department of Planning, Industry and Environment – Water		
WAL 39799	Sydney Basin - North Coast Groundwater Sources – Aquifer Licence	N/A
20BL173935	Monitoring Bore Licence	Perpetuity
WAL36340	Wollar Creek Water Source -Aquifer	N/A
WAL37582	Upper Goulburn River Water Source – Unregulated River	N/A
WAL37583	Wollar Creek Water Source - Unregulated River	N/A
WAL41888	Upper Goulburn River Water Source - Aquifer	N/A
WAL19424	Wollar Creek Water Source - Unregulated River	N/A

During the reporting period the following approvals were granted:

- Moolarben Coal Complex Mining Operations Plan 2017-2019 Amendments F;
- Moolarben Coal Complex Mining Operations Plan 2020-2022;
- Stage 1, Modification 14;
- Stage 2, Modification 3;
- EPBC 2017/7974;
- EPL12932 was varied twice during the reporting period:
    - Licence Variation No.1576687 was approved on the 4 March 2019 to allow for the relocation of monitoring point No.48; and
    - Licence Variation No.1583644 was approved on the 4 October 2019 to update the licence to align with MOD14 and MOD 3.

3.2 ANNUAL REPORTING

Table 7 provides a checklist of AR requirements and performance conditions along with the relevant sections within this report.

Table 7: Annual Review Requirements

Approval Type & Reference		Annual Review Section
Project Approval 05_0117 Condition 4 Schedule 5	*By the end of March each year, or other timing as may be agreed by the Secretary, the Proponent shall review the environmental performance of the project to the satisfaction of the Secretary. This review must:* *a. describe the development that was carried out in the previous calendar year, and the development that is proposed to be carried out over the next year;* *b. include a comprehensive review of the monitoring results and complaints records of the project over the previous calendar year, which includes a comparison of these results against the* • *the relevant statutory requirements, limits or performance measures/criteria;* • *the monitoring results of previous years; and* • *the relevant predictions in the EA;* *c. identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;* *d. identify any trends in the monitoring data over the life of the project;* *e. identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies; and* *f. describe what measures will be implemented over the next year to improve the environmental performance of the project.*	4.2 & 4.3 6 to 10 1, 6 to 10 & 12 6 to 10 6 to 10 6 to 10 & 13
Project Approval 08_0135 Condition 4 Schedule 6	*By the end of March each year, or other timing as may be agreed by the Secretary, the Proponent shall review the environmental performance of the project to the satisfaction of the Secretary. This review must:* *a. describe the development that was carried out in the previous calendar year, and the development that is proposed to be carried out over the next year;* *b. include a comprehensive review of the monitoring results and complaints records of the project over the previous calendar year, which includes a comparison of these results against the* • *the relevant statutory requirements, limits or performance measures/criteria;* • *the monitoring results of previous years; and* • *the relevant predictions in the EA;* *c. identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;* *d. identify any trends in the monitoring data over the life of the project;* *e. identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies; and* *f. describe what measures will be implemented over the next year to improve the environmental performance of the project.*	4.2 & 4.3 6 to 10 1, 6 to 10 & 12 6 to 10 6 to 10 6 to 10 & 13
Mining Lease 1605, 1606 & 1628 Condition 4 & 5	*The lease holder must lodge Environmental Management Reports (EMR) with The Director-General annually or at dates otherwise directed by the Director-General.* *The EMR must:* *- report against compliance with the MOP;* *- report on progress in respect of rehabilitation completion criteria;*	This Report & Section 9

Approval Type & Reference		Annual Review Section
	- report on the extent of compliance with regulatory requirements; and *- have regard to any relevant guidelines adopted by the Director-General;*	
Mining Lease 1691 Condition 4	*(a) The lease holder must lodge Environmental Management Reports (EMR) with the Director-General annually or at dates otherwise directed by the Director-General.* *(b) The EMR must:* *I. Report against compliance with the MOP;* *II. Report on progress in respect of rehabilitation completion criteria;* *III. Report on the extent of compliance with regulatory requirements; and* *IV. Have regard to any relevant guidelines adopted by the Director-General.*	This Report & Section 9
Mining Lease 1715 Condition 3	*f) The lease holder must prepare a Rehabilitation Report to the satisfaction of the Minister. The report must:* *(i) provide a detailed review of the progress of rehabilitation against the performance measures and criteria established in the approved MOP;* *(ii) be submitted annually on the grant anniversary (or at such other times as agreed by the Minister; and* *(iii) be prepared in accordance with any relevant annual reporting guidelines published on the Department's website at www.resources.nsw.gov.au/environment.*	This Report & Section 9

4.0 OPERATIONS SUMMARY

4.1 MINING OPERATIONS

Details of production and associated waste generated by the site for the report period and next reporting period are provided in **Table 8**.

Table 8 : Production Summary

Material	Approved Limit (PA 05_0117 & 08_0135)	Reporting Period		
		Previous Period (actual)	Current Period (actual)	Next Period (forecast)
Waste Rock/ Overburden (BCM)	N/A	51,640,016	47,275,395	44,331,252
Open Cut ROM Coal (t) (OC1, 2 & 3)	10,000,000	3,933,920	3,890,579	3,309,302
Open Cut ROM Coal (t) (OC4)	16,000,000	9,065,915	10,198,715	10,493,281
Open Cut ROM Coal (t)	16,000,000	12,999,835	14,089,294	13,802,583
Underground ROM Coal (t)	8,000,000	5,588,036	6,424,761	7,092,149
Coal Washing (t)	16,000,000	12,570,428	13,489,718	13,390,687
Rejects (Co Disposal)	N/A	2,137,235	2,662,424	2,394,732
Product Coal (t)	N/A	16,521,118	17,851,631	18,500,000

4.2 REPORTING PERIOD ACTIVITIES

This section provides further detail on the activities undertaken in the reporting period. Works were carried out in accordance with the relevant Mining Operations Plan (MOP). **Figure 4** presents the areas of activity.

4.2.1 EXPLORATION

Exploration activities were undertaken in EL6288, EL7073, ML1715, and ML1691, including a total of 35 exploration holes within EL6288, 58 exploration holes within EL7073, 14 exploration holes focusing on OC3 within ML1691, and a further 67 exploration holes primarily focusing on UG1, UG2 and OC4 within ML1715.

4.2.2 LAND DISTURBANCE

During the reporting period 114ha were disturbed taking the total mine footprint to 1,493ha with the majority of the increased land disturbance associated with the progression of mining. The areas disturbed this reporting period are shown in **Figure 3**.

All land disturbance is undertaken in accordance with the Ground Disturbance Permit (GDP) process. This includes pre-clearance surveys, heritage clearance, erosion and sediment control plans, confirmation of land ownership and disturbance extents reviewed to ensure compliance with relevant management plans (Surface Water, Heritage, Biodiversity and Rehabilitation Management Plans).

Topsoil, mulch and select salvageable hollows were reclaimed for use in rehabilitation areas, or stockpiled for future use.

4.2.3 CONSTRUCTION

Construction works undertaken during the reporting period included the progression of mining infrastructure for Underground 1 (UG1) and Open Cut 3 (OC3). Mine infrastructure works included water management infrastructure and ancillary works. Construction activities commenced or undertaken in the period included:

- Construction of the Water Treatment Plant and associated infrastructure;
- Construction of the Moolarben Creek Crossing;
- Construction of the Bora Creek discharge point; and
- Open Cut 1 fuel farm upgrade works.

4.2.4 MINING OPERATIONS

Mining activities were undertaken in accordance with relevant project approvals and the approved MOP. During the reporting period general mining activities included:

- Overburden removal from OC2 and OC4 using excavator and truck fleets;
- Overburden removal from OC4 using cast and dozer push;
- Coal extraction from OC2 and OC4;
- Drilling and blasting select overburden and coal;
- Spoil emplacement in-pit in OC2, OC4 and within the OC4 Out of pit emplacement;
- Bulk spoil reshaping and rehabilitation;
- Construction and operation of water management works;
- Continued underground development; and
- Extraction of LW102, LW103 plunge planel and commencement of LW103.

4.2.5 COAL PROCESSING AND TRANSPORT

Open Cut ROM coal was transported from the ROMs via conveyor to the CHPP for processing. ROM coal from the UG1 ROM was transported to the underground product stockpile via conveyor. Washed product coal was transported to the product coal stockpile prior to railing. Coarse rejects were co-mingled with dewatered fine rejects and transported by conveyor to the Rejects Bin and then trucked back to the open pit for selective placement with mine spoil.

All product coal was loaded onto trains via the Train Load-out in the Moolarben rail loop and transported via rail to port. MCO monitors the amount of coal transported from site each year and the date/time of each movement. During the period, the maximum number of train movements per day was 9 with an average of 5.5 per day.

4.2.6 REHABILITATION

Rehabilitation works during the reporting period were undertaken within Open Cut 2, Open Cut 4, and progressive rehabilitation of construction areas. More detail of rehabilitation activities during the reporting period is provided in **Section 9.0**.

4.3 NEXT REPORTING PERIOD

The proposed mining sequence for 2020 is detailed in the currently approved 2020-2022 MOP dated December 2019. The status of proposed activities at the end of 2020 are provided in **Figure 5**.

MCO will continue to operate 24 hours per day, 7 days per week with blasting limited to the hours and frequency detailed in PA 05_0117 Schedule 3, Condition 9 & 10 and PA 08_0135 Schedule 3, Condition 10 & 11.

4.3.1 EXPLORATION

Proposed exploration activities during 2020 will primarily focus on OC4 within ML1715 and UG4 within ML1605 and ML1628, with some exploration also required within EL6288 and EL7073. All exploration carried out on MCO Exploration Licence areas will be approved through the DPIE Resource Regulator's application to Conduct Exploration Activities, including all required environmental assessments.

4.3.2 LAND DISTURBANCE

During the next reporting period, approximately 301ha will be disturbed for open-cut mining across OC2, OC3 and OC4. The areas to be disturbed are shown in **Figure 3**.

4.3.3 CONSTRUCTION

Proposed construction works during the next reporting period includes mine sustaining infrastructure and of Open Cut 3 expansion. Construction activities include:

- Completion of a Water Treatment Facility and associated infrastructure;
- Construction of water infrastructure;
- Moolarben Creek Crossing and Open Cut 3 infrastructure; and
- Open Cut 1 fuel farm upgrade works.

4.3.4 MINING OPERATIONS

Mining operations for the next period are shown in **Figure 5** and include:

- Drilling and blasting select overburden and coal;
- Overburden removal from OC2, OC3 and OC4 using dozer, excavator and truck fleets;
- Overburden removal from OC4 using cast and dozer push;
- Spoil emplacement in-pit in OC1, OC2, OC3 and OC4;
- Coal extraction from OC2, OC3, and OC4;
- Bulk spoil reshaping and rehabilitation;
- Construction and operation of water management works;
- Continued underground development, including commencement of UG4 first workings; and
- Continued longwall operations at UG1 in LW103 and LW04.

4.3.5 COAL PROCESSING AND TRANSPORT

Open Cut ROM coal will be transported from the ROMs via conveyor to the CHPP for processing. Underground coal and Open Cut coal will be transferred with the UG1 coal handling system. Product coal will be stored on the product coal stockpile prior to transport. Coarse rejects will be co-mingled with dewatered fine rejects and transported by conveyor to the Rejects Bin from where it will be trucked back to the open pit for selective placement within mine spoil.

All product coal will be loaded onto trains in the Moolarben rail loop and transported via rail. All train movements will be conducted in accordance with the conditions of approval.

4.3.6 REHABILITATION

Rehabilitation works proposed for the next reporting period will be undertaken in OC2 and OC4. Rehabilitation activities will include landform establishment, growth medium development, ecosystem and landuse establishment and rehabilitation maintenance if required.

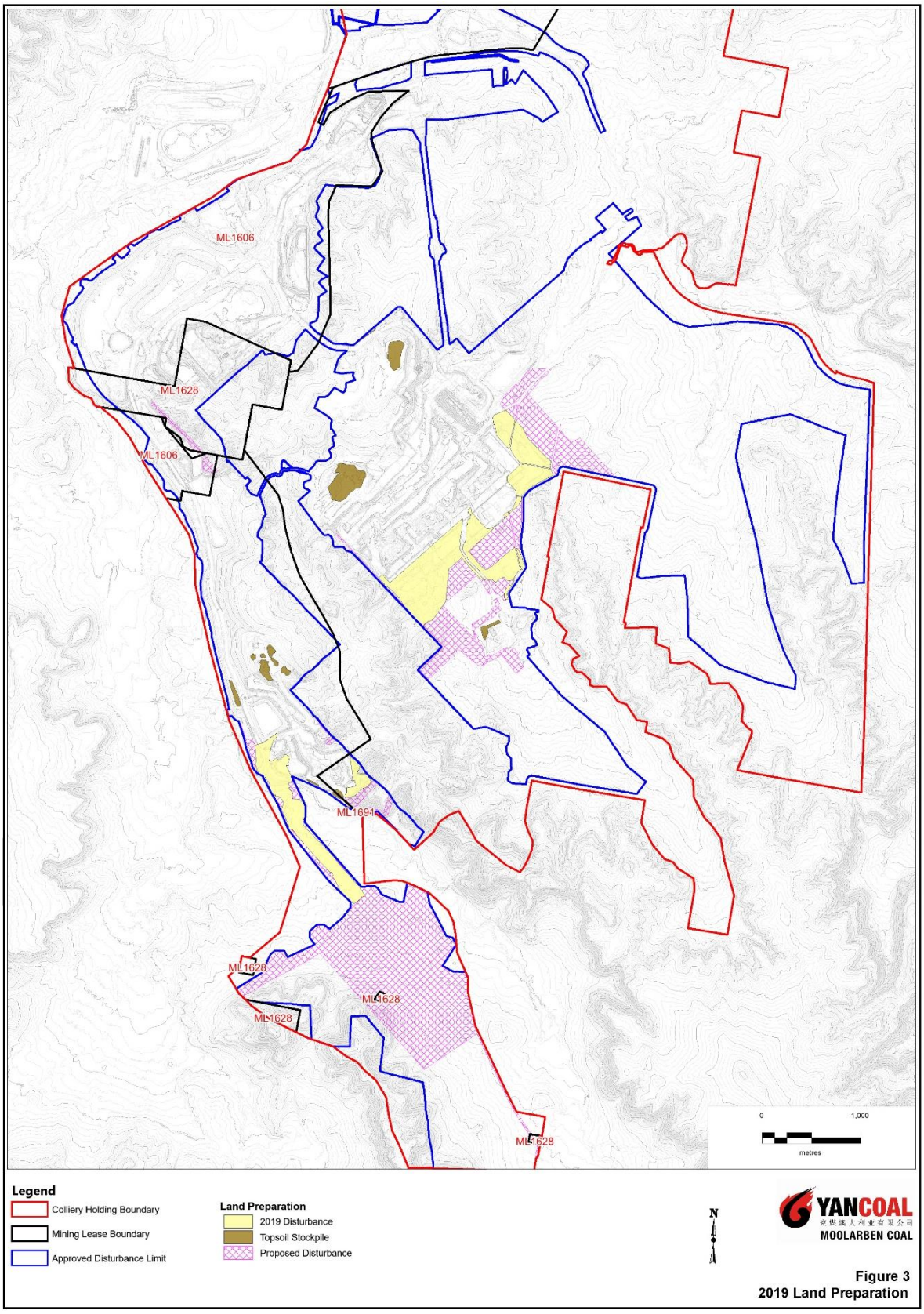


Figure 3: Land preparation areas

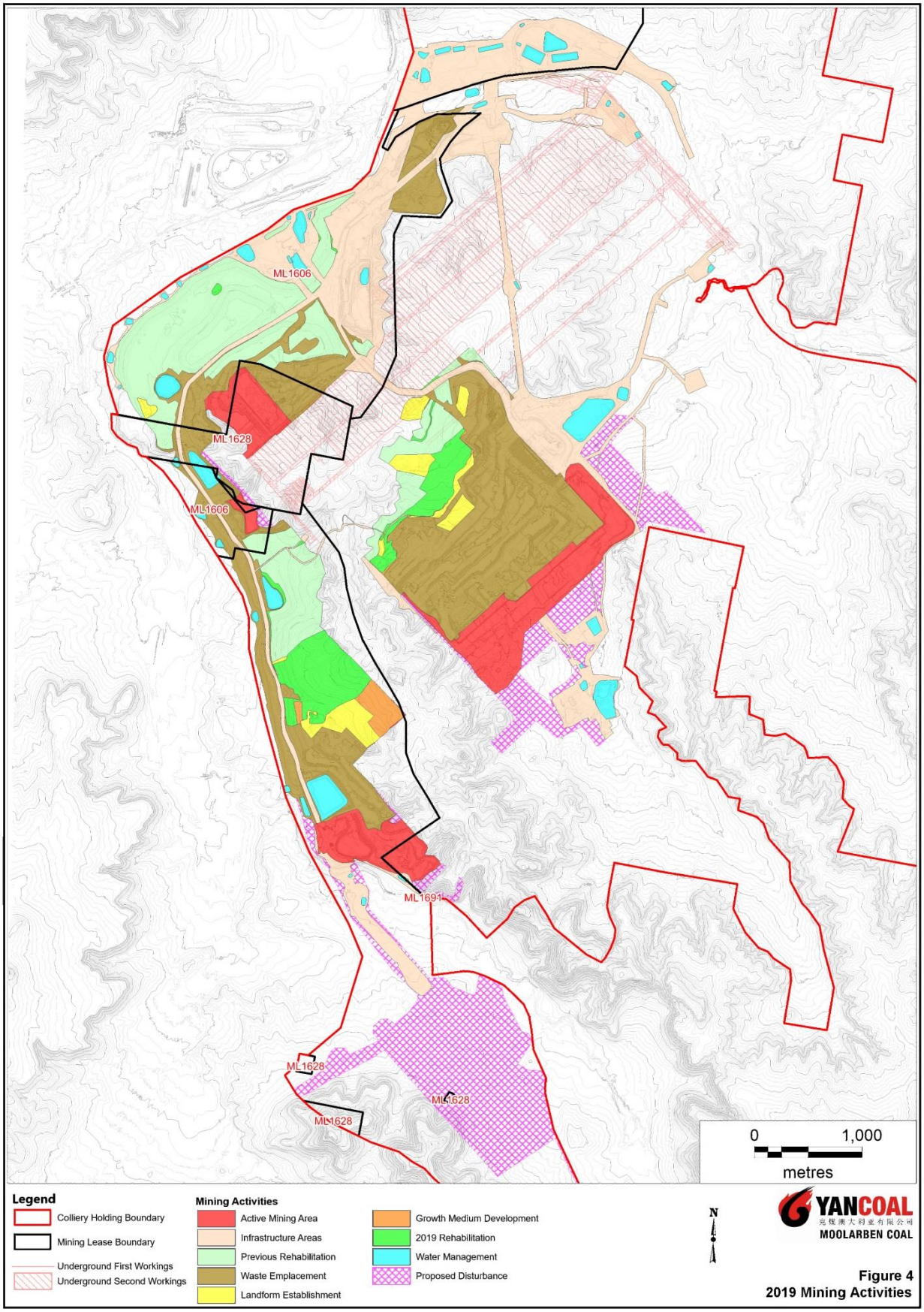


Figure 4: Mining activity areas during the reporting period

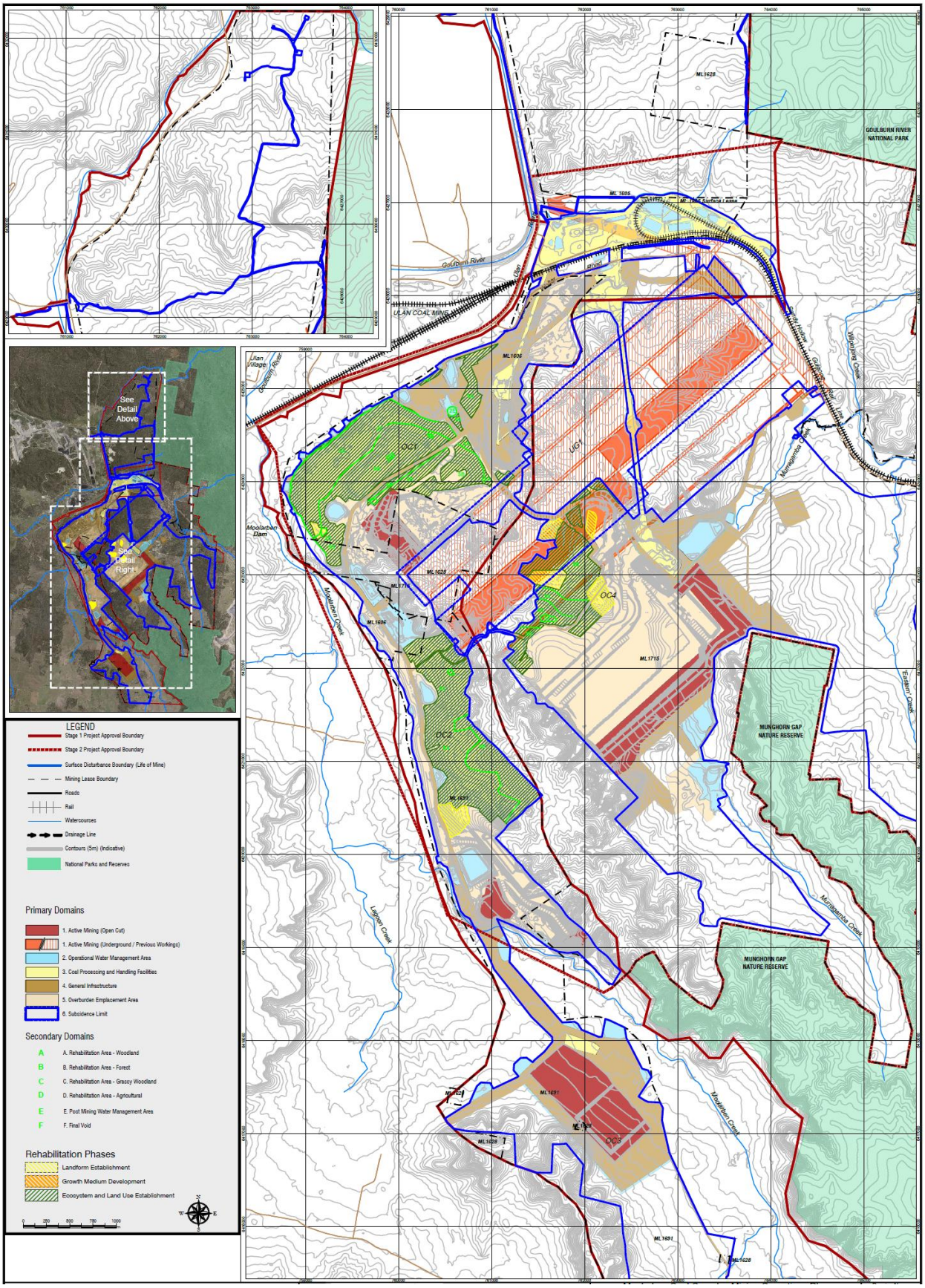


Figure 5: Mining Activities for the next reporting period (MOP Plan 3A)

5.0 ACTIONS REQUIRED FROM PREVIOUS REPORTING PERIOD

The 2018 AR was submitted to the RR (formally the Department of Resources and Geoscience) and DPIE on the 31 March 2019. The 2018 AR was accepted and approved on the 13 May 2019 and 22 May 2019 respectively. There were no actions issued to MCO in regards to the 2018 AR, and the 2018 AR was placed on the MCO website within one month of approval.

Actions outlined by MCO in the 2018 AR are provided in **Table 9**.

Table 9 : Actions from Previous Annual Review

Action Required from previous Annual Review	Requested by	Action Taken by MCO	Section of AR addressing this action
Review and revise all environmental management plans as necessary	MCO	Complete	Sections 6 to 9
Review and revision of Biodiversity Management Plans.	MCO	Biodiversity MP revised. Action Ongoing	Section 6.5
Continue to progress offset security instruments.	MCO	10 Offsets secured Action Ongoing	Section 6.5
Continue baseline monitoring of PZ201, 202, 203, 211, 213 and 214 to develop SWL, pH and electrical conductivity triggers.	MCO	Monitoring in progress. Action Ongoing	Section 7.4
Continued progressive rehabilitation.	MCO	Action Ongoing	Section 9
Establish baseline monitoring sites for LW103 where not already in place.	MCO	Complete	Section 8

6.0 ENVIRONMENTAL PERFORMANCE

In accordance with the MCC Project Approvals, MCO have developed a series of environmental Management Plans in consultation with the relevant government agencies. Current approved plans are available for review via the MCO website - http://www.moolarbencoal.com.au

In order to measure compliance with the project approvals, various licences, and site management plans, MCO undertakes a comprehensive environmental monitoring program. The locations of environmental monitoring undertaken during the 2019 reporting period are identified in **Appendix 2**. This section provides summary details on:

- **Section 6.1** - Meteorological overview
- **Section 6.2** - Noise;
- **Section 6.3** – Blasting;
- **Section 6.4** – Air quality;
- **Section 6.5** – Biodiversity; and,
- **Section 6.6** – Heritage.

Water, subsidence, rehabilitation and community aspects are reported in **Sections 7.0, 8.0, 9.0** and **10.0** respectively.

6.1 METEOROLOGICAL SUMMARY

MCO utilises two meteorological monitoring station - WS03 (Ulan Road), and WS04 located near OC2. The localities of the stations are illustrated in **Appendix 2**. Both weather stations are linked to the real-time monitoring system. WS03 is the principal weather station for reporting purpose, with WS04 used to supplement weather data as required. Meteorological parameters recorded by WS03 include:

- wind speed at 10 m;
- wind direction at 10 m;
- sigma theta;
- temperature at 2 m and 10 m;
- relative humidity at 2 m;
- solar radiation at 2 m; and,
- Rainfall

WS03 rainfall and temperature records for 2019 are summarised in **Table 10**. A total of 360mm of rainfall was recorded in 2019, with March the wettest month (130.4mm) and April the driest (0.6mm). The total rainfall at MCO for 2019 was 290mm below the annual average rainfall at the Gulgong Post Office of 650mm and below both 2018 and 2017 totals of 492mm and 536.6mm respectively.

Temperature recorded at WS03 ranged from -5.8°C in August to 42.5°C in December. The lowest minimum temperature of -5.8°C was slightly warmer than the lowest minimum of -7.0°C recorded in 2018. The highest maximum temperature of 42.5°C was slightly more than the highest maximum temperature of 42.0°C recorded in 2018.

From January to April north east and easterly winds were predominant with south westerly and southerly winds predominant from May to December. Meteorological data and monthly wind roses are presented in **Appendix 3A**.

Table 10: Meteorological Summary (WS03)

Month	Rainfall (mm)	Cumulative Rainfall (mm)	Long-term average Rainfall (mm)	Max Temp (°C) @ 2m	Min Temp (°C) @ 2m
Jan-19	113.4	113.4	70.5	41.9	21.6
Feb-19	4.4	117.8	61.1	38.3	19.2
Mar-19	130.4	248.2	55.2	34.8	4.9
Apr-19	0.6	248.8	43.9	30.2	0.5
May-19	21.6	270.4	45.1	23.7	-1
Jun-19	12.2	282.6	50.9	21.3	-5.2
Jul-19	3.8	286.4	49.1	21.7	-3.4
Aug-19	9.6	296	45.8	24.6	-5.8
Sep-19	31.2	327.2	47.1	30.1	-3.5
Oct-19	7.6	334.8	55.5	34.1	0.7
Nov-19	19.2	354	60.0	37.2	4.1
Dec-19	6.0	360	67.3	42.5	6.8
Total	**360**	**360**	**651.5**		

6.2 NOISE

MCO manages noise in accordance with the MCO Noise Management Plan (NMP) (Version 3). The NMP was revised (NMP Version 4) and resubmitted for approval in November 2019. The NMP was developed by MCO with advice from experienced and qualified experts (SLR Consulting Australia Pty Ltd) to satisfy Condition 7, Schedule 3 of PA 05_0117 (as modified) and Condition 8, Schedule 3 of PA 08-0135.

During the reporting period, major noise producing activities included:

- The operation of OC1, OC2 and OC4, UG1, the CHPP and rail load-out facilities; and,
- Construction activities.

Operational processes for MCO to reduce noise emissions included:

- Use of sound attenuated major equipment;
- Operation of some support fleet during the daytime only;
- Use of shielded areas in adverse weather conditions;
- Use of real-time noise monitoring data and Mine Production Environmental Assistants to assist operational personnel in proactive and reactive management of noise impacts;
- Use of predictive noise models to assess predicted noise risks associated with meteorological influences;
- Sound power testing equipment; and
- Routine maintenance of equipment, including sound attenuation components.

6.2.1 REAL- TIME NOISE MONITORING

The NMP identifies response triggers for real-time noise via four monitoring stations (refer **Appendix 2** for localities). When a trigger has been reached, an SMS alarm is sent to operational personnel and members of the Environment and Community Department. The real-time monitoring network operated throughout the reporting period.

6.2.2 ATTENDED NOISE MONITORING

During the 2019 reporting period, attended environmental noise monitoring was conducted monthly, with additional sites monitored quarterly. The purpose of attended noise monitoring is to quantify and describe the acoustic environment around MCO's operations and compare noise contribution from the MCC to the project Noise Criteria.

Noise Criteria are specified for day, evening, and night period for the amenity of neighbouring residences. Noise Criteria are expressed as $LAeq_{(15min)}$ and $LA1_{(1min)}$. **Table 11** provides a summary of project noise criteria and noise performance based on attended noise monitoring for 2019, together with management implications and proposed actions.

MCO complied with the project specific noise criteria at all monitoring sites during attended noise monitoring in the reporting period. A summary of results from attended noise monitoring undertaken during the period in accordance with the NMP is provided in **Appendix 3B**.

6.2.3 ATTENDED VALIDATION NOISE MONITORING

In accordance with the NMP, attended monitoring was undertaken during the reporting period at four locations (i.e. NA2, NA3, NA10 & NA12) to verify the results of real-time noise monitoring.

A review of validation monitoring concluded that the current real-time monitors consistently overestimated the MCO LAeq during the validation periods. The real-time data appeared to be routinely influenced by extraneous low frequency noise sources such as road traffic, aircraft, dogs, and wind. Due to the inability to distinguish between contributing noise sources, the real-time data is not suitable for compliance purposes and cannot be relied upon to provide an accurate estimate of mine generated noise. Real-time monitoring remains suitable for management purposes.

6.2.4 COMPARISON AGAINST PREVIOUS YEARS

Attended noise monitoring results were reviewed against previous years to 2012. This review found a high level of variability in results. Of the results where a noise reading was determined (i.e. not inaudible and criteria applicable, there is some correlation between monitoring results and the distance to the receiver from the operations.

Attended noise monitoring undertaken at NA1 Ulan school between 2012 and 2019 during the day time period shows that MCO was inaudible during 78% of the samples, with no exceedances of criteria. Monitoring at NA6 Lower Ridge Road between 2012 and 2019 during the night period shows that MCO was inaudible during 15% of the samples, with no exceedances. Attended noise monitoring completed at NA12 Winchester Crescent between 2012 and 2019 during the night period shows that MCO was inaudible during 47% of the samples, with no sustained exceedances of criteria.

Quarterly attended noise monitoring results at the Goulburn River National Park and the Munghorn Gap Nature Reserve indicate that MCO was inaudible during 17% and 78% of the samples respectively, with no exceedances recorded during monitoring.

Table 11 : Attended Noise Monitoring Summary

Aspect	Approved Criteria					Performance During the Reporting Period	Key Management implications	Implemented/ proposed management Actions
Attended Noise Monitoring	**Land No.**	**Day [1]L_{A1eq} (15min).**	**Evening[2] L_{A1eq} (15min).**	**Night[3]**		Monthly attended monitoring was undertaken at the three required noise compliance locations (NA1, NA6 & NA12) throughout 2019 as required by the NMP. Quarterly monitoring was undertaken at the two required noise compliance locations (GRNP & MGNR) throughout 2019 as required by the NMP. There were no recorded noise exceedances during the 2019 reporting period at the five noise compliance monitoring locations NA1, NA6, NA12, GRNP & MGNR. MCO continued to coordinate noise management with neighbouring mines. ***Note*** *approved noise compliance monitoring locations were selected as representative of residences* and are shown in **Appendix 2**.	Noise management controls effective.	Continue the implementation of the NMP. MCO will review and if necessary revise, the NMP in accordance with Schedule 5 condition 5 and Schedule 6 condition 5 of PA05_0117 and PA08_0135 respectively.
				L_{A1eq} (15min).	**L_{A1eq} (1min).**			
	63	39	39	39	45			
	70	37	37	37	45			
	75	36	36	36	45			
	All other privately owned residences	35	35	35	45			
	Ulan Primary School	35 (internal) when in use			-			
	Ulan Anglican Church	35 (internal) when in use			-			
	Goulburn River National Park Munghorn Gap Nature Reserve	50 when in use			-			

1 Day is defined as the period between 7am-6pm Monday to Saturday, and 8am-6pm on Sundays and Public Holidays
2 Evening is defined as the period 6pm-10pm
3 Night is defined as the period from 10pm-7am Monday to Saturday, and 10pm-8am on Sundays and Public Holidays.

6.2.5 COMPARISON TO PREDICTED LEVELS

Predicted noise levels from Year 2019 of the Open Cut Optimisation Modification (Stage 1 Modification 14 and Stage 2 MOD 3) were compared against actual noise levels during 2019. The 2019 results indicated that MCO was generally lower than the predicted levels where meteorological conditions were relevant.

Measured operational levels are compared to predicted levels in **Table 12**. In this table, a 'positive' difference is where the measured level is greater than the predicted level. A 'negative' difference is where the measured levels are less than the predicted levels. Where the meteorological conditions (primarily wind direction and temperature gradient) during the attended monitoring do not correspond with those that are modelled, no further analysis is undertaken. Attended noise monitoring results are included in **Appendix 3B.**

Table 12: EA Predictions – Attended Noise Monitoring, Various Weather Conditions

	$dB(A)_{Leq\ (15min)}$[1]			$dB(A)_{LA1(1min)}$[1]		
	NA1 Ulan School	**NA6 Lower Ridge Rd**	**NA12 Winchester Cres**	**NA1 Ulan School**	**NA6 Lower Ridge Rd**	**NA12 Winchester Cres**
	Day	**Night**	**Night**	**Day**	**Night**	**Night**
January	NC	-2[2]	-	NA	-1[2]	-
February	NA	NC	NC	NA	-11[2]	NC
March	NC	NC	NC	NA	NC	NC
April	NA	NA	-	NA	NA	-
May	NA	NC	-	NA	NC	-
June	NC	-8[2]	NC	NA	-7[2]	-13[2]
July	NA	-3[3]	-	NA	-3	-
August	NA	-1[3]	-8[3]	NA	-2[3]	-8[3]
September	NC	-4[2]	NC	NA	+1[2,4]	-4[2]
October	NA	-4[3]	-6[3]	NA	-2[3]	-5[3]
November	NA	NA	NC	NA	NA	NC
December	NC	NA	-	NA	NA	-

[1.] NA indicates meteorological conditions during the measurement did not correspond with any modelled meteorological conditions, and were not applicable for comparison.
NC indicates measured MCO noise levels were inaudible (IA), not measurable (NM), or expressed as a "less than" quantity (e.g. less than 30 dB), therefore measured and predicted noise levels were not comparable.
[2.] Wind conditions assumes winds at speeds between 0.1 and 3 m/s during monitoring and assumes the following possible predicted wind directions: 45°-112.5° or 180°-270° Celsius.
[3.] Strong Inversion of 5.2° Celsius per 100 m altitude or greater.
[4.] The measured site-only LA1,1minute noise level was greater than predicted by 1 dB at NA6 under "wind only" conditions. Measured MCO noise levels were lower than predicted noise during all other measurements when site contributions were directly quantifiable and meteorological conditions corresponded with modelled meteorological conditions.

6.3 BLASTING

MCO manages blasting in accordance with the Blast Management Plan (BMP) (Version 4). The BMP was developed by MCO with advice from experienced and qualified experts (SLR Consulting Australia Pty Ltd) to satisfy Condition 15, Schedule 3 of PA 05_0117 (as modified) and Condition 16, Schedule 3 of PA 08-0135 (as modified).

Blasting criteria, blasting hours, blasting frequency, property inspection requirements and operating conditions are provided in Conditions 8 to 14, Schedule 3 and Conditions 9 to 15, Schedule 3 of the NSW Project Approvals (05_0117) and (08_0135) respectively.

The blast monitoring locations are identified in **Appendix 2**. During the reporting period blast monitoring included airblast overpressure and ground vibration at locations representative of privately owned residences, churches and schools, and aboriginal rock shelters.

6.3.1 SUMMARY OF BLAST MONITORING RESULTS

Blast monitoring compliance for the reporting period is presented in **Table 13** and a summary of blast monitoring results for the period is provided in **Table 14**. Individual blast results are provided in full at **Appendix 3C**. No exceedances of the blasting criteria occurred during the reporting period.

Table 13 : Blast Monitoring Summary (BM1 & BM5)

Blast Summary	Number	Compliance (% Of Blasts)
Total Blasts	157	Compliant
Days with >2 blasts (PA05 Sch 3 C 10)	0[1]	Compliant
Annual average blasts per week	3.02	Compliant
Blasts outside blasting hours	0	Compliant
Airblast Overpressure >115 dB(Lin Peak) [2]	1[3]	Compliant (0.64%)
Airblast Overpressure >120 dB(Lin Peak)	0	Compliant
Ground Vibration >5 mm/s [2]	0	Compliant (0%)
Ground Vibration >10 mm/s	0	Compliant
Reportable Fume Events	0	Nil

[1] Misfires excluded as per PA05_0117 Sch 3 Con. 10 and PA08_0135, Sch. 3, Con. 11.
[2] Allowable exceedances of 5% of total blasts over a period of 12 months.
[3] One blast event recorded in exceedance of 115dBL for the reporting period –one at BM5 (18/12/19)

No blasting was undertaken within 500m of any public road, railway line, 330kV powerline or private land.

One blast event on the 1st July 2019 resulted in a visible dust plume that moved in a general westerly direction and gradually dissipated due to a decrease in wind speed. The PIRMP was activated including notification of EPA and other agencies. Dust levels recorded at the time of the Blast were well below the Air Quality criteria for Project Approval (05_0117) and Project Approval (08_0135). MCO has updated its predictive meteorological forecasting model to assist with air emissions and the incident has been considered in revisions to the Air Quality and Blast Management Plans.

Table 14 : Blast Monitoring Summary

Aspect	Approved Criteria				Performance During the Reporting Period	Trend/ Key Management Implications	Implemented/ proposed actions
Blast	Receiver	Air Blast Overpressure Level dB (Linear Peak) dBL[1]	Peak Particle Velocity – Ground Vibration mm/s[2]	Allowable Exceedance	Compliance monitoring was undertaken at the following representative locations for the 2019 reporting period • **BM1 – Ulan School** ○ Max. Overpressure = 114.5 dBL ○ Max Ground Vibration = 0.80 mm/s ○ Average Ground Vibration = 0.19 mm/s • **BM5 – Ridge Road** ○ Max. Overpressure = 119.0 dBL ○ Max Ground Vibration = 0.80 mm/s ○ Average Ground Vibration = 0.18 mm/s A full blast summary is contained at **Appendix 3C**.	In accordance with condition 13 (c), Schedule 3 of project approval 05_0117 and condition 14 (d), schedule 3 of project approval 08_0135 MCO co-ordinates the timing of blasting onsite with the timing of blasting at Ulan and Wilpinjong mines to minimise cumulative impacts. Air blast over pressure and peak particle velocity continue to remain stable over the life of the operation at BM1 Ulan School and BM5 Ridge Road.	MCO will review and if necessary revise, BMP in accordance with Schedule 5 condition 5 and Schedule 6 condition 5 of PA05_0117 and PA08_0135 respectively. During the reporting period MCO continued to maintain the blast monitoring network.
	Privately Owned Residence	120	10	0%			
		115	5	5% of the total number of blasts over a period of 12-months			
	All Public Infrastruct	-	50[3]	0%			

Notes - [1]- dB (Linear Peak) dBL = decibel linear peak [2]- mm/s = millimetres per second [3] - These criteria do not apply if the Proponent has a written agreement with the relevant owner, and has advised the Department in writing of the terms of this agreement. MCO has written agreements with TransGrid and Australian Rail Track Corporation (ARTC) to undertake blasting within 500 metres (m) of the Wollar-Wellington 330 kV transmission line and within 500 m of ARTC infrastructure, respectively.

6.3.2 COMPARISON TO PREVIOUS BLAST MONITORING AND PREDICTED LEVELS

A comparison of the 2019 blast results to the 2018 results and predications in the Environmental Assessment (EA) for Stage 1 Modification 14 and Stage 2 Modification 3 are outlined in **Table 15** below.

Table 15 : Comparison to Blasting Results - BM1 & BM5 2018, 2019 and EA

Site	EA Vibration Predictions (mm/s) [2]	2018 vibration range (mm/s)	2019 vibration range (mm/s)	Comment on results
BM1 Ulan School	2.1	0.03 - 0.76	0.02 – 0.80	Generally lower than previous results and predictions.
BM5[3] Ridge Rd	3.0	0.01 - 0.82	0.01 – 0.80	Generally lower than previous results and predictions.
Site	**EA Overpressure (dBL) [2]**	**2018 Overpressure range (dBL)[1]**	**2019 Overpressure range (dBL)[1]**	**Comment on results**
BM1 Ulan School	112.0	81.1 - 116.6	81.1 – 114.5	Generally consistent with previous results and predictions.
BM5[3] Ridge Rd	114.0	78.8 - 117.3	76.1 – 119.0	Generally consistent with previous results and predictions.

[1] Excludes environmental influenced results.
[2]Overburden blast design MIC 4,500 kg, 5% exceedance prediction.
[3]Modelled predictions taken from nearest private receiver ID No.70 adjacent from BM5

Blast Monitoring 80%ile and 50%ile trends since 2012 are depicted below in **Figure 6** and **Figure 7**. The monitoring data indicates a correlation between monitoring results and distance of the receiver from the blast locations. Within the graphs the five percent and maximum limit has been included for the blast overpressure graph and the five percent limit has been included within the ground vibration graph. Results have generally been below these criteria.

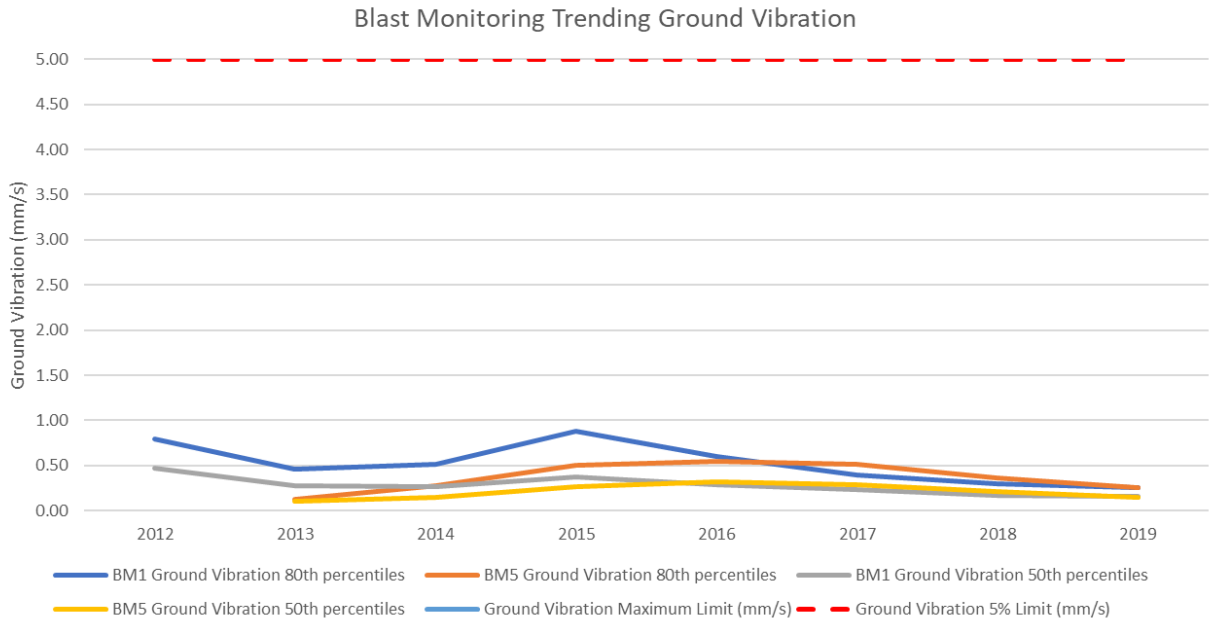


Figure 6 Blast Monitoring Trending Ground Vibration

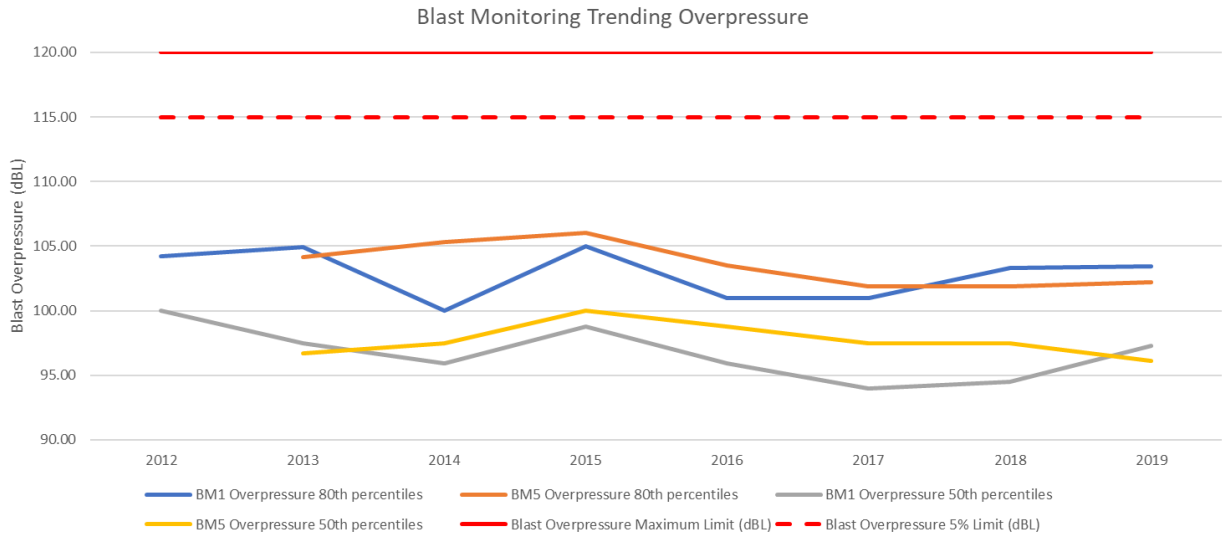


Figure 7 Blast Monitoring Trending Overpressure

6.4 AIR QUALITY

MCO manages air quality in accordance with Air Quality Management Plan (AQMP). The current AQMP (Version 4) was approved in November 2017. The AQMP was revised (AQMP Version 5) and resubmitted for approval in October 2019 to align with Stage 1 Modification 14 and Stage 2 Modification 3. The AQMP was developed by MCO with advice from experienced and qualified experts (Todoroski Air Sciences) to satisfy Condition 19, Schedule 3 of PA 05_0117 and Condition 22, Schedule 3 of PA 08-0135.

During the reporting period, MCO undertook air quality monitoring in accordance with the approved AQMP (Version 4). This included:

- Deposited particulate matter monitoring with Dust Depositional (DD) gauges at eleven locations around the Moolarben Coal Complex;
- PM_{10} – High Volume Sampling (HVAS) monitoring at two sites – Ulan Village (PM01) and south-west of Open Cut 1 and west of Open Cut 2 (PM02);
- PM_{10} – Real Time Monitoring via Tampered Element Oscillating Mass Balance's (TEOMs) at three permanent locations around the Moolarben Coal Complex representative of private residences and one upwind of operations when winds towards private residences;
- Total Suspended Particulate (TSP) matter calculated from TEOM PM_{10} monitoring results;
- Meteorological monitoring is undertaken via Automatic Weather Stations (AWSs), with WS03 (located on Ulan Road) the principal station for reporting purposes.

In February 2019 MCO commissioned a dual function TEOM unit at the existing monitoring site of TEOM 7. The new TEOM unit has capacity to monitor for both PM_{10} and $PM_{2.5}$. Reporting requirements for $PM_{2.5}$ monitoring for the 2019 reporting period commenced following the approval of Open Cut Optimisation modification in July 2019 and are in accordance with EPL12932 (**Section 6.4.2**).

The AQMP monitoring locations are identified in **Appendix 2**. The air quality monitoring program is outlined in **Appendix 3D**. A summary of air quality monitoring results for the reporting period is provided in **Table 16**, **Table 17** and **Appendix 3D**.

Table 16: Air Quality Monitoring Summary

Aspect		Approved Criteria	Performance during the Monitoring Period	Trend/ Key Management Implications	Implemented/proposed Management Action
Air Quality	**Monitoring Form**				
	Dust Deposition	4 g/m^2/month (max total)	Annual averages for each dust depositional gauge are reported in **Table 18**. All dust depositional results for the 2019 reporting period were below the 4/g/m^2/month criterion. The 2g/m^2/month criterion was not triggered. Results were impacted by regional dust and bushfire events (extraordinary events).	Annual Average Dust depositional results for the operation indicate a slight increasing trend over the period, yet they remain well below the criteria.	MCO will review and if necessary revise, the AQMP in accordance with Schedule 5 condition 5 and Schedule 6 condition 5 of PA05_0117 and PA08_0135 respectively. During the reporting period MCO continued to maintain the air quality monitoring network. Monitoring of PM2.5 commenced.
		2 g/m^2/month above background average (Incremental increase)			
	PM_{10}	50 µg/m^3 (24hr average)	All PM_{10} results were within criteria. Results due to extraordinary events are excluded from the dataset.	24-Hour average PM_{10} results for the operation indicate a slight increasing trend over the period, yet they remain well below the criteria.	
	PM_{10}	25 µg/m^3 (Annual average)	The average PM_{10} results for the reporting period are presented in **Table 19**. All sites were below the Annual average criteria. Results were impacted by regional dust and bushfire events (extraordinary events).	Annual average PM_{10} results for the 2019 reporting period indicate a slight increasing trend at all locations when compared to 2018.	
	$PM_{2.5}$	25 µg/m^3 (24hr average)	All PM2.5 results were within criteria. Results due to extraordinary events are excluded from the dataset.	24-Hour average PM2.5 results for the operation indicate a slight decreasing trend over the period remaining below the criteria.	
		8 µg/m^3 (Annual average)	Results were impacted by regional dust and bushfire events (extraordinary events).	Annual average results were not available in the period Results were impacted by regional dust and bushfire events.	
	Total Suspended Particulate (TSP)	90 µg/m^3(Annual average)	TSP results are presented in **Table 20.** TSP is calculated using the approved AQMP methodology based on PM_{10} constituting 40% of the total TSP. During the reporting period, all sites where calculated as being below the 90µg/m^3 criterion.	Annual average TSP results for the 2019 reporting period indicate similar results when compared to 2018 with some sites increasing and some sites decreasing during the period.	

6.4.1 DATA CAPTURE RATE

The following table (**Table 17**) provides details on the data capture rates for the reporting period. Data capture was impacted by maintenance, power loss and equipment failures.

Table 17 Data Capture Rate for PM_{10} & $PM_{2.5}$ Annual Averages

Location	2019 Data Capture Rate
TEOM 01 (Ulan School)	97%
TEOM 04 (Ulan Road)	98%
TEOM 06 (Ulan-Wollar Road)	95%
TEOM 07 (Ulan Road)[1]	92%
PM 01 (Ulan Village	100%
PM 02 (Ridge Road)	100%

[1] TEOM monitors for both PM_{10} and $PM_{2.5}$

6.4.2 COMPARISON TO PREVIOUS AIR QUALITY MONITORING AND BACKGROUND LEVELS

Dust Deposition

A comparison of the 2019 dust deposition results with previous results from 2012 and predications in the Environmental Assessment (EA) for Stage 1 Modification 14 and Stage 2 Modification 3 is provided in **Table 18.**

A number of extraordinary events occurred in 2019 including bushfires and regional dust storms impacting on results.

All deposition results are within criteria and were generally greater than predicted results reflecting the significant impact of extraordinary events (regional dust and bushfires) that occurred in 2019 (**Table 18**). Data trends are presented in **Appendix 3D.**

Table 18: Comparison of Depositional Dust results

Dust Gauge	Annual Average (g/m2/month) (Criteria = 4 g/m^2/month)									
	Back-ground	2012	2013	2014	2015	2016	2017	2018	2019	EA Predictions[1]
DG01#	1.2	0.3	0.5	0.8	0.6	0.5	0.6	0.9	1.3	1
DG04^	2.0	1.3	1.3	1.6	1.0	1.2	1.0	1.4	1.8	1
DG05^	1.8	0.8	1.0	2.0	0.8	1.3	1.5	1.8	1.5	1
DG06^	1.2	0.4	0.7	1.0	0.6	0.6	0.7	1.7	1.5	1
DG07^	1.7	0.8	1.0	0.9	0.9	0.9	0.7	1.4	1.3	1
DG08^	1.4	0.7	0.7	0.8	0.6	0.7	0.9	1.7	1.8	1
DG09^	-	0.4	0.7	2.0	0.6	0.6	0.9	1.9	1.5	1
DG11^	-	-	0.6	0.8	0.6	0.7	1.1	1.7	2.0	1
DG12*	-	-	-	-	1.5	1.0	1.2	2.1	1.7	1
DG13^	-	-	-	-	0.7	0.7	0.7	1.6	1.6	1
DG14*	-	-	-	-	1.1	0.7	1.2	1.9	2.7	1

[1] EA predictions for 2019
Background monitoring
^Representative of nearest non-mine owned residence
*Representative of mine owned land

PM_{10}

A comparison of the 2019 PM10 results with previous results from 2012 and predications in the Environmental Assessment (EA) for Stage 1 Modification 14 and Stage 2 Modification 3 is provided in **Table 19.**

A number of extraordinary events occurred in 2019 including bushfires and regional dust storms impacting on results.

Results are within criteria and generally consistent with or above predicted results (**Table 19**) indicating that current air quality management practices are effective despite the impact of significant regional events during the period. Data trends are presented in **Appendix 3D.**

Table 19: Comparison of annual average PM_{10} Results

Unit	Annual Average (µg/m³)[4] (Criteria = 25 µg/m³)									
	Back-ground	2012	2013	2014	2015	2016	2017	2018	2019	EA Predictions[5]
Ulan School (TEOM01)	15.1	10.2	12.4	11.4	13.2	13.0	12.3	15.1	17.3	18
Ulan Road (TEOM04)	-[1]	8.9	10.8	12.7	9.0	11.6	15.1	18.7	20.0	17
Ulan-Wollar Road (TEOM06)	-[1]	-[2]	-[2]	-[2]	9.0	11.5	12.5	15.7	19.7	*
Ulan Road (TEOM07)	-[1]	-[2]	-[2]	-[2]	-[2]	-[2]	11.2[3]	16.5	15.6	11
Ulan Village HVAS (PM01)	17.9	11.9	12.2	13.8	13.2	11.5	13.0	16.9[6]	18.9	18
Ridge Road HVAS (PM02)	-[1]	9.7	10.0	11.7	10.8	9.9	13.5	18.1[6]	18.7	13

[1] No background values as site established after 2009.
[2] No previous data as site not established.
[3] Calculated on 5 months of data.
[4] Annual Averages exclude extraordinary events such as bushfires and prescribed burns.
[5] EA predictions based on the Open Cut Optimisation Modification 2019 Scenario
[6] 2018 values previous reported including extraordinary events
*No EA prediction was made for TEOM06 as it is representative of conditions 'upwind' of MCO (ie not a private residence)

Total Suspended Particulates

TSP results (**Table 20**) are within criteria and generally higher than predicted results due to a number of extraordinary events in 2019 including bushfires and regional dust storms.

Table 20: Comparison of annual average TSP results

Unit	Annual Average Calculated TSP (µg/m3) (Criteria = 90 µg/m3)									
	Back-ground	2012	2013	2014	2015	2016	2017	2018	2019	EA Predictions[4]
TEOM01 (Ulan School)	37.75	25.5	31	28.5	33	32.6	30.7	37.7	43.2	35
TEOM04 (Ulan Road)	0	22.25	27	31.75	22.5	29.0	37.9	46.8	50.1	37
TEOM06 (Ulan-Wollar Rd)	-[1]	-[2]	-[2]	-[2]	22.5	28.8	31.4	39.3	49.3	*
TEOM07 (Ulan Road)	-[1]	-[2]	-[2]	-[2]	-[2]	-[2]	27.9[3]	41.3	39.0	24
PM01 (Ulan Village HVAS)	44.75	29.75	30.5	34.5	33	28.8	32.4	49.0[5]	47.3	35
PM02 (Ridge Road HVAS)	-[1]	24.25	26.25	29.25	27	24.8	33.7	45.3[5]	46.7	28

[1] No background values as site established after 2009.
[2] No previous data as site not established.
[3] Calculated on 5 months of data.
[4] EA predictions based on the Open Cut Optimisation Modification 2019 Scenario
[5] 2018 values previous reported including extraordinary events
*No EA prediction was made for TEOM06 as it is representative of conditions 'upwind' of MCO (ie not a private residence).

6.4.3 SPONTANEOUS COMBUSTION

Moolarben identified areas of self-heating within the OC2 overburden emplacement area in September 2019. Once identified, actions were commenced in accordance with MCO's approved Air Quality Management Plan including;

- Restricting access to the area
- Reviewing the risk to personnel, environment, community, and operations
- Watering to cool the heating
- Exposure, spreading, and excavation of the heating material
- Applying further water
- Cover with inert material, track roll and reshape
- Monitoring of area to identify any further areas of heating.

The event was investigated and a report provided to the government agencies. Following the investigation, the Air Quality Management Plan was revised and is currently subject to final approval. The updated plan included additional measures for the management of odour relating to spontaneous combustion.

6.4.4 GREENHOUSE GAS

Yancoal's Australian operations reported under the National Greenhouse and Energy Reporting Scheme for the 2018-19 financial year. Scope 1 and Scope 2 emissions calculated for the 2018-19 financial year was 252,996t CO_2-e. Scope 1 and Scope 2 emissions calculated for the 2017-18 financial year was 232,056t CO_2-e. The increase in emissions can be attributable to an increase in open cut production.

The Optimisation Modification (Mod 14), estimated emissions for Scope 1 and Scope 2 to increase by approximately 37,640t CO_2-e, due to the increase in open cut ROM coal production.

6.5 BIODIVERSITY

MCO manages biodiversity in accordance with the Biodiversity Management Plan (BioMP). The current BioMP (Version 4) was approved during the reporting period in September 2019. The BioMP was developed by MCO with advice from experienced and qualified experts (EcoLogical Australia) to satisfy Condition 36, Schedule 3 of PA 05_0117 (as modified) and Condition 39, Schedule 3 of PA 08-0135 (as modified). In accordance with Condition 13(a), Schedule 2 of the Project Approvals (05_0117 and 08_0135), the BioMP is being staged and revisions of the plan will be submitted on a progressive basis. Offset management is also undertaken in accordance with relevant components of the Landscape Management Plan and Biodiversity Offset Management Plan (2013/6926).

The objectives of the management plans are to provide procedures and strategies to be implemented during the life of the Project to minimise biodiversity impacts on site (albeit in consideration of the approved impacts) and enhance biodiversity values on the offset areas. In addition to monitoring, the management plans describe procedures for:

- Vegetation Clearance Protocol – including Ground Disturbance Permits (GDPs), Pre-clearance surveys, habitat features, identification of suitable release locations;
- Collection and use of locally sourced native seed and supplementary tubestock;
- Strategies to manage vegetation onsite and improve vegetation connectivity;
- Additional biodiversity measures – rehabilitation of the environmental bund, weed and pest management, surface water management and erosion control, management of grazing and agriculture, access restrictions, and bushfire management.

The objective of biodiversity monitoring is to evaluate the vegetation and fauna habitat condition at the Moolarben Coal Complex (including recovery and/or enhancement of native vegetation) and to identify appropriate management actions to be applied, where required. Biodiversity monitoring relating to the vegetation management zone also includes noxious weed and vertebrate pest monitoring. Monitoring will be used to measure success against the short, medium and long-term targets described in the management plans and identify the need for corrective actions.

Monitoring of mine rehabilitation areas is described in the Rehabilitation Management Plan.

6.5.1 BIODIVERSITY OFFSET WORKS UNDERTAKEN

Weed and feral animal monitoring and control works were undertaken throughout the reporting period. Wild dog and feral pig baiting was undertaken in conjunction with the NSW Local Land Service (LLS) and neighbouring landholders within biodiversity offset properties. Weed control works were undertaken throughout the offset areas focusing on Serrated Tussock, Blackberries, Blue Heliotrope, Tree of Heaven, St Johns Wort, Spiny Rush and Prickly Pear. Native seed collection was continued within MCO owned lands and some offset areas.

During the reporting period over six Kilometres of new fencing was installed and over 21 Kilometres of redundant fencing removed from MCO offsets. Track maintenance and upgrades were completed on over 19 kilometres of required access and bushfire management trails. Revegetation works were continued within the offsets with over 5000 stems planted.

During the reporting period ten offsets were secured through a 'Positive Covenant' and a 'Restriction on the Use of Land by a Prescribed Authority' under Section 88E(3) the NSW *Conveyancing Act 1919* executed between MCO and the NSW Department of Planning, Industry and Environment (DPIE). The remaining offsets have draft Positive and Restrictive Covenants terms with the NSW DPIE for review. MCO will continue to engage with DPIE on securing the offsets.

6.5.2 BIODIVERSITY OFFSET MONITORING

Flora and fauna monitoring during the reporting period included the Stage 1 and EPBC (2007/3297) Biodiversity Offset Areas (BOAs), Stage 1 Mod 9 and EPBC (2013/6929) offset areas, and the continuation of baseline flora and fauna monitoring of the Stage 2 and EPBC (2008/4444) BOAs. Flora monitoring included monitoring of analogue sites located in National Parks or State Conservation Areas. Monitoring locations are provided in **Appendix 2**.

Offset monitoring included:

- Full floristic surveys
- Rapid assessment
- Fauna surveys targeting diurnal and nocturnal birds, reptiles, amphibians, mammals, microbats and habitat assessment

Stage 2 and EPBC (2008/4444) BOA baseline monitoring included vegetation validation, full floristic survey, fauna surveys and natural regeneration monitoring.

Monitoring is undertaken across two management zones that have been mapped within the BOAs. Each of these zones have defined strategic ecological management objectives, with an overall aim to achieve a sustainable landscape with improved overall ecological quality in the long term. The management zones are:

- Management Zone 1 (MZ1) – Enhancement of remnant vegetation; and
- Management Zone 2 (MZ2) – Regeneration/revegetation of grassland to forest/woodland.

6.5.2.1 Offset Monitoring Results

Stage 1 and EPBC (2007/3297) offset areas monitoring

Floristic monitoring undertaken within the Stage 1 BOAs during autumn and spring 2019 recorded:

- 212 species were recorded across BOA 1. Of these, 168 species were native, 32 species were exotic, and 12 species could not be identified as native or exotic.
- 145 species were recorded across BOA 2. Of these, 120 were native, 16 species were exotic, and nine species could not be identified as native or exotic.
- 152 species were recorded across BOA 3. Of these 135 species were native, eight species were exotic, and nine species could not be identified as native or exotic.

The majority of MZ1 sites received an overall high or moderate ranking which compares favourably with the analogue site results. Consistent with the analogue sites, Native Tree Cover (NTC), Native Mid-Storey Cover (NMC) and Native Ground Cover (NGC) were the attributes receiving the lowest scores. All sites were meeting Exotic Species Cover (ESC) benchmark.

The conditions at MZ2 sites were variable. BOA1 and BOA3 showed the best conditions compared to benchmarks with some evidence of structural development. Native Groundcover Grass (NGCG) was consistently above the benchmark, with NMC meeting or progressing towards benchmark at most sites. NTC continues to develop towards benchmark with signs of structural development at one site. ESC continues to meet benchmark across most sites.

In general woodland/forest birds dominated species and abundance counts at MZ1 sites whereas the reverse was true at MZ2 sites. These results are consistent with the flora monitoring and the differences in the provision of a range of structural layers within each MZ.

Microbat indicator species counts were similar for both indicator groups across MZ1 and MZ2 sites although DNG indicator species abundance was greater overall in both management zones.

Stage 1 Mod 9 and EPBC (2013/6929) offset areas monitoring.
Floristic monitoring undertaken within the MOD 9 BOAs during autumn and spring 2019 recorded:

- 138 species were recorded across the Bobadeen BOA. Of these, 84 species were native, 39 species were exotic, and 15 species could not be identified as native or exotic.
- 96 species were recorded across the Clarkes BOA . Of these, 80 species were native, 12 species were exotic, and 4 species could not be identified as native or exotic.
- 75 species were recorded across the Clifford BOA. Of these, 69 species were native, three species were exotic, and three species could not be identified as native or exotic.
- 83 species were recorded across the Elward BOA. Of these, 77 species were native, two species were exotic, and four species could not be identified as native or exotic.
- 108 species were recorded across the Moolarmoo BOA. Of these, 71 species were native, 24 species were exotic, and 13 species could not be identified as native or exotic.
- 76 species were recorded across the Property 5 BOA. Of these, 49 species were native, 21 species were exotic, and 6 species could not be identified as native or exotic.
- 68 species were recorded across the Property 24/25 BOA. Of these, 52 species were native, 12 species were exotic, and 4 species could not be identified as native or exotic.

The majority of MZ1 sites received an overall high or moderate ranking which compares favourably with the analogue site results. In general, spring conditions were poorer than in autumn which is linked to the on-going drought conditions experienced in the latter part of 2019.

The conditions at MZ2 sites were variable. Clarkes, Clifford and Elward BOAs recorded the best conditions compared to benchmarks. There was some evidence of structural development at these BOAs and at one site at Bobadeen. As at MZ1 sites, conditions were generally poorer in spring compared to autumn and this was most evident at Moolarmoo, Property 5 and Property 24/25.

At MZ1 sites, woodland/forest indicator birds dominated species and abundance counts within Clarkes, Elward, and Property 24/25 due to the extent of canopy cover within the BOA and surrounding landscape. Generally, at MZ2 sites, woodland/forest indicator birds continued to dominate species and abundance counts within Elward, Moolarmoo and Property 24/25. Species counts of woodland/forest indicator birds were similar to DNG indicator birds at Bobadeen and Clarkes, but DNG abundance was higher.

Stage 2 and EPBC (2008/4444) offset areas monitoring.
Floristic monitoring undertaken within the Stage 2 BOAs during autumn and spring 2019 recorded:

- 275 species were recorded across the Dun Dun BOA. Of these, 187 species were native, 65 species were exotic, and 23 species could not be identified as native or exotic
- 68 species were recorded across the Libertus BOA. Of these, 60 species were native, seven species were exotic, and one species could not be identified as native or exotic
- 204 species were recorded across the Nori BOA. Of these, 143 species were native, 42 species were exotic, and 19 species could not be identified as native or exotic
- 163 species were recorded across the Old Bobadeen BOA. Of these, 102 species were native, 43 species were exotic, and 18 species could not be identified as native or exotic
- 148 species were recorded across the Onsite Offsets BOA. Of these, 114 species were native, 24 species were exotic, and 10 species could not be identified as native or exotic
- 130 species were recorded across the Ulan 18 BOA. Of these, 90 species were native, 28 species were exotic, and 12 species could not be identified as native or exotic.

MZ1 sites have shown NSD trends to be variable with some sites showing an increasing trend, while others have shown a decreasing trend or have fluctuated around the same value. NTC values have generally improved compared to 2018. NMC has generally fallen over time, but some BOAs have shown variation in responses to the on-going drought conditions.

MZ2 sites have shown NSD trends to be variable with some sites showing a stable or increasing trend, while others have fluctuated around the same value. NTC is low and has not shown much change over the three years of monitoring although increases have been recorded at Dun Dun West. NMC is low and has not notably changed. NGC has generally not changed overall, but there has been a recovery in NGCG in 2019. ESC has shown a notable decline overall except at some individual sites.

Natural regeneration was recorded at all BOAs. In general, transect monitoring showed that in areas where regeneration had previously been recorded there had been either a stabilisation of, or increase in, the extent of regeneration in 2019 compared to previous years.

MZ1 sites show woodland/forest indicator bird species richness and abundance consistently exceeded that of DNG indicator bird species at Libertus and On-site Offsets. Stage 2 MZ2 sites show woodland/forest indicator bird species richness and abundance has generally exceeded that of DNG indicator bird species at On-site Offsets. The remaining offsets showed higher DNG indicator bird species richness and abundance than woodland/forest indicator bird species.

The 2019 monitoring showed a slight increase in the abundance of woodland/forest indicator microbat species at some sites, however there have been no strong trends in microbat data.

6.5.3 ACTIONS FOR NEXT REPORTING PERIOD

During the next period activities to be undertaken include review of management plans and revision where necessary, continued monitoring, revegetation planning and implementation, fencing, track and fire trail works, weed and feral animal control works, maintenance of property security, securing seven offset areas and progression of Gilgal Biodiversity Stewardship Agreement.

6.6 HERITAGE

MCO manages heritage in accordance with the Heritage Management Plan (HMP). The current HMP (Version 6) was approved in November 2017.

During the reporting period MCO continued the salvage and management of Aboriginal heritage sites associated with the project. The results of all survey and salvage activities during the period have been included in the MCO heritage database.

Annual inspections of historic heritage conservation areas were completed during 2019, the condition of the areas is unchanged since the last monitoring period.

6.6.1 ACTIONS FOR NEXT REPORTING PERIOD

Further salvage and management of Aboriginal and European heritage sites associated with the project may be completed during the next reporting period. Registered Aboriginal Party (RAP) groups will continue to be involved in due diligence and salvage works in accordance with the Heritage Management Plan.

6.7 BUSHFIRE

During the reporting period the MCO Bushfire Management Plan was reviewed and updated. No major outbreaks of fire occurred at the MCC during the reporting period, however a small fire ignited from a lightning strike on the 26 November 2019 within MCO's Libertus Offset property. The fire burnt approximately 5ha within BOA and was extinguished by the Rural Fire Service (RFS) with assistance provided by MCO on the same day.

MCO continued to implement the Bushfire Management Plan and conducted bushfire trail inspections and maintenance across Moolarben Coal owned lands. In the next reporting period inspection and maintenance works on fire trails will continue.

6.8 WASTE MANAGEMENT

During the reporting period MCO continued to maintain a Total Integrated Waste Management Service to manage all waste streams generated on site and to maximise recycling. This includes general waste, cardboard and paper recycling, co-mingled recycling, batteries, waste oil, and steel. The volumes of total waste and recycled material removed from site are shown in **Table 21**. During the reporting period 71% of all waste removed from site was recycled. Waste volumes have been variable since 2012, with volumes increasing in association with the expansion of the operations, commencement of underground operations and construction works.

Table 21: Waste Removal Volumes removed during the reporting period

	2012	2013	2014	2015	2016	2017	2018	2019
Total Waste (t)	990.6	1379.6	1490.5	1276.7	2615.1	2612.9	2559.3	3087.1
Recycled Waste (t)	778.2	1173.1	1346.5	1058.3	1730.2	1806.0	1851.4	2178.0
Percentage Recycled	79%	85%	90%	83%	66%	69%	72%	71%

7.0 WATER MANAGEMENT

MCO manages water in accordance with the Water Management Plan (WAMP). The WAMP (Version 4) and its component plans including Site Water Balance (SWB) (Version 2), Surface Water Management Plan (SWMP) (Version 3) and Groundwater Management Plan (GWMP) (Version 2) were approved in March 2018. During the reporting period the WMP and its component plans were revised and resubmitted for approval on 17 October 2019.

During the reporting period, MCO undertook water monitoring and data review in accordance with the WAMP. Surface water and groundwater monitoring sites are provided in **Appendix 2.** Surface water monitoring includes:

- Surface water quality and flow (monthly/6 monthly/event based);
- Stream health (annually);
- Channel stability (annually);
- Mine site water management structures quality and level (monthly/6 monthly); and
- Licensed discharge points.

Groundwater related monitoring includes:

- Groundwater levels/pressure (monthly);
- Groundwater quality (6 monthly);
- Groundwater take; and
- Potential seepage from mine water storages.

The groundwater monitoring includes the following lithological units:

- Quaternary alluvium;
- Tertiary aged unconsolidated sediments;
- Triassic sandstones;
- Permian coal measures;
- Ulan seam coal;
- Marrangaroo formation; and
- Basement units (consisting mostly of granites and metavolcanics).

During the period MCO commenced construction of a water treatment facility and associated pipelines and discharge point, constructed water storages (mine water and sediment), extended the dewatering and transfer network and installed operational and construction related erosion and sediment controls.

Details of water licensing and associated take are provided in **Section 7.1**. A summary of the site water balance is provided in **Section 7.2**. A summary of surface water monitoring and groundwater monitoring results for the reporting period are provided in **Section 7.3** and **Section 7.4** respectively. Detailed surface water and groundwater monitoring results for the reporting period are provided at **Appendix 3F** and **Appendix 3G** respectively.

7.1 WATER LICENCES

A summary of water take and available water under water access licences for the reporting period (1 January to 31 December 2019), as well as a prediction for the next reporting period (1 January to 31 December 2020) is provided in **Table 22**. Water take is provided in six monthly periods to coincide with the water year (i.e. 1 July 2018 to 30 June 2019).

Table 22: Water Licences and Take

Water Access Licence	Description	Available Water (Units) [1]	2019 Estimated Water take (ML) (OC3 Null Model[2])			2020 Forecast Water Take (ML)
			Jan - Jun	Jul - Dec	Total	
36340 37583	Wollar Creek Water Source	436	11	13	24	40
37582 & 41888	Upper Goulburn River Water Source	299	55	52	107	183
39799	Sydney Basin - North Coast Groundwater Sources	5900	801[3]	953[3]	1755[3]	3233

[1] One unit equivalent to 1.0 ML as per the *Available Water Determination Order for Various NSW Unregulated and Alluvial Water Sources (No. 1) 2018* and *Available Water Determination Order for the North Coast Coastal Sands and the North Coast Fractured and Porous Rock Groundwater Sources 2018 for the 2018/19 water year. Available water is reported in IWAS including carry-over and temporary transfers.*

[2] OC3 Null Model and water balance used to estimate water take by water source.

[3] No water was directly extracted from WAL 39799 tagged groundwater extraction bores.

Water take is estimated as part of the Annual Review after the end of the calendar year. MCO determines water take in accordance with the approved WAMP. Water take is either groundwater inflow removed from the operation, water extracted from licenced bores, or modelled take from surface and alluvial aquifers. The review estimate incorporates site water balance reconciliations, recirculation to underground and water take for the period. Indirect or passive take is based on modelling predictions for the relevant period.

Water take by water source has been determined in consideration of the Groundwater Model documented in the approved GWMP and based on the Open Cut Optimisation Modification application (Stage 1 (MOD 14) and Stage 2 (MOD 3)). The mine schedule and sequence in the reporting period varies from that in the HydroSimulations model. Further model revision and analysis was undertaken by HydroSimulations in 2018 to better reflect actual mine sequence, including exclusion of OC3 resulting in the development of the OC3 Null Model (OC3 Null Model). This OC3 Null Model has also been used in the estimation of water take for the 2019 calendar year. The estimated water take during the 2019 calendar year has been summarised in **Table 22**.

The available water for 2018/19 water year for all water sources was greater than the water take. MCO will continue to take necessary action to ensure that it holds sufficient water entitlements.

7.2 WATER BALANCE

MCO monitors the water balance for the operation to assist forecasting and management of site water. The site water balance (**Table 23**) for the reporting period was prepared with input from suitably qualified and experienced consultants WRM and SLR. Site water storage decreased by 245ML during the reporting period. The main demands were coal processing and dust suppression. The Balance includes a variance of 38ML (1.5%).

During the Period, no water was extracted from licences Production Bores.

Table 23: Site Water Balance

Water Sources (Inflows)	Volume (ML)
UCML Water	178
Groundwater Extraction (bores)	0
Rainfall / runoff	494
Groundwater inflows	1,886
Total	2,557
Water Loss (Outflows)	
Evaporation	340
Seepage	0
Construction & dust suppression	1,276
Licensed Discharge	0
Unlicensed Discharge	0
CHPP Demand	944
Underground demand	203
Total	2,764
Water Balance	
Inflows minus outflows	-207
Change in inventory	-245
Balance	38 (1.5%)

7.3 SURFACE WATER

7.3.1 SURFACE WATER QUALITY AND FLOWS

7.3.1.1 Surface Water Flows

The Moolarben Coal Complex is within the Upper Goulburn River and Wollar Creek catchments. Moolarben Creek and Sportsmans Hollow creek are the primary tributaries of the upper Goulburn River catchment with Bora Creek a minor tributary. Wilpinjong Creek and its tributaries (Eastern and Murragamba creeks) drain to the Wollar Creek. Most of the adjacent watercourses are ephemeral in nature.

In accordance with the SWMP, stream flow gauges have been installed in the ephemeral Wilpinjong, Murragamba, Eastern and Bora Creeks. Creek flow is heavily influenced by rain events. Data has been supplemented with data from Ulan Coal Mines. The recorded stream gauging is provided in **Appendix 3F**.

7.3.1.2 Surface Water Quality

Surface water monitoring was undertaken in the Goulburn River, Bora Creek, Moolarben Creek, Wilpinjong Creek, Murragamba Creek, and Eastern Creek in accordance with the SWMP. Results varied both spatially and temporally consistent with fluctuations associated with rainfall events in ephemeral watercourses. Several locations were not flowing or dry during monitoring rounds reflecting the ephemeral nature of the creeks and below average rainfall. Goulburn River sites SW01 and SW02 in the Goulburn River National Park and Conservation Area were closed by NPWS during November and December 2019 monitoring periods due to bushfire conditions. Monitoring results during the reporting period were influenced by the below average rainfall received during 2019. The findings are

described in **Section 7.3.2.1** below. Water quality data for the period is presented in **Figure 8** and

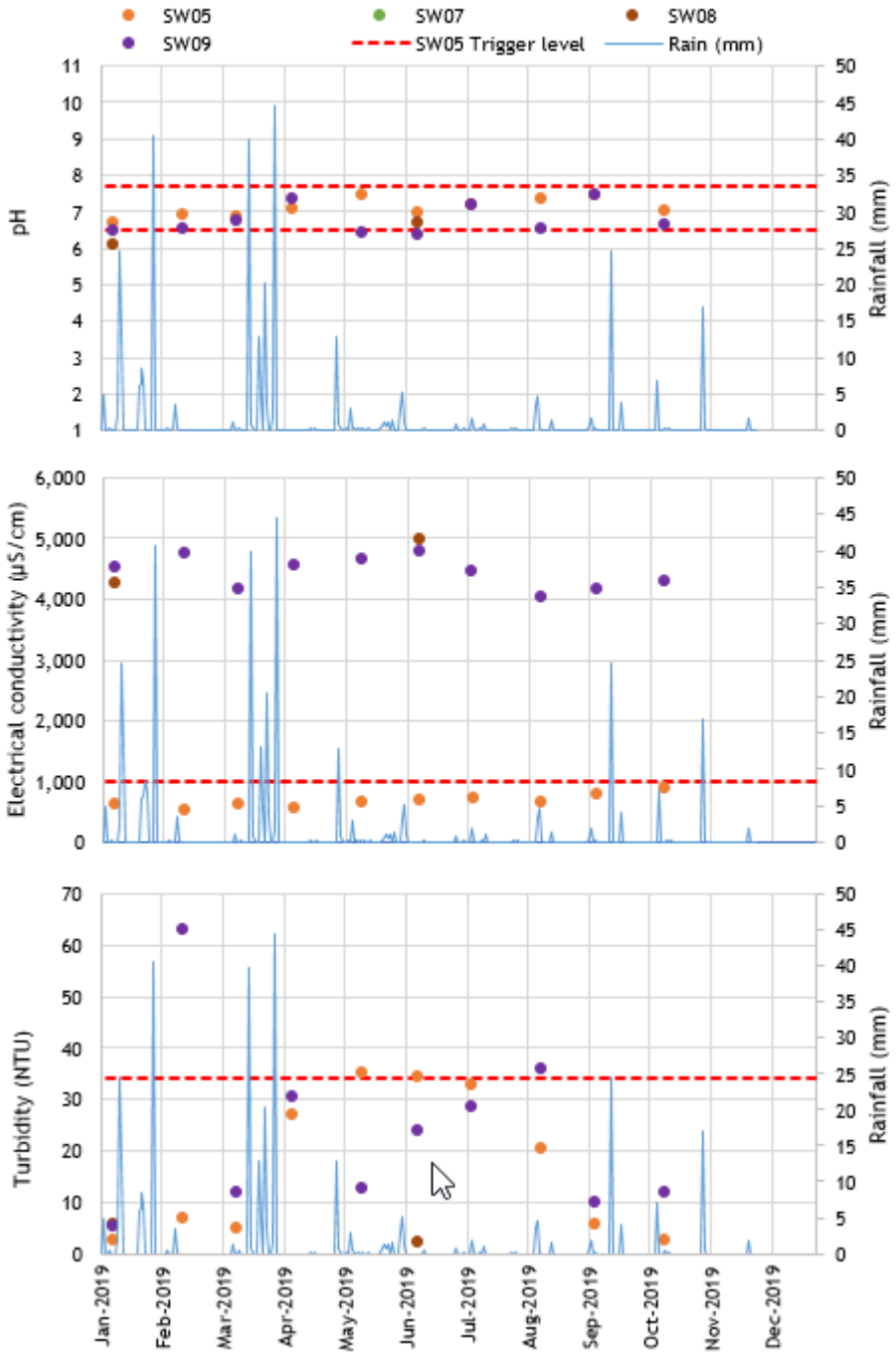


Figure 9**.** Monitoring data is provided in **Appendix 3F**.

7.3.1.3 Rainfall Event Sampling

As per MCO's approved SWMP rainfall sampling is undertaken where rainfall exceeds 30mm in 24 hours. During the reporting period, there were three occasions where rainfall events triggered the requirement to collect additional water samples. All samples were collected within the prescribe timeframes.

7.3.2 WATER DISCHARGES

MCO is licensed to discharge water in accordance with its Environmental Protection Licence (EPL 12932) subject to various water quality and rainfall criteria.

No water discharges occurred from MCO during the reporting period.

7.3.2.1 Comparison to baseline and trends

Location	Trigger Values (20th / 80th %ile)		Performance during the Monitoring Period (01/01/2019 - 31/12/2019)	Trend/ Key Management Implications (Monitoring Period 01/01/2015 - 31/12/2019)	Implemented / proposed Management Action
Surface Water Quality					
Goulburn River Sites; SW01 SW02 SW12*	PH	*6.5 - 8.5*	Surface water pH in the Goulburn River was neutral to slightly alkaline ranging from 7.0 to 7.4 (20%ile and 80%ile). Readings were generally within the historical range. All results were within the current trigger levels during the period with the exception of January, when SW01 and SW02 were slightly below the lower trigger value and did not coincide with any MCO releases.	pH readings range between 7.2 and 8.1 (20%ile and 80%ile) for SW01 and SW02 and between 7.1 and 7.6 (20th and 80th percentiles) for SW12.There is no discernible trend in pH at these locations over the last five years.	Continue the implementation of the SWMP. MCO will review and if necessary revise, the SWMP in accordance with Schedule 5 condition 5 and Schedule 6 condition 5 of PA05_0117 and PA08_0135 respectively.
	EC	*900*	The EC readings were generally consistent with the samples over the last five years. EC ranged from 521 to 831 (20%ile and 80%ile) during the reporting period. All results were below the current applicable trigger levels.	EC readings range between 597 and 834 µS/cm (20%ile and 80%ile) for SW01 and SW02 and between 399 and 566 µS/cm (20th and 80th percentiles) for SW12.The recorded EC values for Goulburn River are generally below the trigger level (900 µS/cm) over the last five years.	
	Turbidity	*25*	All the turbidity results were below the applicable current applicable trigger level and consistent with historical data.	Turbidity readings range between 0.5 and 6.3 NTU (20th and 80th percentile) for SW01 and SW02 and between 4.3 and 28.4 NTU (20th and 80th percentile) for SW12. The turbidity readings for all three monitoring locations are generally below the trigger level (25 NTU), except for a number of readings in mid-2016 and December 2017. The exceedances do not coincide with any MCO releases and are likely due to natural flow conditions.	
Bora Creek	PH	*6.5 - 7.5 (6.5-8.5)***	Bora Creek is an ephemeral creek with flow not recorded during monthly sampling events at both SW10 and SW11 during 2019.	pH ranged from 6.6 to 7.5 (20%ile and 80%ile) for SW10 and from 6.5 to 7.5 (20%ile and 80%ile) for SW11. The majority of the pH samples are within the trigger levels. There is no discernible trend in pH at these locations over the last five years.	

Location	Trigger Values (20th / 80th %ile)		Performance during the Monitoring Period (01/01/2019 - 31/12/2019)	Trend/ Key Management Implications (Monitoring Period 01/01/2015 - 31/12/2019)	Implemented / proposed Management Action
Sites; SW10* SW11					
	EC	*318 (900)***	Bora Creek is an ephemeral creek with flow not recorded during monthly sampling events at both SW10 and SW11 during 2019.	EC readings range between 80 and 117 µS/cm (20%ile and 80%ile) for SW10 and between 174 and 365 µS/cm (20%ile and 80%ile) for SW11. There is no discernible trend in EC at these locations over the last five years.	
	Turbidity	*331*	Bora Creek is an ephemeral creek with flow not recorded during monthly sampling events at both SW10 and SW11 during 2019.	Turbidity readings at SW10 range between 3 and 6 NTU (20%ile and 80%ile) and between 33 and 103 NTU (20%ile and 80%ile) for SW11. All samples are below the trigger level. There is no discernible trend in turbidity at these locations over the last five years.	
Moolarben and Lagoons Creek Sites; SW05 SW07* SW08* SW09*	PH	*6.5 – 7.7*	Surface water pH in the Moolarben and Lagoon creeks was generally neutral ranging from 6.8 to 7.6 (20%ile and 80%ile). Readings were generally within the historical range. All results were within the current trigger levels during the period.	pH was neutral to slightly alkaline ranging from 6.5 to 8.0 (20%ile and 80%ile). Some of the samples were above the trigger levels for Moolarben Creek. The pH at SW08 and SW09, upstream of the confluence of Lagoon Creek, is generally lower than at SW05 and SW07. There is no discernible tend in the results.	
	EC	*1,000*	The EC readings were generally consistent with the samples over the last five years. EC ranged from 337 to 585 (20%ile and 80%ile) for SW05. All EC readings at SW05 were within the trigger level while upstream (non-mine impacted) EC readings continued to be elevated, consistent with historical records.	EC readings at SW05 range between 475 and 861 µS/cm (20%ile and 80%ile) and are lower than the trigger level. Upstream (non-mine impacted) Lagoon Creek (SW07) and Moolarben Creek (SW08 and SW09), the EC readings are elevated ranging between 1,292 and 4,790 µS/cm (20%ile and 80%ile).	
	Turbidity	*34*	Turbidity readings were all consistent with the historical data. Two non-consecutive trigger level exceedances were recorded at SW05. The	The 20th percentile turbidity readings for all four monitoring locations ranges between 1.3 and 5 NTU, while the 80th percentile ranges between	

Location	Trigger Values (20th / 80th %ile)		Performance during the Monitoring Period (01/01/2019 - 31/12/2019)	Trend/ Key Management Implications (Monitoring Period 01/01/2015 - 31/12/2019)	Implemented / proposed Management Action
			exceedances did no coincide with any MCO releases.	14.8 and 28.5 NTU. There are several recordings that exceed the trigger level during 2019, however they are consistent with historical recordings. There is no discernible trend in turbidity at these locations over the last five years.	
Murragamba, Eastern and Wilpinjong Creek Sites; SW04 SW15 SW16 SW17* SW19* SW20*	PH	*a. 6.1 – 7.7* *b. 6.4-7.3* *c. 6.5-7.4*	Murragamba, Eastern and Wilpinjong Creeks are ephemeral with flow not recorded during monthly sampling events at SW04, SW15, SW16, SW17, SW19 and SW20 during 2019.	pH readings range between 6.2 and 6.8 (20th and 80th percentiles) for upstream Murragamba Creek (SW19) and between 6.9 and 8.3 (20%ile and 80%ile) for downstream Murragamba Creek (SW04). The 20th and 80th percentiles for SW04 are above the trigger levels for Murragamba Creek. Wilpinjong Creek has a pH ranging between 6.1 and 7.3 (20%ile and 80%ile) for SW15, SW16 and SW17, while the 20th percentile for SW18 is 4.4. There is no discernible trend in pH at these locations over the last five years.	
	EC	*a. 1,622* *b. 437* *c. 714*	Murragamba, Eastern and Wilpinjong Creeks are ephemeral with flow not recorded during monthly sampling events at SW04, SW15, SW16, SW17, SW19 and SW20 during 2019.	The EC in Murragamba Creek ranges between 38 and 584 µS/cm (20%ile and 80%ile) for SW19 and 258 and 1,018 µS/cm (20%ile and 80%ile) for SW04. SW04 recorded high EC readings between July 2015 and July 2016. These high EC recording are associated with extended dry periods. Wilpinjong Creek has EC ranging between 85 and 619 µS/cm (20%ile and 80%ile). There is no discernible trend in EC at these locations over the last five years.	
	Turbidity	*a. 156* *b. ND*	Murragamba, Eastern and Wilpinjong Creeks are ephemeral with flow not recorded during	Murragamba Creek has turbidity readings between 12 and 91 NTU (20th and 80th	

Location	Trigger Values (20th / 80th %ile)		Performance during the Monitoring Period (01/01/2019 - 31/12/2019)	Trend/ Key Management Implications (Monitoring Period 01/01/2015 - 31/12/2019)	Implemented / proposed Management Action
		c. ND	monthly sampling events at SW04, SW15, SW16, SW17, SW19 and SW20 during 2019.	percentiles) with the majority of the samples recording a turbidity value below the trigger level. Wilpinjong Creek has a turbidity ranging between 20 and 132 NTU (20th and 80th percentiles). Several exceedances of Turbidity trigger levels have been recorded in the past 5 years (none since 2017). There is no discernible trend in turbidity at these locations over the last five years.	

* Monitoring site does not have associated trigger investigation levels
** Limit equivalent to approved EPL discharge limits during releases
a. Trigger investigation levels are for SW04
b. Trigger investigation levels are for SW15
c. Trigger investigation levels are for SW16
ND. No data (i.e. less than 24 monitoring points)

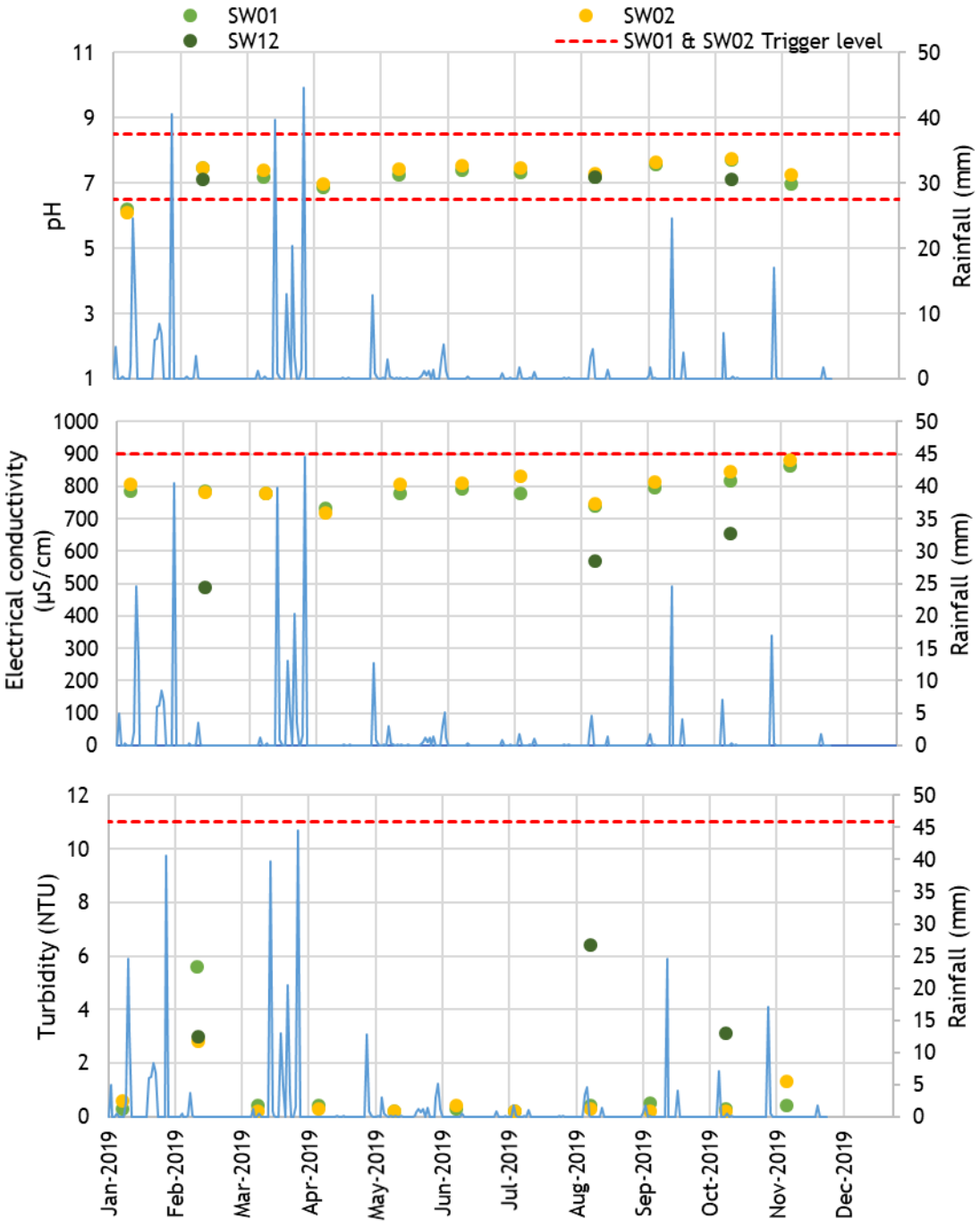


Figure 8: Goulburn River Water Quality

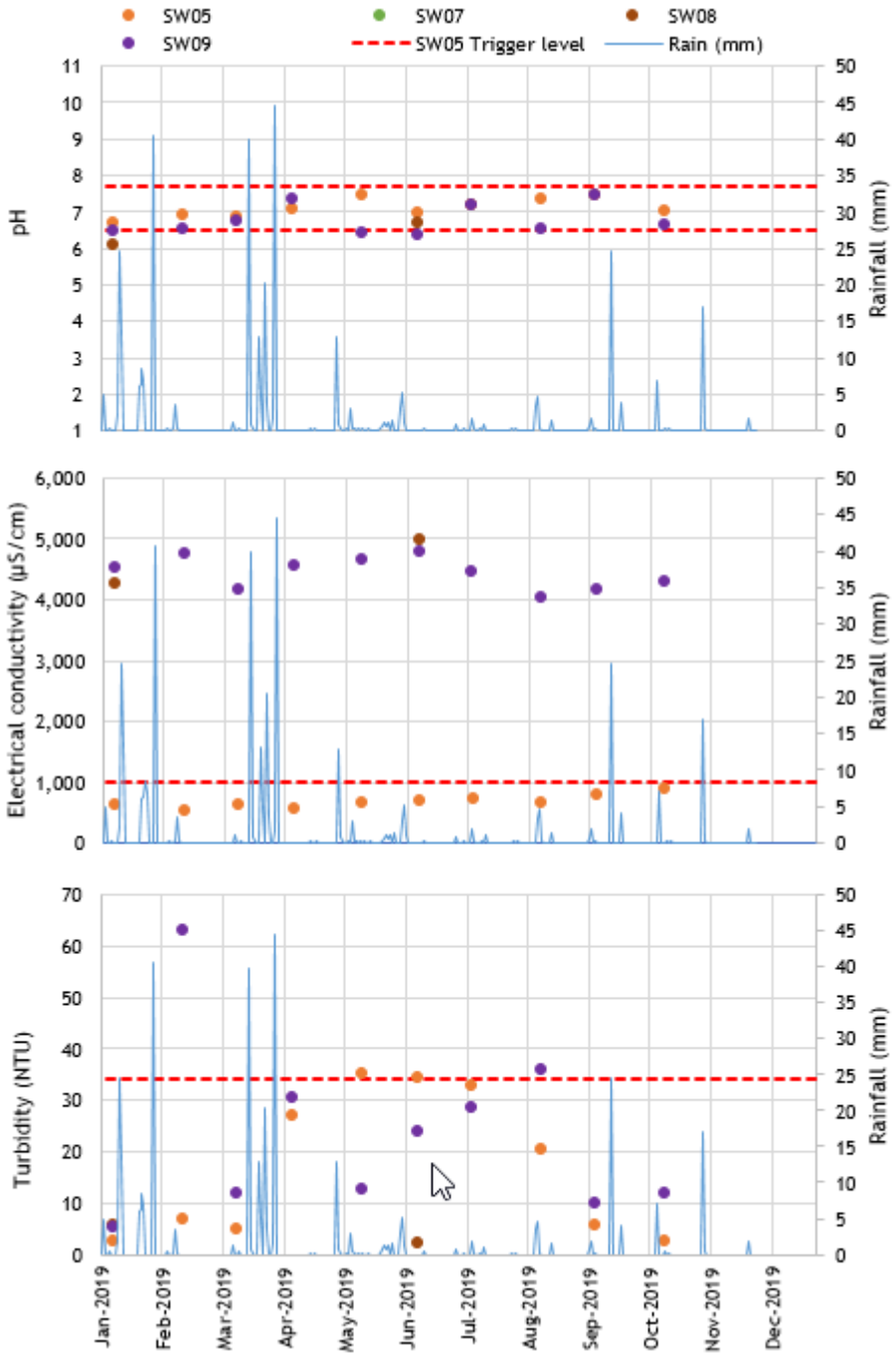


Figure 9: Moolarben and Lagoon Creek Water Quality

7.3.3 STREAM HEALTH MONITORING

Stream health monitoring was undertaken in Autumn and Spring 2019 including Aquatic Habitat Condition (RCE Index), Aquatic Macroinvertebrate Diversity and Pollution Tolerance SIGNAL2 Scores. Trigger investigation values have been incorporated into the SWMP with investigations triggered when values fall below the trigger value. Scores from the Autumn and Spring monitoring programs all identified above these values.

7.3.3.1 Autumn 2019

Autumn stream health monitoring was undertaken between 11th to 14th May 2019. In line with 2018 monitoring sites SH03, SH04, SH15 and SH19 were dry and not sampled. The Autumn 2019 stream health sampling was conducted following lengthy dry spells interrupted by rain events in January and March.

There were no indications of MCO mine-related impact on stream health or aquatic habitat conditions in Autumn 2019, with differences between sites generally relating to natural environment habitat features and prevailing weather conditions.

- Aquatic Habitat Condition (RCE Index) - All site results were above established trigger values (**Figure 3-e**), with minor changes to eight of the 14 sites owing to variations in the levels of filamentous green algae or macrophytes. This factor has been the main source of variation in RCE scores over recent surveys.
- Aquatic Macroinvertebrate Diversity - The macroinvertebrate taxa diversity results were above established trigger value levels at all sites (**Figure 3-e**). The site diversity values across the larger catchment groups (Moolarben Creek and Goulburn River) were generally lower than the pre-mining mean values with only SH13 identified as supporting a higher diversity than the pre-mining average number of taxa. All the Wilpinjong Creek sites, apart from SH16, had higher taxa diversities than in Spring 2018.
- Pollution Tolerance SIGNAL-2 Scores – All Autumn 2019 SIGNAL-2 scores were above established trigger values, with SH13 the only site which supported higher diversity than the pre-mining average number of taxa (**Figure 3-e**). All Moolarben Creek site SIGNAL-2 values were relatively stable with sites SH06 and SH12 recording lower SIGNAL2 values than Spring 2018 and sites SH08 and SH10 recording higher values than Spring 2018. For the Goulburn River catchment sites, three of the downstream river sites were lower than the Spring 2018 surveys values (SH01B, SH02 and SH05). Wilpinjong Creek site SIGNAL-2 scores were consistent with the previous two years' values.

7.3.3.2 Spring 2019

Spring stream health monitoring was undertaken between 2nd and 3th December 2019. Prevailing weather conditions leading into the survey were very dry, with well below average precipitation occurring throughout the region for the period since the Autumn 2019 survey in May. Several sites were dry, including Bora Creek sites SH03 and SH04, with SH17 the only Wilpinjong Creek catchment site that contained water. Further to this, Goulburn River sites SH01 and SH02 were unable to be sampled due to access restrictions in the Goulburn River National Park, given the regions' prevailing bushfire threat.

- Aquatic Habitat Condition (RCE Index) - RCE scores were above established trigger values at all sites (**Figure 3-e**). There were minor changes to RCE scores at five of the eight sites due to fluctuations in the levels of macrophytes and filamentous green algae between surveys. As mentioned in the Autumn results above, changes in the relative levels of filamentous green algae and macrophyte occurrence has been the main source of variation in RCE scores between Autumn and Spring seasonal surveys over recent years.
- Aquatic Macroinvertebrate Diversity – The Spring 2019 site taxa diversity results were above established trigger values for all sites (**Figure 3-e**). For the Goulburn River sites SH05 and SH13 taxa diversity values were much lower than the Autumn 2019 survey. All Moolarben Creek sites recorded values within the range of recent seasonal surveys, though site taxa diversity values were similar to, or high than, the Autumn 2019 survey at SH06, SH08 and SH10 and

marginally lower at Ryans Creek site SH12. The only Wilpinjong Creek site monitored for Spring 2019 (SH17) returned a reduced taxa diversity value when compared to Autumn 2019.

- Pollution Tolerance SIGNAL-2 Scores - All the Spring 2019 SIGNAL-2 scores were above established trigger values and all sites except for SH05 and SH08 recorded SIGNAL-2 scores similar to, or higher than, the pre-mining mean values (**Figure 3-e**). The spring 2019 SIGNAL-2 values for Moolarben Creek sites were generally consistent with values recorded over the previous 5-year period. The sites that were sampled at Goulburn River in Spring 2019 were within the range of values recorded over the broader study period. Many of the individual Wilpinjong Creek site SIGNAL-2 values have remained constant over the five-year period.

7.3.3.3 Trends

Riparian and stream ecology throughout the period have been influenced by naturally occurring climatic factors and non MCO licensed discharges. In 2019 all the RCE, macroinvertebrate diversity and SIGNAL-2 Index stream health criteria in both seasonal surveys did not trigger investigations. Rainfall records indicate that the study area has been subjected to varying rainfall patterns over the previous five-year period with increasingly dry conditions experienced in 2019.

Review of the aquatic habitat condition (RCE Index) trends indicate that over recent (post 2016) surveys RCE scores have remained relatively stable, with only minor inter-seasonal fluctuations occurring at most sites, primarily due to the relative levels of macrophytes and filamentous green algae. Several sites have recorded extended periods with no change in RCE scores, reflecting a stability in channel forms (bed and bank structures, sediments, detritus and pool form) in the absence of high magnitude flow events, and stability in riparian attributes (surrounding vegetation) despite the lack of precipitation.

Given that overall aquatic habitat conditions of MCO stream health sites have remained stable, it is determined that climatic factors and flow regimes are the dominant influence on aquatic ecological community and macroinvertebrate assemblage change over time. Flow regimes are related to the physical locations of monitoring sites within their respective catchments and subject to local rainfall runoff or licensed discharges. Accordingly, sites located in the smaller upper catchments above licensed discharge, including Wilpinjong and Moolarben Creeks, can be expected to be influenced more readily by low flow and drought or high scouring storm flow conditions (boom and bust). Sites in the Goulburn River would experience more persistent flows from UMC licenced discharge and some additional contribution from Bobadeen Creek.

7.3.4 CHANNEL STABILITY MONITORING

The channel stability monitoring program occurred on the 4th and 20th of November at locations in **Appendix 2**. Monitoring involved visual and written observational surveys of erosive and depositional features, cross sections at strategic locations and photographic records.

7.3.4.1 Monitoring results

Bora Creek channel stability monitoring results indicate a declining trend moving downstream consistent with previous monitoring. The upper reaches of Bora Creek including sites BC-pt01, BC-pt02 and BC-pt04 were ranked 'Very Stable' to 'Potentially Stabilising'. The lower reaches of Bora Creek were ranked 'Active to 'Very Active'. The 2019 scores are considered comparable to the results recorded in 2018.

Moolarben Creek channel stability monitoring identified continuation of morphological processes identified in previous monitoring, however the overall trend for 2019 indicates a slight declining trend. The main reasons were the slightly lower scores attributed to less vegetation noted on either the bed

of the channel and/or the bank walls. The average CSIRO classification for Moolarben Creek in 2019 was 'Potentially Stabilising'.

Murragamba Creek channel stability monitoring results indicate similar scores to 2018. The main observation in 2019 was the decline in vegetation noted along the creek banks and creek bed, similar to 2018. The decline in observed vegetation on the bed and banks of the flow channel was reflected in slightly lower channel stability scores at nearly all sites for 2019 and 2018 when compared to 2017.

Wilpinjong Creek channel stability monitoring results indicate no significant variances in stability when compared to previous results. The 2019 channel stability monitoring also noted similar morphological processes, as assessed and identified previously and continues to remain spatially variable. The average CSIRO classification for Wilpinjong Creek in 2019 was 'Potentially Stabilising' but in contrast to previous years there was almost no pooling/flowing water in 2019.

Eastern Creek channel stability monitoring results indicate very little change, when compared to previous results. The 2019 channel stability monitoring identified continuation of morphological processes identified in previous monitoring, however the overall trend for 2019 indicates a slight decline. The slight deterioration to the overall channel stability trend in 2019, similar to that of 2018, was primarily due to the absence of vegetation within the channel, most likely caused by ongoing drought conditions.

7.3.4.2 Trends

Channel stability within each creek was variable during the period. Locations vulnerable to erosion were characterised by steep banks, little vegetative cover and exposed dispersive subsoil. More stable locations were characterised by vegetated banks with low gradient slopes. Where active erosion was recorded at sites along each creek, this was predominantly the result of natural influences exacerbated by past land use and agricultural practices that exposed dispersive subsoils. The impact of creek stability within these creeks due to mining operations is considered negligible over the past 12 months.

7.3.5 EFFLUENT

During the period MCO continued to operate four sewerage treatment plants. Discharge quantity was within design limits during the period. Discharge quality is presented in **Appendix 3F**.

7.4 GROUNDWATER

7.4.1 GROUNDWATER LEVELS

MCO monitors a network of piezometers in accordance with the Groundwater Management Plan (GWMP). The monitoring program includes trigger values established to determine the need for investigation and possible response actions for potential impacts to groundwater levels in the Alluvial and Triassic aquifers. The Permian strata does not include triggers as it is already extensively affected by past mining, is predicted to undergo further impact from ongoing mining and contains groundwater of generally poor quality.

Response triggers for groundwater levels within Quaternary Alluvium and Triassic Sandstone aquifers are based on the minimal impact considerations in the Aquifer Interference Policy (DPI, 2012). Monitoring frequency and response triggers have been implemented to identify trends that could potentially lead to a private bore being impacted above the Aquifer Interference Policy considerations (i.e. greater than 2 m drawdown).

Over the 2019 monitoring period MCO continued to observe a general declining trend of groundwater levels as a result of the continued below average rainfall conditions (as indicated by the Rainfall Cumulative Deviation (RCD)), UG1 mining, open cut operations and regional depressurisation due to neighbouring operations. Rainfall in the reporting period was significantly below average with a continued reduction in the RCD (**Figure 10**).

Three groundwater level investigation sites were triggered during the period, PZ184, PZ187, and PZ105C. PZ184 is located within the approved OC4 pit and between current OC4 operations and neighbouring operations. PZ184 remained dry and below the groundwater trigger level during the reporting period, groundwater trends at this bore are closely correlated with rainfall trends, with a decline in groundwater levels in line with a period of sustained below average rainfall. PZ187 showed a subdued response to climatic trends. The bore was decommissioned during the reporting period. PZ105C continues to show a localised effect with Triassic bores between PZ105C and MCO's operations not exhibiting the same level of response. Investigation triggers, along with monitored groundwater levels are presented in **Table 24**. Standing water level/pressures for all piezometers for the period (including vibrating wire piezometers) are presented in **Appendix 3G**.

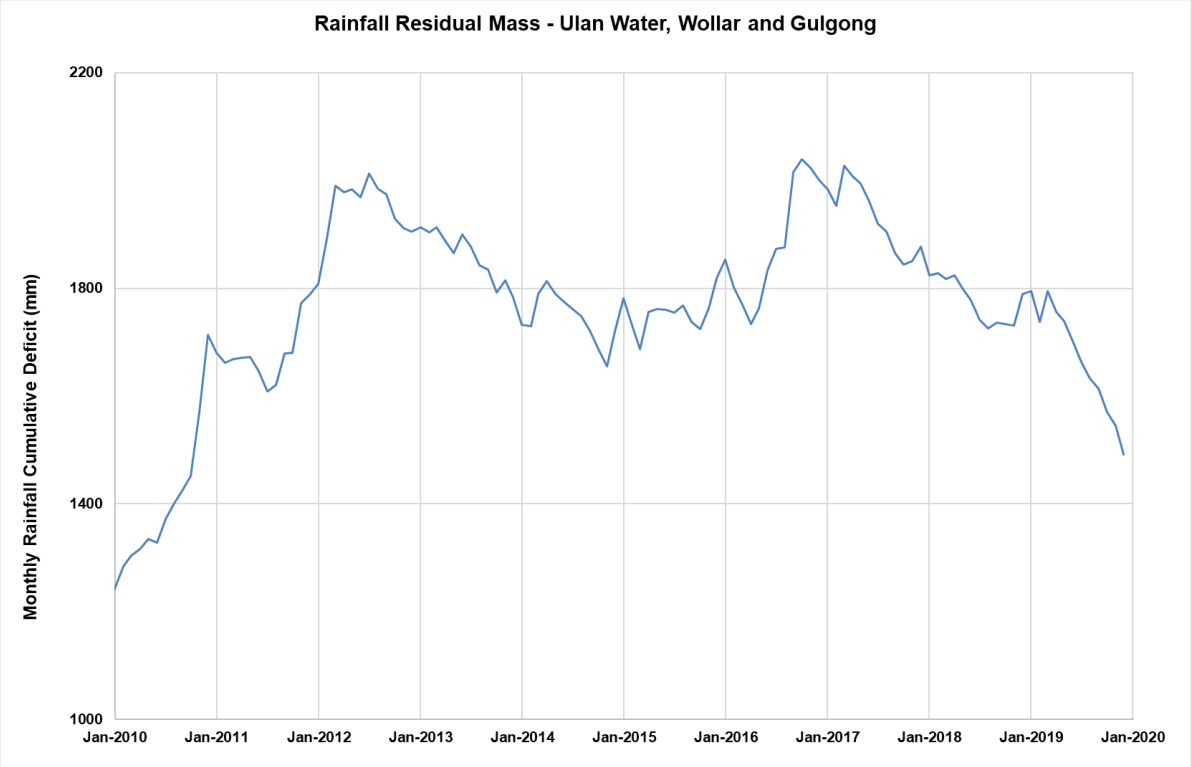


Figure 10: Rainfall Residual Mass - Wollar

Drawdown in the Ulan coal seam and the Permian coal measures is influenced by open cut mining, UG 1 underground mining and neighbouring operations. The influence of UG1 continued over the period. Permian VWP PZ129-74 VWP recorded a decline in pressure followed by a recovery from October. This was not replicated at other locations.

Groundwater levels in Triassic bores remained stable to slightly declining during 2019. PZ105C located 5 km north of the current MCO mining operations, continued to gradually decline. The decline observed in PZ105C is likely to be a localised effect. Triassic bores between PZ105C and MCOs operations do not exhibit the same level of response.

Groundwater levels in the Alluvium and Tertiary Palaeochannel declined during the period, influenced by the on-going dry conditions and reduction in the RCD. PZ184 remained dry during the period. No significant response was observed associated with the rainfall in January and March.

During the period PZ187 was decommissioned and PZ186 was converted from a standpipe monitoring bore to a Vibrating Wire Piezometer.

Over the longer-term many monitoring network bores exhibit a long-term rise in water levels from 2006 to December 2012 followed by a prolonged period of water level decline to December 2019.

7.4.2 GROUNDWATER QUALITY

Site specific trigger levels for acidity (pH) and electrical conductivity (EC) have been developed for the Moolarben Coal Complex. A review of the groundwater quality performance is provided in **Table 25**. Water quality results from all piezometers are provided in **Appendix 3G**.

Water quality for the period is generally consistent with baseline data and previous monitoring results. Two Ulan Seam water quality monitoring sites PZ151 and PZ191 were triggered for investigation due to EC in the period. PZ151 is located within the OC4 footprint, elevated EC concentrations are likely related to the decline in water level associated with a combination of approved operations and climatic influence. PZ191 saw a decline in EC concentrations, but remained above the established trigger level across the 2019 monitoring period. This exceedance is likely related to predicted water level drawdown associated with approved operations. PZ055 EC reduced, though remained elevated above trigger level.

7.4.3 PRIVATE GROUNDWATER USERS

MCO had negligible impact on private groundwater users during the reporting period. No compensatory water supply was required or supplied during the period.

7.4.4 ACTIONS FOR NEXT REPORTING PERIOD

During the next reporting period the following actions are proposed:

- Review groundwater triggers as part of next Groundwater Management Plan Review.
- WAMP to be reviewed and revised as necessary.

Table 24: Water Levels – Triassic, Alluvium and Palaeochannel Bore Performance

Location	Investigation Trigger Level (mAHD)	Minimum Groundwater Level/Pressure (mAHD)		Trend/ Key Management Implications	Implemented/proposed Management Action
		Baseline	2019		
Alluvium and Palaeochannel Bores					
PZ55	419.8	421.8	422.8	Below average rainfall with continued reduction in rainfall cumulative deviation. Bores generally continued to exhibited a declining trend during 2019 consistent with the RCD. Investigation triggers exceeded at PZ184 during the reporting period due to climatic and regional effects. PZ187 showed a subdued response to climatic trends. The bore was decommissioned during the reporting period due to damage.	Continue monitoring program. Continue monitoring to develop triggers for bores without triggers. MCO will review and if necessary revise, the GWMP in accordance with Schedule 5 condition 5 and Schedule 6 condition 5 of PA05_0117 and PA08_0135 respectively.
PZ58a	465.8 (dry)	467.5	466.8		
PZ184	410.4 (dry)	412.0	Dry		
PZ187	413.7	415.7	413.6		
PZ188	413.2	415.2	413.5		
PZ203	401.1	403.1	402.2		
PZ211*	TBC	433.5	Dry		
PZ213*	TBC	412.6	412.8		
PZ214*	TBC	412.8	412.9		
Triassic Bores					
PZ101C	378.7	380.7	380.2	Declining water level/pressures generally consistent with the RCD and rainfall recharge and natural discharge. PZ105C remained below trigger level and continues to be a localised effect with Triassic bores closer to MCOs operations not exhibiting the same level of response. Monitoring to continue.	Continue monitoring program.
PZ105C	374.9	376.9	373.8		
PZ129 (VWP-35m)	387.0 (dry)	388.4	390.0		

* *Trigger to be developed.*

Table 25: Water Quality Performance

Location	Investigation Trigger Criteria	Trend/ Key Management Implications	Implemented/proposed Management Action
Water Quality			
All	pH and Electrical Conductivity	Water quality for the period is generally consistent with baseline data and previous monitoring results. Two Ulan Seam water quality sites for EC were triggered for investigation in the period at PZ151, and PZ191. PZ151 is located within the OC4 footprint, elevated EC concentrations are likely related to the decline in water level associated with a combination of approved operations and climatic influence. PZ191 saw a decline in EC concentrations, but remained above the established trigger level across the 2019 monitoring period. This exceedance is likely related to predicted water level drawdown associated with approved operations. PZ055 EC reduced, though remained elevated above trigger level.	Continue monitoring program. MCO will review and if necessary revise, the GWMP in accordance with Schedule 5 condition 5 and Schedule 6 condition 5 of PA05_0117 and PA08_0135 respectively.

8.0 MINE SUBSIDENCE

MCO undertakes secondary extraction in accordance with the UG1 Longwalls 101 to 103 Extraction Plan (2019) (the Extraction Plan). The Extraction Plan and associated sub-plans were prepared with input from experienced and qualified experts to satisfy Condition 5, Schedule 4 of PA 08_0135 and was approved in September 2017, a revision was completed and approved in March 2019 to include amendments to the 103 layout.

During the reporting period, secondary extraction was undertaken in Longwall 102A, 102B and LW103. Mining of longwall panel 102A was completed on 03 May 2019. A longwall move was carried out in May 2019 with LW102B commencing on 27 May 2019. As of the 31 December 2019 Longwall LW103 had retreated 1,431m. The combined total extracted length during the 2019 reporting period was 4,115 m.

During the reporting period MCO continued to conduct monitoring of subsidence lines, flora and fauna habitats, cliffs, landscape features, and built features for LW101, 102 and LW103. Routine monitoring of subsidence lines, surface water, groundwater, UG1 inflows and outflows continued. Routine built feature monitoring triggers were not exceeded in the period. Post mining inspections were carried out for flora and fauna above LW101 and LW102.

Subsidence monitoring included the 2D ground monitoring A, B, C, and D lines. Monitoring line A is orientated transverse to the Longwalls and crosses LW101 near the commencing end. LW102A mined directly beneath this monitoring line during 2019. Line B is a longitudinal monitoring line located above the centreline of LW101 at the commencing end. During 2019, LW102A had mined adjacent to the B Line. Line C is a monitoring line located along the centreline of LW101, at the longwall finishing end. At the end of 2018, LW102B had been extracted adjacent to the monitoring line and the extraction face of LW103 was located more than 2.1km from the south-west end of monitoring Line C. Line D is located along the centreline of LW102B at the longwall finishing end. LW102B mined directly beneath this monitoring line during 2019. At the end of 2019, the extraction face of LW103 was located more than 2.1 km from the south-west end of the monitoring line. Subsidence impacts during the period were consistent with predictions as shown in **Table 26.**

Table 26 Comparison of maximum observed and predicted vertical subsidence, tilt & strain for the A, B, C & D Line.

Survey Line	Type	Maximum vertical subsidence (mm)	Maximum tilt (mm/m)	Maximum tensile strain (mm/m)	Maximum compressive strain (mm/m)
A	Measured	1837	53	9	9
	Predicted	2400	45	15[1]	15[1]
B	Measured	1781	50	64	19
	Predicted	2350	100	> 30[1]	> 30[1]
C	Measured	1795	43	6	16
	Predicted	2350	70	25[1]	25[1]
D	Measured	1643	48	8	19
	Predicted	2200	60	20[1]	25[1]

[1] denotes that the values represent the conventional strains based on the predicted curvatures multiplied by a factor of 10.

A summary of performance against the relevant subsidence performance indicators and subsidence performance measures (i.e. the subsidence performance assessment), detailed in the Extraction Plan and Condition 1 and Condition 3, Schedule 4 of Project Approval (08_0135) is provided in **Table 27** and **Table 28**.

Table 27: Assessment of Subsidence Performance Indicators Measures for UG1 – Natural and Heritage Features

Subsidence Impact Performance Measure		Subsidence Impact Performance Indicator	Indicators Exceeded?	Assessment of Subsidence Impact Performance Measures	Performance Measures Exceeded?
Water Resources:					
Drainage Lines *(DL1 – DL7)*	*No greater subsidence impacts or environmental consequences than predicted in the EA*	• Change in visible erosion. • Development of, or change in, head-cut erosion along DL7. • Change in character, such as increased erosion or change in vegetation along drainage line. • Extensive duration of water ponding. • Downstream water quality (consistent with approved complex-wide SWMP). • Appearance of unsealed surface cracking across the bed of DL7.	**No**	The upper reaches of DL7 is located within LW103, however was not undermined in 2019. It is unlikely that DL7 experienced measurable ground movements due to mining. No impacts greater than predicted recorded. Pre-mining inspections of DL7 completed.	**No**
Land:					
Cliffs C7, C9 and C10	*Negligible environmental consequences (that is occasional rockfalls, displacement or dislodgement of boulders or slabs or fracturing, that in total do not impact more than 0.5% of the total face of such cliffs within any longwall mining domain)*	• Not applicable (NA). C7, C9 and C10 are located outside the Study Area of Longwalls LW101 to LW103.	**NA**	Cliffs C7, C9 and C10 were located outside the mined extents of LW101 and LW102A at the end of 2019, at distances greater than 1.6 km. It is unlikely that these cliffs experienced measurable ground movements due to the mining. No impacts greater than predicted recorded.	**No**
Other cliffs	*No greater subsidence impacts or environmental consequences than predicted in the EA*	• The total length of cliffs within the Longwalls 101-103 Study Area that experiences cliff instabilities (i.e. the exposure of a fresh face of rock and debris scattered around the base of the cliff) is to be less than 6 m.	**No**	Cliffs C5 and C6 are located above the as-extracted extent of LW103 during 2019. All other relevant cliffs are outside LW101 to 103 area. Pre-mining inspections and establishment of monitoring points at cliff line C5 and C6 above LW103 have been completed. Ground movements measured during 2019 were similar to or less than those predicted Some minor rockfalls and cracking and slabbing observed. Post-mining surveys to be undertaken at the completion of longwall 103 mining.	**No**

Subsidence Impact Performance Measure		Subsidence Impact Performance Indicator	Indicators Exceeded?	Assessment of Subsidence Impact Performance Measures	Performance Measures Exceeded?
Minor cliffs Rock face features Steep slopes	*Minor environmental consequences (that is, occasional rockfalls, displacement of or dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 5% of the total face area of each such type of features within any longwall mining domain)*	• In each instance of an identified impact (occasional rockfalls, displacement of boulders or slabs, or fracturing) the affected percentage of the total face area of the feature affected will be determined. It is expected that occasional rockfalls or fracturing would not impact more than 5% of the total face area of rock ledges and overhangs in the Longwall mining domain.	**No**	Pre-mining surveys completed and monitoring sites established above LW102A, 102B and 103. Ground movements measured during 2019 were similar to or less than those predicted. Some minor rockfalls and cracking. Post-mining surveys to be undertaken at the completion of longwall mining.	**No**
Biodiversity:					
Threatened species, threatened populations, or endangered ecological communities	*Negligible subsidence impacts or environmental consequences*	Subsidence related impacts to threatened flora, fauna or EECs, including: • Areas of cracking or ponding that exceed predictions in the subsidence predictions and assessments of the impacts relating to the predicted subsidence above Longwalls 101-103; • Declining trend in canopy health or vegetation structure inconsistent with seasonal trends at analogue sites; • Deterioration in tree health outside natural variations (analogue sites to be used as a guide); • Areas of weed incursion and/or infestation; or • Mortality of more than a small number of threatened flora or fauna species attributed to subsidence impacts. • Evidence of impacts (attributable to subsidence) to more than 5% of features that provide potential bat roosting sites in the Longwalls 101 to 103 Study Area (i.e. cliffs and minor cliffs).	**No**	Pre-mining baseline floristic monitoring along transects above LW101, LW102A, 102B and 103 completed. Ten baseline floristic sites have been established along 8 transects above LW101-103 in five Plant Community Types (PCTs). Two of these, PCT 266 and PCT 1606, are listed as an Endangered Ecological Community (EEC). Pre-mining targeted cliff line monitoring for potential microbat roosting sites completed. Low levels of activity of three target predominantly cave-roosting microbat species across all sites sampled, indicating that significant roosts of these species were unlikely to be present within the study area. Post-mining surveys were undertaken at LW101 and 102 for biodiversity. No performance measures had been exceeded.	**No**
Heritage Sites:					
Aboriginal heritage sites S2MC 236 (AHIMS No.s 36 3 0016 and 36 3 0134)	*Negligible subsidence impacts or environmental consequences*	• Not applicable (NA) S2MC236 [AHIMS No.s 36-3-0016 and 36-3-0134] are located outside the Study Area of Longwalls LW101 to LW103.	**No**	S2MC236 [AHIMS Nos. 36-3-0016 and 36-3-0134] are located outside the Study Area of Longwalls LW101 to LW103.	**No**

Subsidence Impact Performance Measure		Subsidence Impact Performance Indicator	Indicators Exceeded?	Assessment of Subsidence Impact Performance Measures	Performance Measures Exceeded?
Historic Heritage Sites	*No greater subsidence impacts or environmental consequences than predicted in the EA*	• Not applicable (NA) all historic heritage sites are located outside the Study Area of Longwalls LW101 to LW103.	**No**	All Historic heritage sites are located outside LW101 to LW103.	**No**
Mine Workings:					
First workings	*First working under an approved Extraction Plan beneath any feature where performance measures require negligible subsidence impacts or negligible environmental consequences to remain long-term stable and non-subsiding*	• First workings remain long-term stable and non-subsiding	**No**	First workings have been designed to meet the requirements of Condition 7, Schedule 4 of Project Approval (08_0135). First workings approvals were granted on the 24 March 2016, 4 May 2016 and 31 August 2018 by the Division of Resources and Geosciences, in accordance with the requirements under Condition 7, Schedule 4 of PA08_0135 and Condition 79 Schedule 3 of PA05_0117..	**No**
Second workings	*To be carried out only in accordance with an approved Extraction Plan*	• Second working are carried out in accordance with an approved Extraction Plan.	**No**	Second workings have been carried out in LW102A, 102B and 103 in accordance with the approved Longwalls 101-103 Extraction Plan during the assessment period.	**No**

Table 28: Assessment of Subsidence Performance Indicators Measures for UG1 – Built Features

Subsidence Impact Performance Measure		Subsidence Impact Performance Indicator Indicators Exceeded?	Indicators Exceeded?	Assessment of Subsidence Impact Performance Measures	Performance Measures Exceeded?
Key Public Infrastructure:					
Gulgong-Sandy Hollow Railway Line	*Always safe and serviceable.* *Damage that does not affect safety or serviceability must be fully repairable, and must be fully repaired*	• No defects or deformation of the rail track and associated infrastructure due to mining. • No visual displacement at joints or cracks in culverts.	**No**	The Sandy Hollow Gulgong Railway Line is located outside the Longwalls 101-103 Study Area, but may be subject to far-field horizontal movements and non-conventional ground movements. Pre-mining monitoring lines established and surveys completed (including FF Line). No triggers of FF Line indicating no defects, deformation of displacement of joints in culverts due to mining.	**No**

Subsidence Impact Performance Measure		Subsidence Impact Performance Indicator Indicators Exceeded?	Indicators Exceeded?	Assessment of Subsidence Impact Performance Measures	Performance Measures Exceeded?
Ulan-Wollar Road		• No additional visible pavement cracking or other defects of the road pavement (when compared against baseline conditions and sections of road outside the Study Area) resulting in deterioration of road quality. • No ponding of water on the road surface as a result of changes in grade from subsidence associated with Longwalls 101-103. • No joint displacement or cracking or other defects of the drainage structure (e.g. pipes/culverts) in excess of 5 mm. • Serviceability of guard rails, marker posts and signage is maintained.	**No**	The Ulan-Wollar Road is located outside the Longwalls 101-103 Study Area, but may be subject to far-field horizontal movements and non-conventional ground movements. Pre-mining monitoring lines established and surveys completed (including FF Line). No triggers of FF Line indicating no additional cracking, defects, additional ponding, deformation of displacement of joints in culverts due to mining.	**No**
Other Infrastructure:					
Murragamba Road	*Always safe.* *Serviceability should be maintained wherever practicable. Loss of serviceability must be fully compensated.* *Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.*	• Not applicable (NA) as Murragamba Road is not publicly accessible.	**NA**	Murragamba Road is not publicly accessible. No observed impacts to Murragamba Road occurred during the assessment period as a result of Longwall LW102A, 102B and 103.	**No**
Low voltage electricity power line		• The structural integrity of the 66 kV/22 kV dual circuit powerline (power poles and transmission lines) is maintained. • The electrical clearance from land, vegetation and roads is maintained. • The serviceability of the access roads/tracks is maintained.	**No**	Pre-mining installation of tilt monitoring points in consultation with Essential Energy and baseline structure survey at each timber pole completed. Monitoring undertaken of Essential Energy poles with ground movements measured at the Essential Energy poles and Substation consistent with the predictions provided Access maintained. No loss of service or observed impacts to the 66kV/22kV powerline and three associated power poles occurred during the assessment period, as a result of LW102A, 102B and 103.	**No**
Telecommunication cable *Fibre-optic cable*	*Serviceability should be maintained wherever practicable. Loss of serviceability must be fully compensated.* *Damage must be fully repairable, and must be fully*	• Negligible transmission loss from mine subsidence impacts. • Negligible impacts on structural integrity of the cable lines from mine subsidence.	**No**	The telecommunication cable and optical fibre cable are located outside the Longwalls 101-103 Study Area, but may be subject to far-field horizontal movements and non-conventional ground movements. No observed/recorded impacts on either the telecommunications line and/or the fibre optic cable occurred during the assessment period, as a result of Longwall of LW102a, 102B and 103.	**No**

Subsidence Impact Performance Measure		Subsidence Impact Performance Indicator Indicators Exceeded?	Indicators Exceeded?	Assessment of Subsidence Impact Performance Measures	Performance Measures Exceeded?
Murragamba Trig Station	*repaired or else replaced or fully compensated.*	• Not applicable (NA) as the Murragamba Trig Station is located outside the Longwalls 101-103 study Area.	**NA**	The Murragamba Trig Station is located outside the Longwalls 101-103 Study Area.	**No**
Other built features (Transgrid)	*Serviceability should be maintained wherever practicable. Loss of serviceability must be fully compensated.* *Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.*	• the structural integrity of the 330 kV ETL (towers and transmission lines) is maintained; • the electrical clearance from land, vegetation and roads is maintained; and • the serviceability of the access roads/tracks is maintained.	**No**	The TransGrid powerline is located outside the Longwalls 101-103 Study Area, but may be subject to far-field horizontal movements and non conventional ground movements. Pre-mining monitoring lines established and surveys completed (including FF Line). No triggers of FF Line indicating no structural integrity changes due to mining Ground movements measured at the TransGrid towers are consistent with the predictions	**No**
Other built features and improvements, including fences	*Serviceability should be maintained wherever practicable. Loss of serviceability must be fully compensated.* *Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.*	• Not applicable (NA) as no other non-mine owned built features and improvements are located within the Longwalls 101-103 Study Area.	**NA**	No other non-mine owned built features and improvements are located within the Longwalls 101-103 Study Area.	**No**
Public Safety:					
Public safety	*Negligible additional risk*	• No more than negligible additional risk to public safety.	**No**	No more than negligible additional risk to public safety has occurred during the assessment period, as a result of Longwall LW102A, 102B and 103, due to the remote location and restricted access of UG1 within MCO's mining operation. There were no incidents regarding public safety as a result of Longwall LW102A, 102B and 103 during the assessment period.	**No**

8.1.1 ACTIONS FOR NEXT REPORTING PERIOD

Activities in the 2020 reporting period include:

- Routine environmental and subsidence line monitoring.
- Establishment and baseline monitoring of additional monitoring locations associated with LW104 where not completed.
- Remediation works, (Eg. Tracks) as required.

8.1.2 SUBSIDENCE REMEDIATION

No subsidence management actions were required to be undertaken as a result of LW102A, 102B and 103 extraction during the reporting period.

9.0 REHABILITATION

MCO manages rehabilitation in accordance with Rehabilitation Management Plan (RMP) and Mining Operations Plan (MOP). The RMP was developed by MCO with advice from experienced and qualified experts to satisfy Condition 68, Schedule 3 of PA 05_0117 and Condition 56, Schedule 3 of PA 08-0135. The MCO Rehabilitation Management Plan (RMP) describes the management of rehabilitation at the Moolarben Coal Complex for Stage 1 and Stage 2. The RMP was updated following the approval of the Open Cut Optimisation Modification (Mod 14) and was approved in July 2019.

The MOP was developed to meet the requirements of Mining Lease Conditions. The MCO Mining Operations Plan (MOP) was revised during the reporting period to capture the changes associated with the approval of Modification 14 (Stage1) and Modification 3 (Stage 2). A new MOP was also submitted in November as the current approved MOP expired on the 31 December 2019. The New MOP has been approved and describes the proposed Stage 1 and Stage 2 mining and rehabilitation activities for the period 1 January 2020 to 31 December 2022 (the MOP term). A description of the proposed rehabilitation activities during the MOP term is provided in Section 7.2 of the MOP. Mining and rehabilitation progression are shown on MOP Plans 3A, 3B and 3C. The MOP and RMP are available on the Moolarben Coal website (www.moolarbencoal.com.au).

This section addressed the annual rehabilitation reporting requirements for Project Approvals PA05_0117 and PA08_0135, the MOP and Moolarben Coal Complex MLs. The rehabilitation performance review for 2019, applies to the proposed rehabilitation activities outlined in the previous MOP 2016 to 2019.

9.1 MINING AND REHABILITATION STATUS

At the end of December 2019 MCO had a Total Mine Footprint of 1,493ha, approximately 218ha less than described in the MOP F Addendum. The reduced disturbance resulted from the later commencement of OC3. The area under rehabilitation preparation and active rehabilitation activities increased to approximately 380ha, 5ha greater than predicted. The area under active rehabilitation increased by 73ha to 328ha, which was 4 ha less than predicted due to minor changes to operations and on-going drought conditions. The area classified as being prepared for rehabilitation was 52 ha, 8 ha more than predicted with 13ha progressing to growth medium development ahead of plan.

In addition, interim/temporary rehabilitation in the form of landscaping and planting has been completed around the main offices, environmental bunds and entry to the operational areas. External batters on dam walls and other infrastructure areas have also been temporarily rehabilitated.

The mining and rehabilitation status is presented in **Table 29**. The land preparation activities undertaken in the period and proposed areas in the next period are discussed in **Section 9.5** and **Section 9.6** and presented in **Figure 3**. The status of mining and rehabilitation is presented in **Figure 4**. The status of mining and rehabilitation, and the agreed post rehabilitation land-use is presented in **Figure 5**.

During the reporting period MCO continued to undertake monitoring and maintenance activities within the existing rehabilitated areas. This included the supplementary seeding of areas with limited cover, placement of mulch, and weed and feral animal control activities.

Table 29: Mining and Rehabilitation Status

Mine Area Type	Previous Reporting Period (2018)	This Reporting Period (2019)	Next Reporting Period (2020)
Total Mine Footprint	1,379	1,493	1,794
Total Active Disturbance	1,036	1,113	1,404
Land being Prepared for Rehabilitation	88	52	28
Land under active Rehabilitation	255	328	362
Completed Rehabilitation	0	0	0

9.2 VEGETATION CLEARANCE AND TOPSOIL STRIPPING

Vegetation clearance was undertaken in accordance with the Vegetation Clearance Protocol and GDPs within the OC2, OC4 and infrastructure areas (**Figure 3**) as described in **Section 6.5.1**. Stripped topsoil was either placed in temporary stockpiles for later use, or placed directly on areas prepared for rehabilitation. Vegetation salvaged was either mulched or retained for use as habitat features within rehabilitation areas.

9.3 SEED COLLECTION

Native seed collection continued throughout the period with seed harvested from MCO owned lands. All activities were undertaken in accordance with the requirements of the Florabank Guidelines (2000). At December 2019 MCO's seed bank contained 303,229 grams of native seed for use in rehabilitation activities across the MCC.

9.4 REHABILIATION MONITORING

MCO undertakes a monitoring program of rehabilitation areas in accordance with the RMP. The monitoring program includes landscape function analysis, floristic monitoring, vegetation structure and growth, fauna monitoring and visual monitoring.

9.4.1 ECOSYSTEM FUNCTION ANALYSIS

EFA was undertaken at 21 EFA sites within the three MCO open cut rehabilitation precincts. This included three (3) new sites established during autumn (R18, R19, R20) and two (2) sites established during spring (R22 and R23) in 2019. An additional site established in autumn 2019 (R21; April 2017 Sedimentary Ironbark Forest) was scheduled to undergo baseline EFA monitoring during spring 2019; however, drainage repairs to the landform were undertaken prior to spring monitoring.

Landscape Function Analysis

LFA assessment allows for the calculation of a Landscape Organisation Index (LO), reflecting the proportion of a transect occupied by patches. Patches are defined by soil surface elements, such as perennial ground cover, litter, logs or rocks that help retain soil and other resources at a site. A higher LO index implies a more stable transect that is less prone to erosion and resource loss.

During 2019, LOI ranged from 0.45 (R4) to 1.0 (R1, R2, R3 and R6). The average LOI for Box Gum Shrubby Woodland rehabilitation sites was 0.85 and the average for Sedimentary Ironbark Forest rehabilitation sites was 0.60. LOI comparison to analogue sites is shown in **Figure 11**.

An increase in bare soil year on year has been recorded (2017-2019), this can be largely attributed to drought conditions experienced during this period. All sites recorded bare soil contributions higher than average bare soil contribution recorded at Box Gum Grassy Woodland and Sedimentary Ironbark Forest analogue sites except for R6 and R16.

Trees/shrubs, and microhabitat features such as logs and rocks, continue to contribute to a limited proportion of the rehabilitation landscape. The average contribution of each of these patch types was consistently less than 1%. Cryptogams were only present within one rehabilitation site (R10 – 43%) the presence of cryptogams at one site is to be expected considering the long period of time that is required for these features to establish. Monitoring sites are presented in **Appendix 2**.

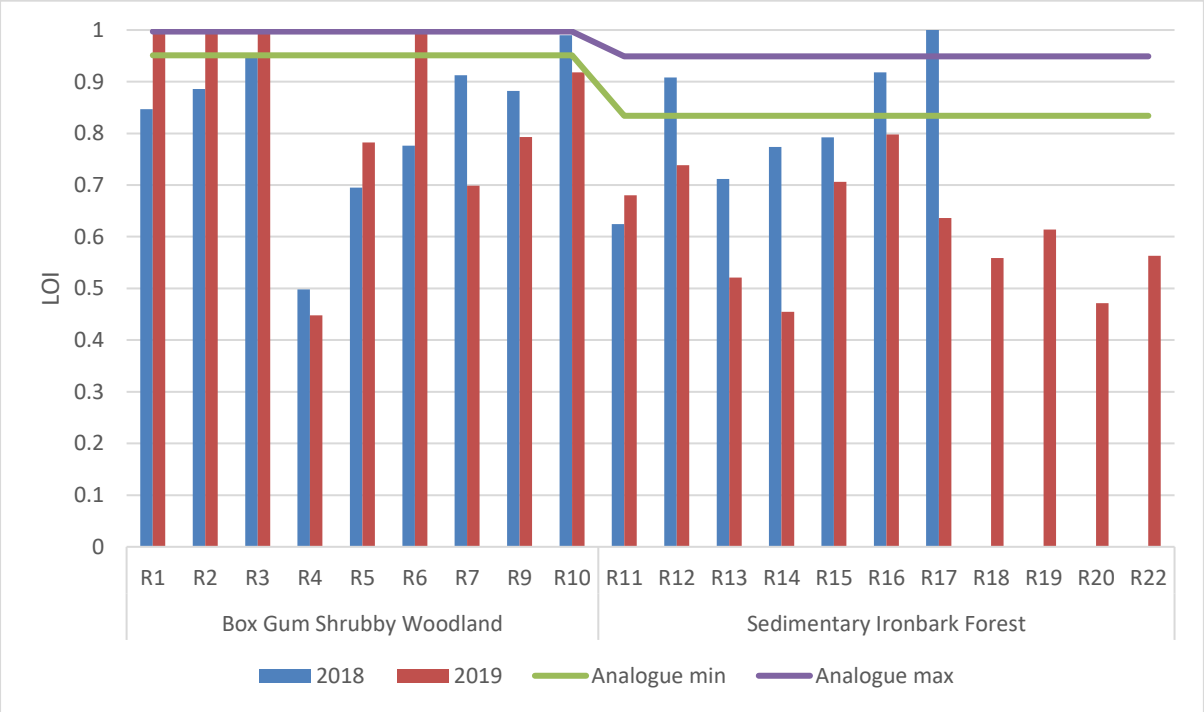


Figure 11: Landscape organisation indices (LOIs) for 2018 and 2019 compared to analogue LOI values

Floristic Monitoring

During autumn 2019 monitoring, all sites except R21, exhibited a higher number of native species than exotic species. Native species richness at Box Gum Shrubby Woodland rehabilitation monitoring sites ranged from 21 species (R7) to 40 species (R1). Native species richness at Sedimentary Ironbark Forest rehabilitation monitoring sites ranged from seven (7) (R21) to 42 species (R18) in 2019. At analogue sites, native species richness ranged from 34 species in the Box-Gum Woodland site A2A to 25 species in the Sedimentary Ironbark Forest site (A5A).

During spring 2019 monitoring, all sites exhibited a higher number of native species than exotic species except R22, which was established during spring monitoring in 2019 (six (6) native species, six (6) exotic species). Native species at Box Gum Shrubby Woodland rehabilitation monitoring sites ranged from 15 species (R17) to 34 species (R4). Native species richness at Sedimentary Ironbark Forest rehabilitation monitoring sites ranged from six (6) species (R22) to 22 species (R10) in 2019. At analogue sites, native species richness ranged from 25 (A1B) to 27 (A1C) species in the Box-Gum Woodland analogue sites. The Sedimentary Ironbark analogue site recorded 25 species (A5B).

The trend in native species diversity at Box Gum Shrubby Woodland rehabilitation sites, shows a similar pattern in recent years to that at the equivalent analogue sites (**Figure 12**). At most sites, there was a decline in native species diversity from 2018 to 2019, likely in response to the very low winter and spring rainfall in the region. The same pattern was observed for Sedimentary Ironbark sites (**Figure 13**). This indicates that the vegetation at rehabilitation sites are responding in a similar way

to that at analogue sites which suggests that it may be developing resilience to environmental stress. If the rehabilitated vegetation responds to an improvement in rainfall patterns in a similar way to analogue sites this will be a clear demonstration of resilience which is a critical element for long-term sustainability.

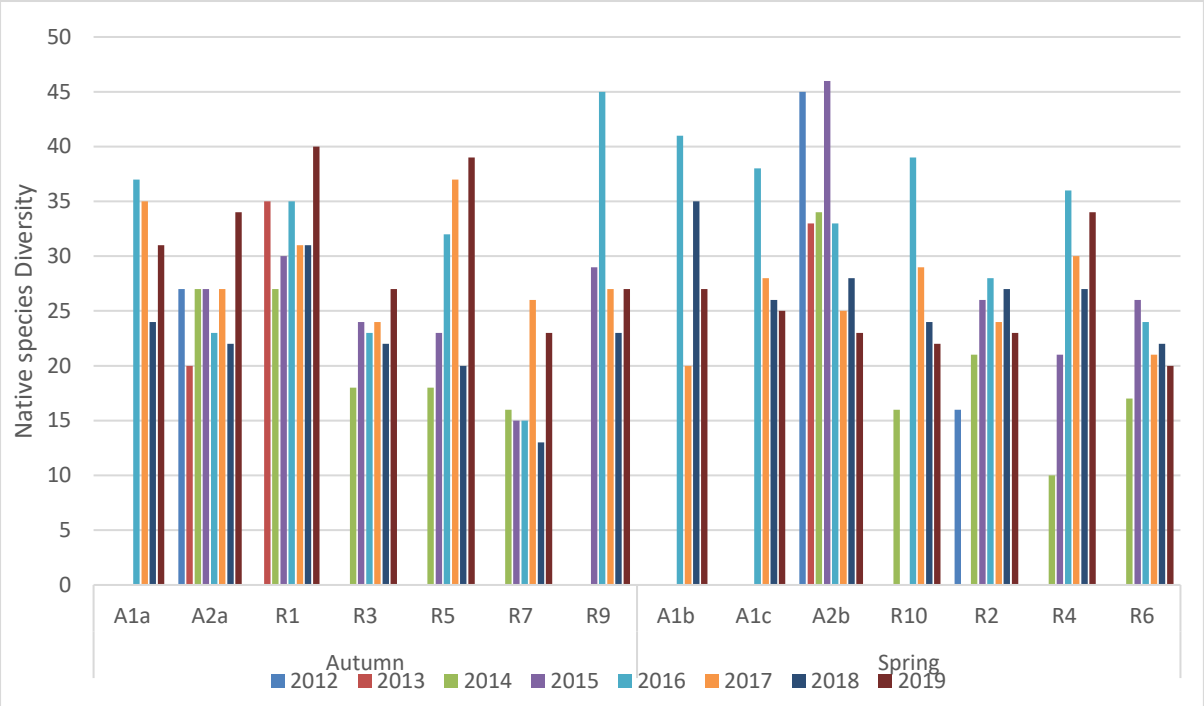


Figure 12: **Native species diversity 2012 – 2019 for Box Gum Shrubby Woodland open cut rehabilitation monitoring sites and Box Gum Grassy Woodland analogue sites.**

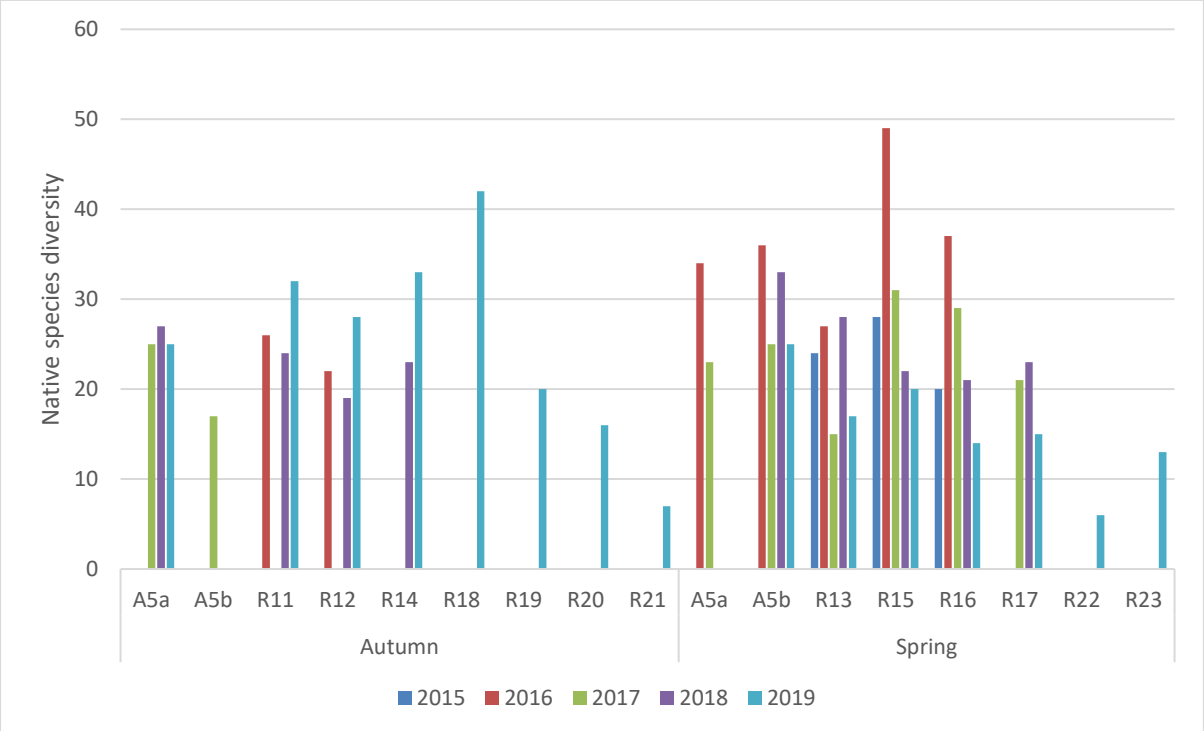


Figure 13: Native species diversity 2015 – 2019 for open cut rehabilitation and analogue Sedimentary Ironbark Forest sites

Vegetation Structure and Growth

At both the Box Gum Woodland and Sedimentary Ironbark Forest sites, the lowest height of the upper strata continues to be less than that seen at their respective analogue sites. This trend is consistent with the age of the rehabilitation. The minimum heights of the upper strata have generally shown an increase demonstrating that these species are continuing to establish within the rehabilitation area.

As with 2018 results, 2019 monitoring indicated that the upper and mid layers were dominated by Acacia species, including *Acacia linearifolia* (Narrow-leaved Wattle), *Acacia spectabilis* (Mudgee Wattle), *Acacia polybotrya* and *Acacia verniciflua* (Varnish Wattle).

Ground cover at rehabilitation Box Gum Shrubby Woodland sites ranged from 2% (R2) to 42% (R5) and Ground cover at rehabilitation Sedimentary Ironbark Forest sites ranged from 0% (R20 and R22) to 64% (R17). These results are consistent with the ongoing intense drought conditions experienced throughout both autumn and spring monitoring periods during 2019.

Fauna Monitoring

A total of 57 native and three (3) exotic fauna species were recorded during spring 2019, including two threatened species *Nyctophilus corbeni* (Corben's Long-eared Bat) and *Chalinolobus dwyeri* (Large-eared Pied Bat). A comparison of species richness over the last seven years of monitoring is shown in **Figure 14**.

Birds were again the most abundant class of fauna identified during spring 2019, a total of 49 bird species were recorded, with 40 native bird species, one (1) exotic bird species (Common Starling (*Sturnus vulgaris*)), and a further eight (8) species were recorded opportunistically. Fourteen (14) species were recorded for the first time during 2019 monitoring, whilst eleven (11) species recorded during 2018 were not recorded during 2019.

Site R7 had the highest bird species richness with 16 species recorded, followed by R12 and R13; with 11 species recorded at both. R7 has consistently recorded the highest species richness since 2017; which is likely a result of the variety of habitat present nearby; and the presence of stags and a nearby water source.

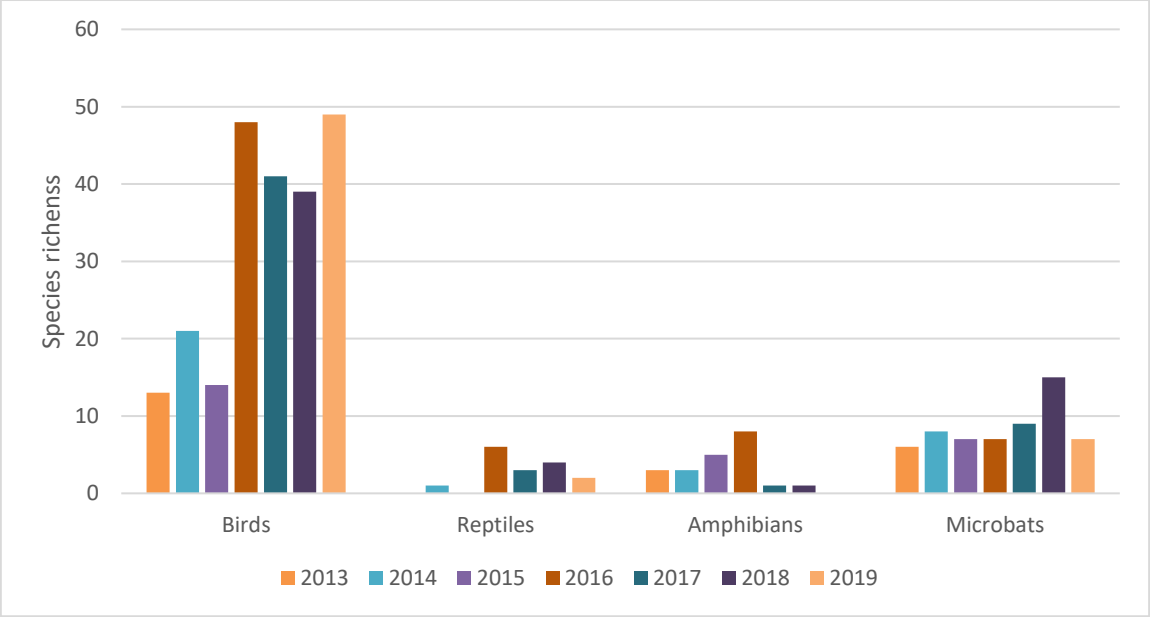


Figure 14: Comparison of target fauna species

Visual Monitoring

Results from 2019 were largely consistent with 2018 results for previously monitored transects across the OC1 rehabilitation. A decrease in ground cover has been evident since 2018 monitoring and this is likely attributed to ongoing drought conditions experienced throughout 2019.

Monitoring of the visual transects within the April 2017 rehabilitation campaign areas of OC1 and OC4 (Transect 11 and Transect 12- established during autumn 2019) demonstrated moderate overstorey components (1-2 canopy species recorded). As expected in rehabilitation of this age, only saplings (no mature eucalypts) were recorded at low densities. Similarly, a moderate score was recorded for mid-storey components with shrubs present throughout both transects. These results are consistent with the age of this rehabilitation. It is expected that these attributes will increase as the rehabilitation matures.

Assessment of Rehabilitation Performance Indicators

Analysis of the Box Gum Woodland and Sedimentary Ironbark Forest rehabilitation against the RMP Performance Indicators (and vegetation structure indicators) is presented in

Table 30 and

Table 31.

Table 30: Box Gum Shrubby Woodland rehabilitation assessment (Secondary Domain A)

Completion Criteria (by years 5-7)	**Objective:** Establish native vegetation comparable to Box Gum Shrubby Woodland communities including stands of Allocasuarina spp. Rehabilitation Monitoring Outcome
No evidence of significant noxious weed infestation	Two priority weed species as per table 5 of LLS (2017) present at less than 1% cover for this secondary domain. **Outcome:** Based on data from autumn and spring 2019, the area covered by all four rehabilitation campaigns within this secondary domain meet the completion criteria related to noxious weeds.
Pest animal populations are not causing significant damage to rehabilitation areas.	**Outcome**: Based on data from autumn and spring 2019, the area covered by all four rehabilitation campaigns within this secondary domain meet the completion criteria related to pest animal populations.
There are one to three overstorey species from the Box Gum Shrubby Woodland EEC present by Years 5 to 7.	All individual rehabilitation campaigns had a minimum of two (2) overstorey species and a maximum of seven (7) species from the Box Gum Shrubby Woodland community. **Outcome**: Based on data from autumn and spring 2019; the area covered by all four rehabilitation campaigns within this secondary domain meet the completion criteria related to Box Gum Woodland overstorey species richness.
Indicator species plant densities are trending towards plant densities of analogue sites at Years 5 to 7.	With the exception of sites R3 and R5 which exceed the criteria, average indicator species plant density in the Box Gum Shrubby Woodland are comparable to analogue sites with an average of 14.44 individuals across the rehabilitation area and an average of 14.73 individuals across analogue sites. **Outcome**: Based on data from autumn and spring 2019; the area covered by all four rehabilitation campaigns within this secondary domain meet the completion criteria related to indicator species plant density trends.

Completion Criteria (by years 5-7)	**Objective:** Establish native vegetation comparable to Box Gum Shrubby Woodland communities including stands of Allocasuarina spp.
	Rehabilitation Monitoring Outcome
A minimum of four native ground cover species that are present in analogue sites are present by Years 5 to 7.	Eight out of nine of the individual plots had a minimum of four (4) native ground cover species and six (6) ground cover species that are present in analogue sites (A1A, A1B, A1C, A2A and A2B) were recorded in this secondary domain during monitoring in 2019. **Outcome**: Based on data from plots monitored in 2019, the area covered by all four rehabilitation campaigns has a minimum of four native ground cover species that are present in the analogue sites. As such this Secondary Domain meets the completion criteria related to native ground cover species
Stands of Allocasuarina spp. are present in Box Gum Shrubby Woodland rehabilitation areas by Years 5 to 7.	Stands of Allocasuarina spp. were recorded within the OC1 rehabilitation in R1 (six (6) individuals) and R5 (13 individuals). An Allocasuarina spp. stand was also recorded in an area downslope (west) of R1. **Outcome**: Based on data from plots and visual transects in 2019 this secondary domain meets the completion criteria related to the presence of stands of Allocasuarina spp.

Table 31: Sedimentary Ironbark Forest rehabilitation assessment (Secondary Domain B)

Completion Criteria (by years 5-7)	**Objective**: Establish native vegetation comparable to Sedimentary Ironbark Forest communities including stands of Allocasuarina spp.
	Rehabilitation Monitoring Outcome
No evidence of significant noxious weed infestation	Two priority weed species as per table 5 of LLS (2017) present at less than 1% cover for this secondary domain. **Outcome:** Based on data from autumn and spring 2019, the area covered by all five rehabilitation campaigns within this secondary domain meet the completion criteria related to noxious weeds.
Pest animal populations are not causing significant damage to rehabilitation areas.	**Outcome**: Based on data from autumn and spring 2019, the area covered by all five rehabilitation campaigns within this secondary domain meet the completion criteria related to pest animal populations.
There are two to three overstorey species from the Sedimentary Ironbark Forest community present by Years 5 to 7	**Outcome**: A minimum of 2 indicator species were recorded at three (3) out of five (5) campaign areas during 2019 monitoring.
Indicator species plant densities are trending towards plant densities of analogue sites at Years 5 to 7.	Monitoring data indicates that all sites within the March 2012 and November 2012 rehabilitation campaigns are trending towards or have exceeded average indicator plant densities. This is the first year of monitoring for two sites within OC1 (R18 and R19; April 2017 rehabilitation campaign) so no trends can be determined for these sites. **Outcome**: The OC1 area of this secondary domain meets the completion criteria related to indicator species plant density trends for areas where this assessment could be verified.
A minimum of four native ground cover species that are present in analogue sites are present by Years 5 to 7.	During 2019 monitoring, four (4) plots contained a minimum of four (4) of the 32 native ground cover species present at analogue sites A5A and A5B. **Outcome**: Based on monitoring results in 2019, two (2) out of the five (5) rehabilitation campaigns within OC1 Secondary Domain B meet the completion criteria related to native Ground cover species richness. Therefore, this completion criteria has not been met on a landscape scale.

Stands of Allocasuarina spp. are present in Sedimentary Ironbark Forest rehabilitation areas by Years 5 to 7.	Stands of Allocasuarina spp. were recorded within the OC1 rehabilitation in R1 (six (6) individuals) and R5 (13 individuals). An Allocasuarina spp. stand was also recorded in an area downslope (west) of R1. **Outcome**: Based on data from plots and visual transects in 2019 this secondary domain meets the completion criteria related to the presence of stands of Allocasuarina spp.

9.5 REHABILITATION WORKS

Rehabilitation of disturbed lands are undertaken sequentially (or in phases) to achieve the final land use. A description of these phases of rehabilitation relevant to the Moolarben Coal Complex are provided in the MOP. A summary of rehabilitation phases completed during the reporting period included:

Decommissioning
There were no decommissioning activities undertaken at MCO.

Landform Establishment
38.5ha of landform establishment in OC1, OC2 and OC4 were present at the end of 2019. Final landforms were established to the relevant completion criteria including:

- Constructed landforms consist with surrounding topography;
- Slopes were generally less than 10^0 to 18^0;
- Constructed landforms were free draining; and
- No hostile overburden material in the final surface layers.

Growth Medium Development
13.6ha in OC2 were in the growth medium phase at the end of 2019. Growth medium was managed and applied to the relevant completion criteria including:

- Topsoil depths achieved a minimum of 100mm;
- Appropriate soil ameliorants have been applied in accordance with specification and recommendations from subsoil and topsoil material characterisation testing; and
- Topsoil areas ripped along the contour.

Ecosystem and Landuse Establishment
328ha of rehabilitation in the ecosystem and landuse establishment phase located in OC1, OC2 and OC4 were maintained and further enhanced during 2019.

9.6 ACTIONS DURING NEXT PERIOD

Rehabilitation actions to be progressed in the next period include:

- Continued progressive rehabilitation;
- Continued weed and feral animal control; and,
- Continued monitoring of rehabilitation areas with low cover or density with consideration of supplementary seeding.
- Development of revised OC2 rehabilitation performance and completion criteria for ecosystem and species credits.

10.0 COMMUNITY

10.1 COMMUNITY ENGAGEMENT

During 2019, MCO continued to foster positive relationships with the local community through engagement and ongoing financial support provided to a range of community groups and events – including, but not limited to – Mudgee High School, Watershed Landcare, Mudgee and Gulgong Chamber of Commerce, Mudgee Rotary, Mudgee Lions Club, Rylstone Street Feast, Survivor Life skills program, AusIMM Women in Mining and Sculptures in the Garden. MCO also supported the Cooks Gap Rural Fire Brigade, Clontarf Academy, Lifeskills Plus, and continued its sponsorship of the Moolarben Celebrity Golf Classic with all proceeds going to the local community. In total, MCO provided **$170,000** in community donations during 2019 to 38 community groups and events through its Community Support Program and other programs (**Appendix 5).**

Community/stakeholder related activities undertaken during the reporting period include:

- Mine tour/career talks with each of the local High Schools
- Mudgee District High Schools 'Try-A-Trade';
- Vocational student placement from Wollongong University;
- Work experience for 2 students in Mining Engineering and Maintenance;
- Max Potential Program at Club Mudgee
- Careers information evening for 2020 apprentices with Skillset;
- Spirit Awards ceremony for 2018 overall winner (held in March);
- Active participation in Wild Dog Groups and the LLS; and
- Direct engagement with nearby landholders.

Moolarben continued to provide the community with information on its website (www.moolarbencoal.com.au). Information available included project approvals, CCC meeting minutes, community complaint records, environmental monitoring information, environmental audits, environmental management plans and annual reviews.

10.2 COMMUNITY COMPLAINTS

MCO maintains a 24-hour Environment and Community Complaints Hotline (1800 556 484). This Hotline is available in order to receive any complaints from neighbouring residents or interested stakeholders. Details for the Hotline are available on the MCO website and in community newsletters.

MCO has developed a Community Complaints Procedure which details how to receive, respond to, record, and action any community complaint received to site. This procedure also outlines the reporting requirements relating to community complaints, including:

- Monthly reporting of community complaints on the MCO website;
- Discussion of community complaints as part of the operational performance provided during CCC meetings; and,
- A summary of complaints is provided in the Annual Review and Annual Return (as part of EPL reporting).

During 2019, a total of 38 complaints were received in relation to MCO Operations by 11 complainants. All complaints are investigated and included in the complaints register on the Moolarben Coal website (www.moolarbencoal.com.au). 50% of complaints were received by two complainants. Noise remained the primary issue of concern (84% of complaints), followed by Air (Dust) (8%) (**Figure 15**).

A comparison of complaints to previous years is presented in **Table 32**. There has been a decrease in noise complaints during the period and continues the trend since 2015. A register of complaints is provided in **Appendix 4**.

The ongoing use of Mining and Production Environmental Assistants continues to provide real-time feedback to the mining operation and to inform proactive and reactive responses. Ongoing community and stakeholder liaison and consultation has continued.

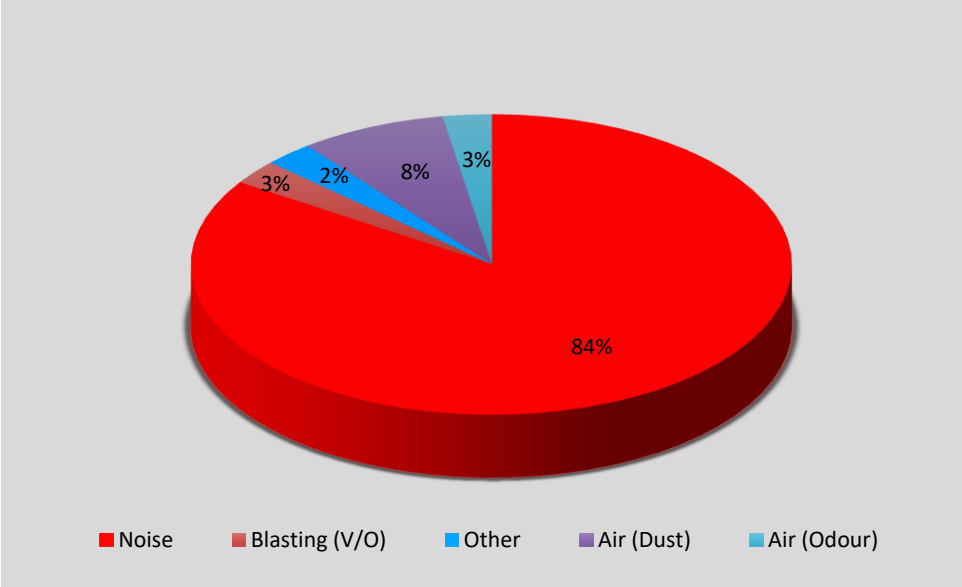


Figure 15 : Community Complaints 2019 – Breakdown by Type

Table 32: Comparison of Community Complaints

Reporting Period	Noise	Blast	Air	Water	Other	Total
2013 - 2014	239	12	2	0	3	**256**
2015	274	6	2	0	4	**286**
2016	157	7	2	0	1	**167**
2017	108	3	1	2	1	**115**
2018	54	10	0	0	1	**65**
2019	33	1	4	0	0	**38**

10.3 COMMUNITY CONSULTATIVE COMMITTEE (CCC)

In accordance with Condition 6, Schedule 5 of project approval (05_0117) and Condition 6, Schedule 6 of project approval (08_0135) the Community Consultative Committee (CCC) continued to meet during the 2019 reporting period. The purpose of a Community Consultative Committee is to provide a forum for open discussion between MCO, the community, the local council and other key stakeholders on issues directly relating to the project, including performance against any conditions, and to keep the community informed on these matters.

Members of the MCO CCC for 2019 are presented in **Table 33**. MCO conducted four CCC meetings during the reporting period with summaries provided in **Table 34.** Meetings were chaired by an independent chairperson with the minutes being available on the MCO website.

Table 33: CCC Members 2019

Name	Representing	Name	Representing
Aleshia Lonsdale	Mudgee Local Aboriginal Land Council	Helen Ungaro	Ulan Public School and Local Landholder.
Andrew Palmer	Mudgee Chamber of Commerce	David Stokes	Local resident
Julia Imrie	Local Landholder and Business Owner	John O'Neil	Councillor, Mid-Western Regional Council
Bev Smiles	Mudgee District Environment Group	Ms Lisa Andrews	DPIE endorsed Independent Chair.

Table 34: CCC Meeting Summary

Date	Meeting Summary
12 March	General update on community interaction, operations and exploration, environmental monitoring, community complaints, rehabilitation, biodiversity offset management, and employment. Update on the Open Cut Optimisation Modification.
4 June	General update on community interaction, operations and exploration, environmental monitoring, community complaints, rehabilitation, biodiversity offset management and employment. Update on the Open Cut Optimisation Modification. Presentation of 2018 Annual Review.
10 September	General update on community interaction, operations and exploration, environmental monitoring, community complaints, biodiversity offset management, and employment. Information on the UG4 Ancillary Works Modification.
26 November	General update on community interaction, operations, exploration, environmental monitoring, community complaints, rehabilitation, biodiversity offset management and employment update. Update on the UG4 Ancillary Works Modification

10.4 ULAN ROAD STRATEGY

The Mid Western Regional Council has continued maintenance works on Ulan Road. Moolarben continues to make financial contributions to the maintenance costs of the Ulan Road works detailed in the agreement.

18 properties along Ulan road have also been identified for noise attenuation works. Works required at each of the properties was determined generally in accordance with the RMS guidelines. The current status is:

- 13 properties with works completed;
- 2 properties with agreement in principle;
- 1 property where owners have declined mitigation works;
- 2 properties on review are outside the mitigation zone; and

11.0 INDEPENDENT AUDIT

In October 2018, an Independent Environmental Audit (IEA) was undertaken in accordance with Condition 9, Schedule 5 of PA 05_0117 (as modified) and Condition 9, Schedule 6 of PA 08_0135. The IEA was undertaken by pitt&sherry. In general, operational environmental management activities observed during the site inspection were being carried out in a competent manner, with the non-compliances identified by the Auditors being the exception. All recommendations associated with audit have been undertaken. The staged development of the Biodiversity Offset Management Plan and offset security continues to be progressed.

A copy of the IEA including the Audi findings can be found on MCO's Website (www.moolarbecoal.com.au)

The next Independent Audit will be required by December 2021.

12.0 INCIDENTS & NON-COMPLIANCES

There was one non-compliance during the reporting period:

- Non-continuous monitoring of TEOMs due to power supply interruption, equipment failures and routine maintenance. Minor Administrative

During the period there were two reportable incidents occurred. A blast event/incident on the 1st July 2019 resulted in a visible dust plume that moved in a general westerly direction from the blast centre and gradually dissipated due to a decrease in wind speed. The PIRMP was activated including notification of EPA and other agencies and provision of report. Dust levels recorded at the time of the Blast were well below the Air Quality criteria for Project Approval (05_0117) and Project Approval (08_0135). MCO has updated its predictive meteorological forecasting model to assist with air emissions and the incident has been considered in revisions to the Air Quality and Blast Management Plans.

Self heating and spontaneous combustion occurred in OC2 and an odour complaint received. The spontaneous combustion was managed in accordance with the Air Quality Management Plan and Mining Operations Plan. An investigation was undertaken and report provided to the EPA and other agencies. The Air Quality Management Plan was revised and submitted for approval with additional measures included for the management of odour relating to spontaneous combustion.

13.0 ACTIVITIES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

The following is a summary of measures to be implemented in the next reporting period.

- Review and revise environmental management plans as necessary.
- Review and revision of Biodiversity Management Plans.
- Continue to progress offset security instruments.
- Continue baseline monitoring of 203, 211, 213 and 214 to develop SWL, pH and electrical conductivity triggers.
- Continued progressive rehabilitation.
- Development of revised OC2 rehabilitation performance and completion criteria for ecosystem and species credits.
- Establish baseline monitoring sites for LW104 where not already in place.

LIST OF APPENDICES

LIST OF FIGURES

APPENDIX 1. LAND OWNERSHIP

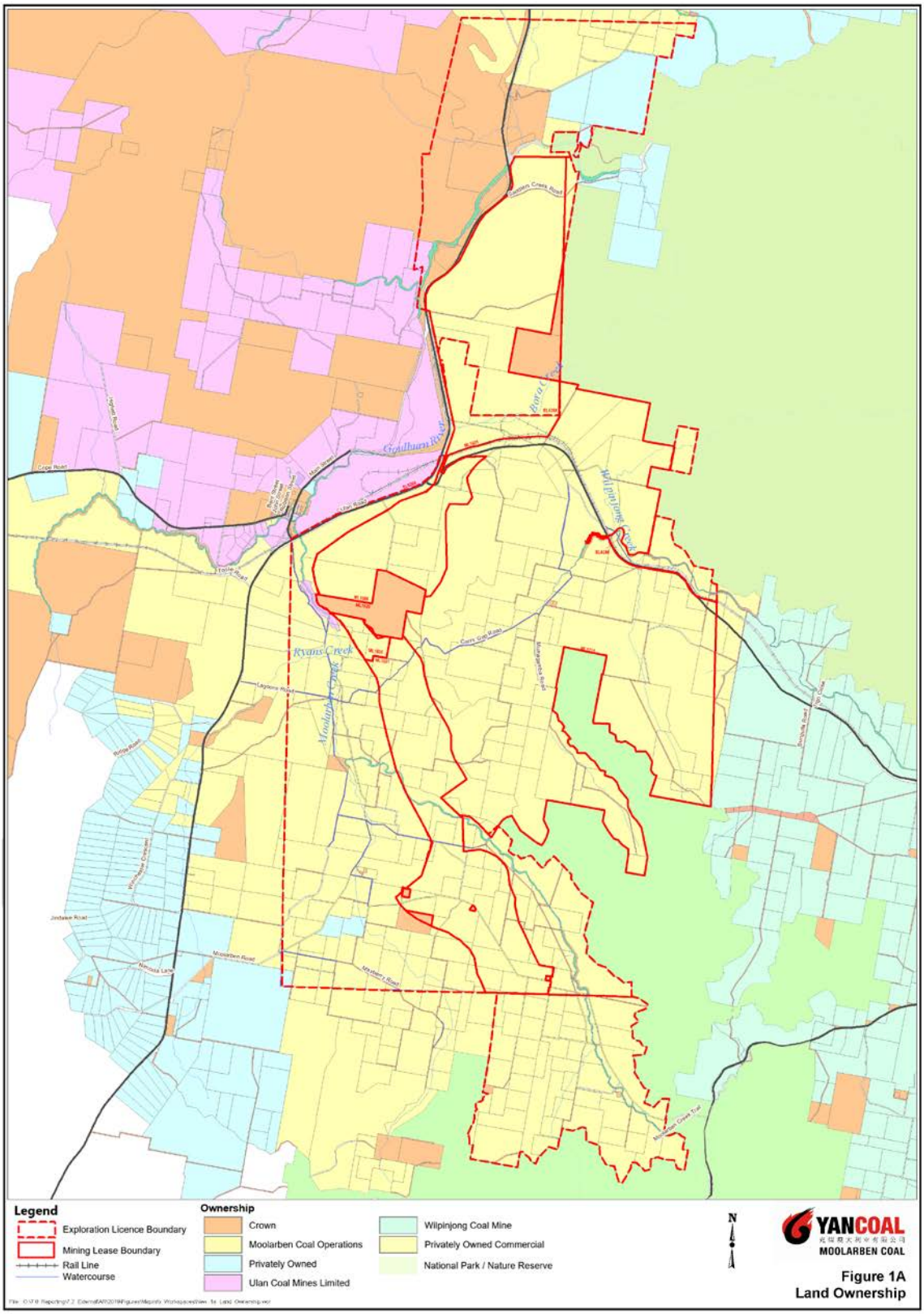


Figure 1-a Land Ownership

APPENDIX 2. MONITORING LOCATIONS

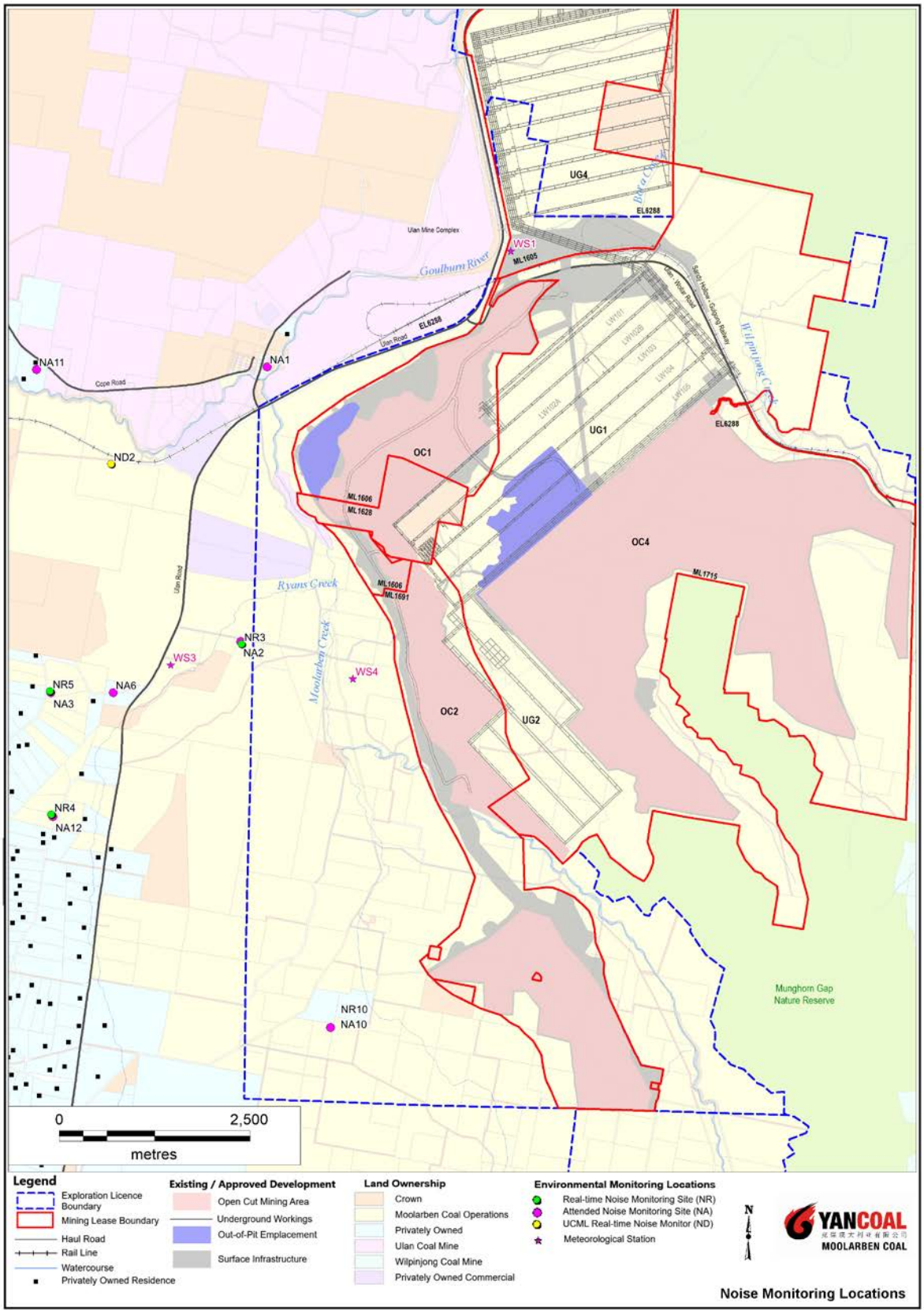


Figure 2-a Noise Monitoring Locations

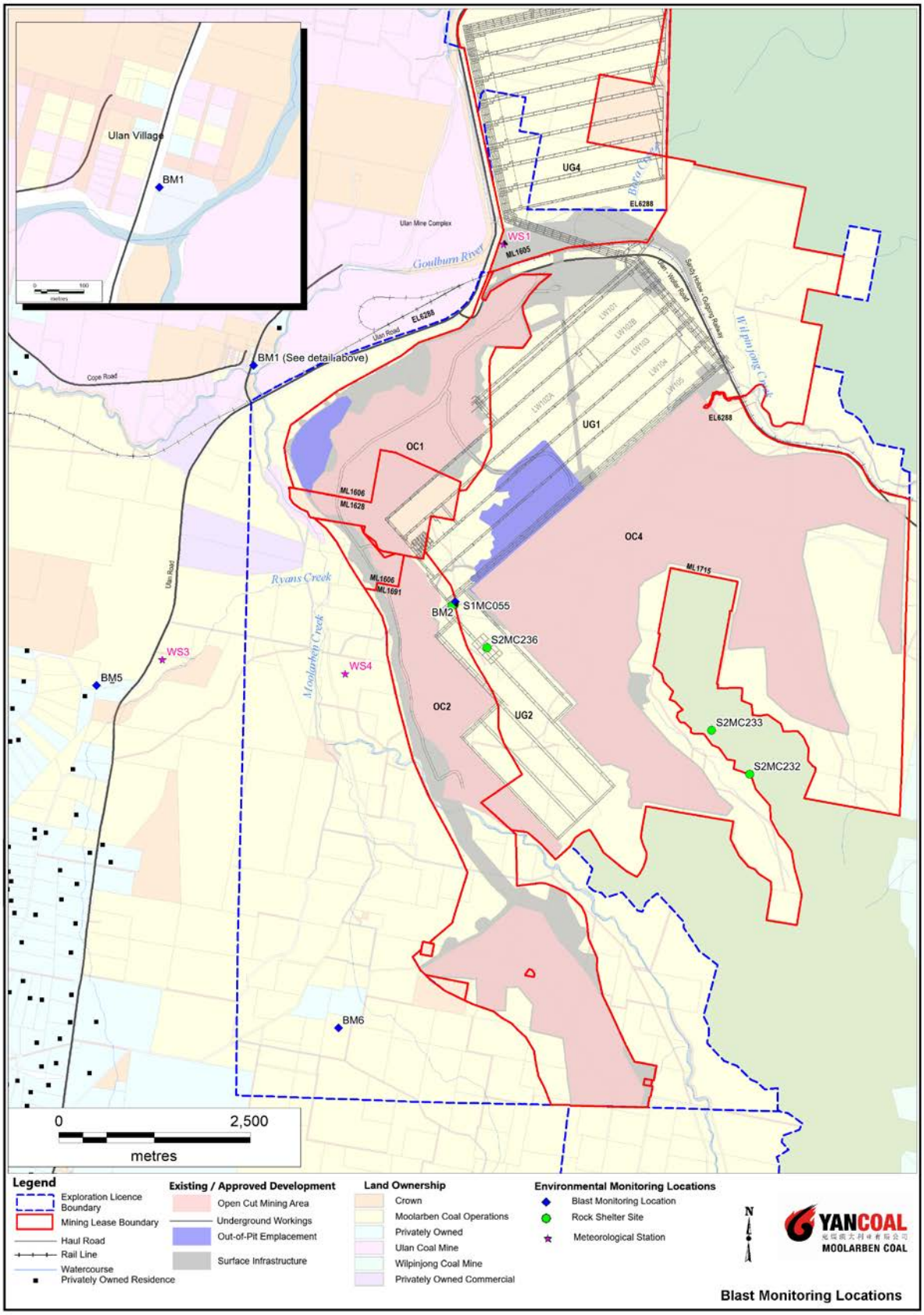


Figure 2-b Blast Monitoring Locations

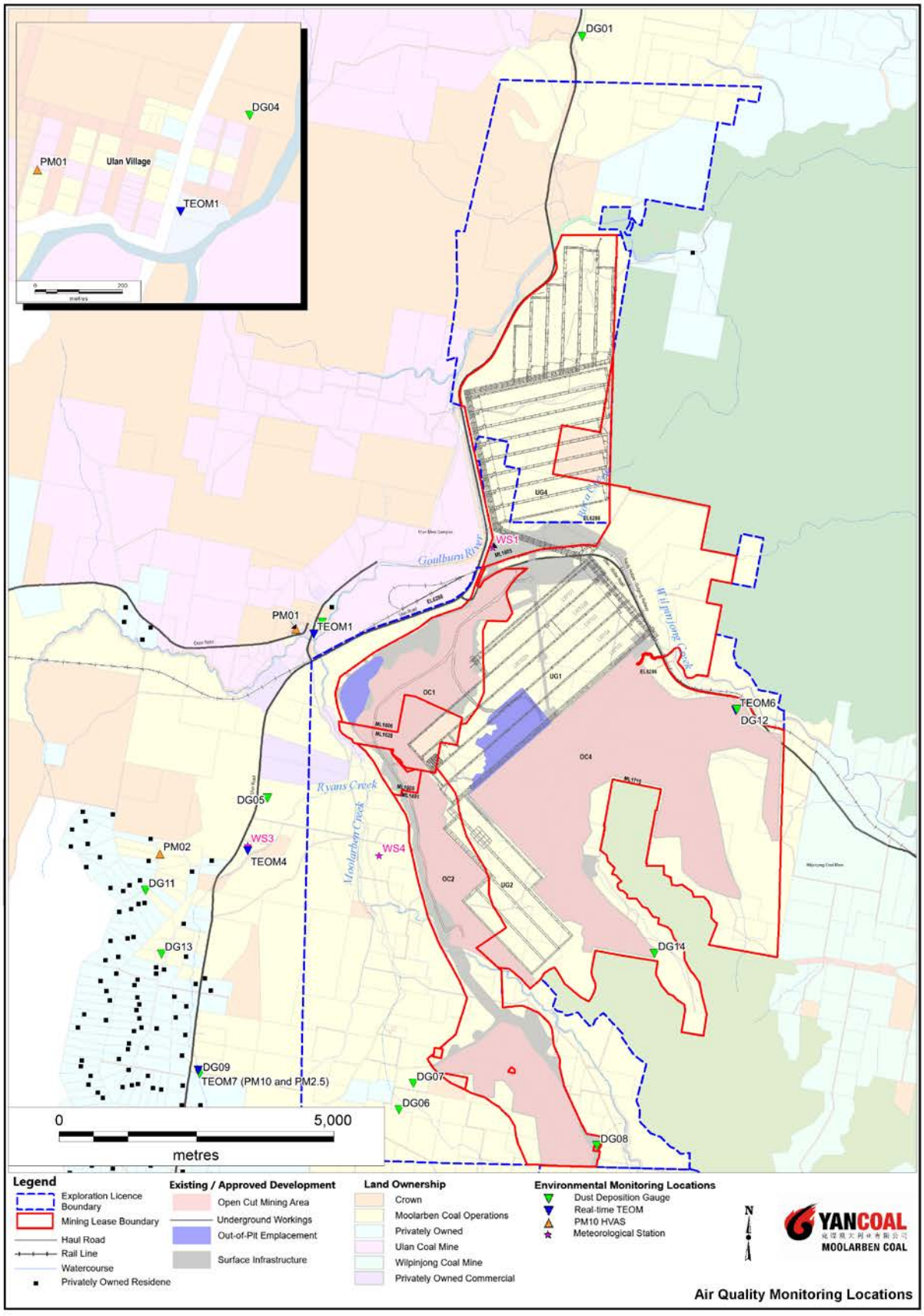


Figure 2-c Air quality Monitoring Locations

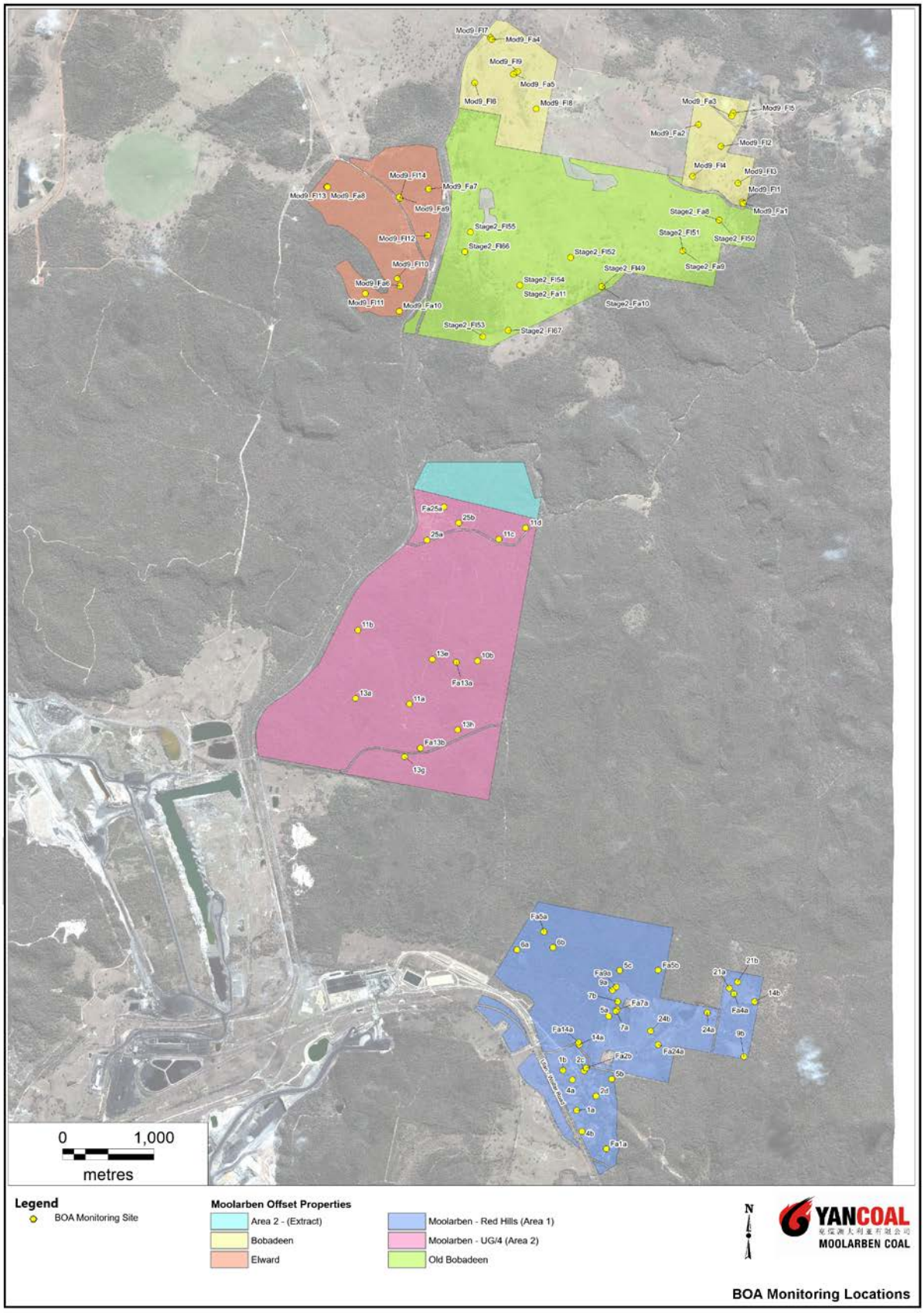


Figure 2-d MCO Northern Biodiversity Offset Area monitoring site locations

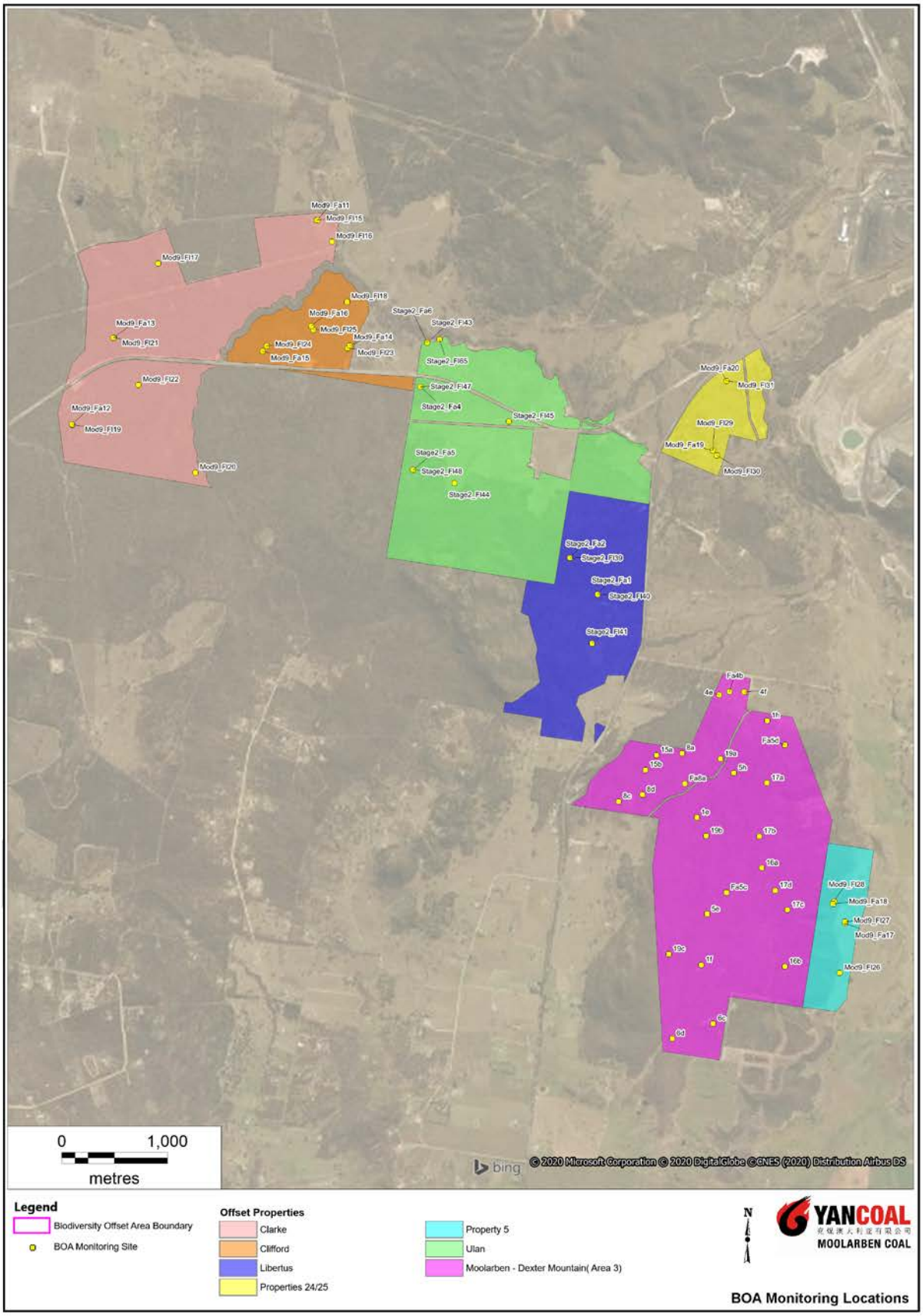


Figure 2-e MCO Western Biodiversity Offset Area monitoring site locations

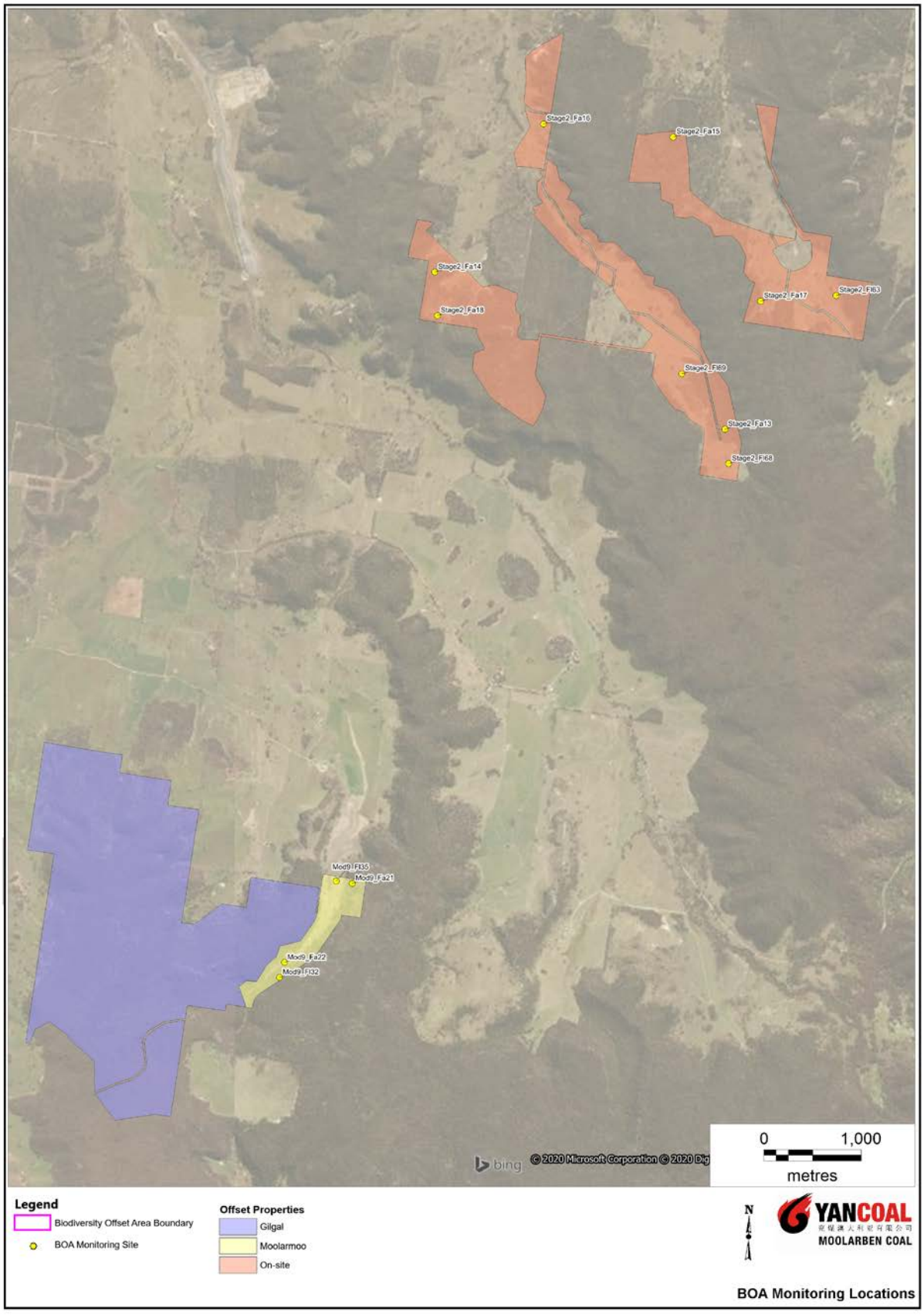


Figure 2-f MCO Southern Biodiversity Offset Area monitoring site locations

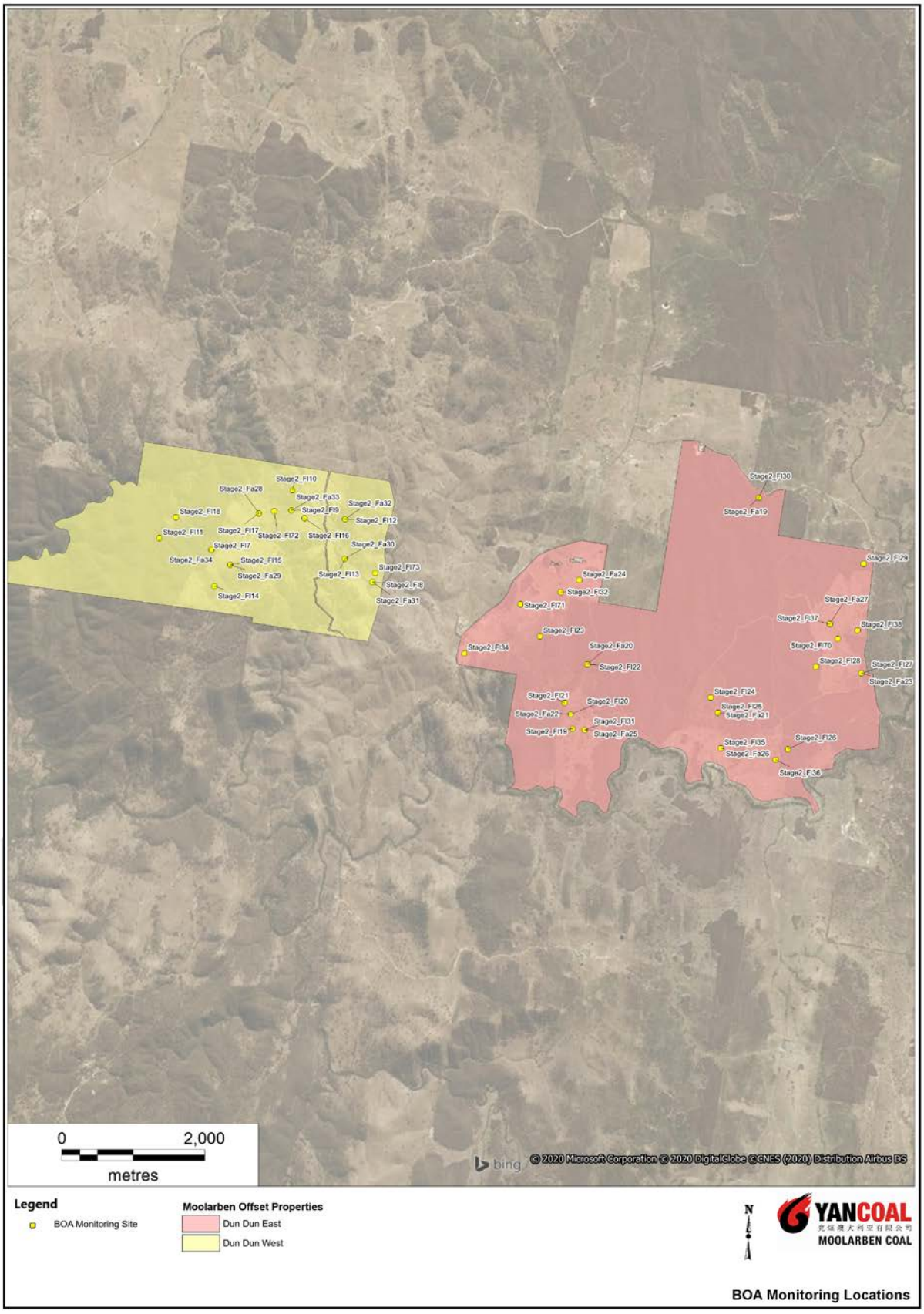


Figure 2-g MCO Remote Biodiversity Offset monitoring site locations

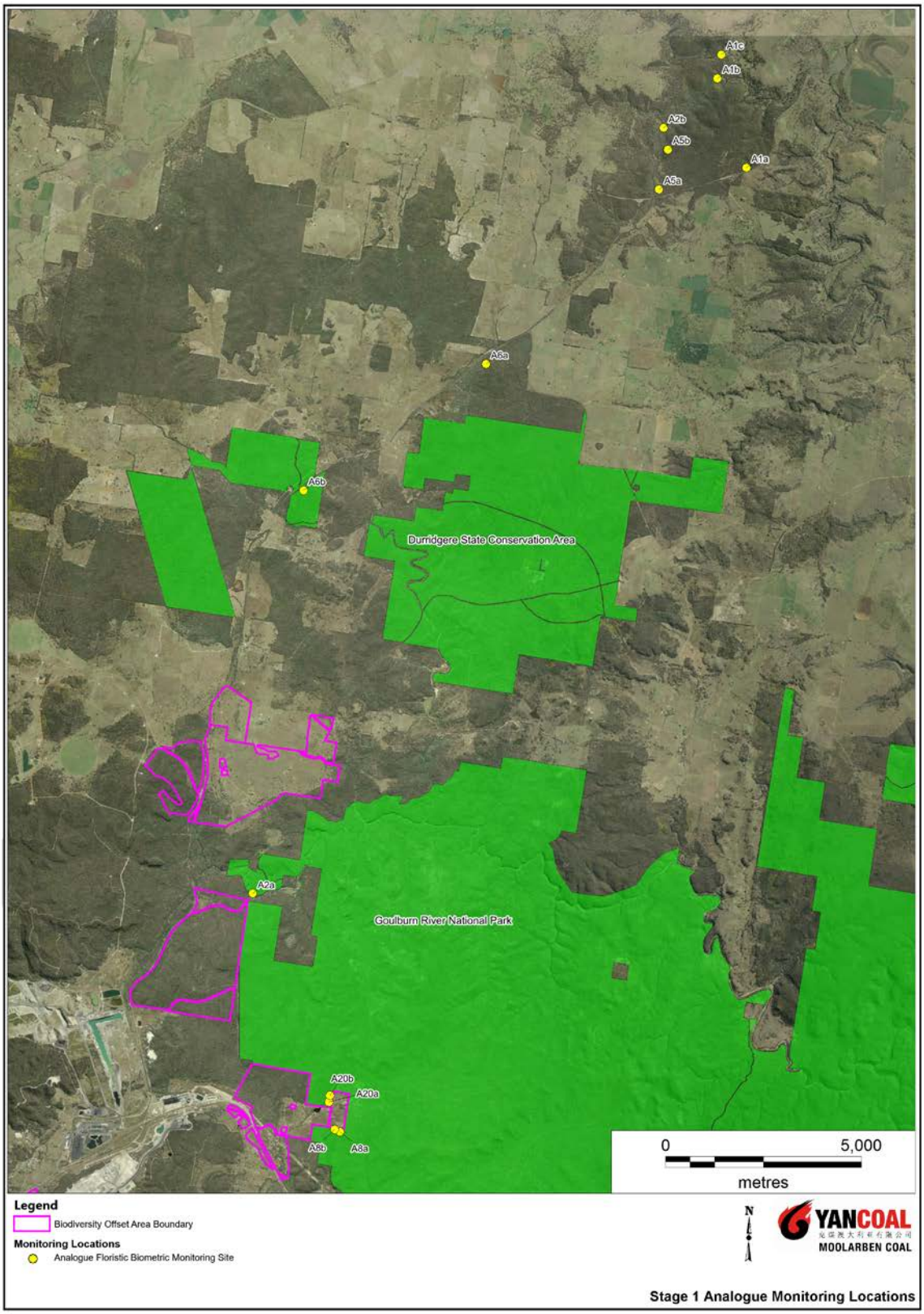


Figure 2-h MCO analogue monitoring site locations

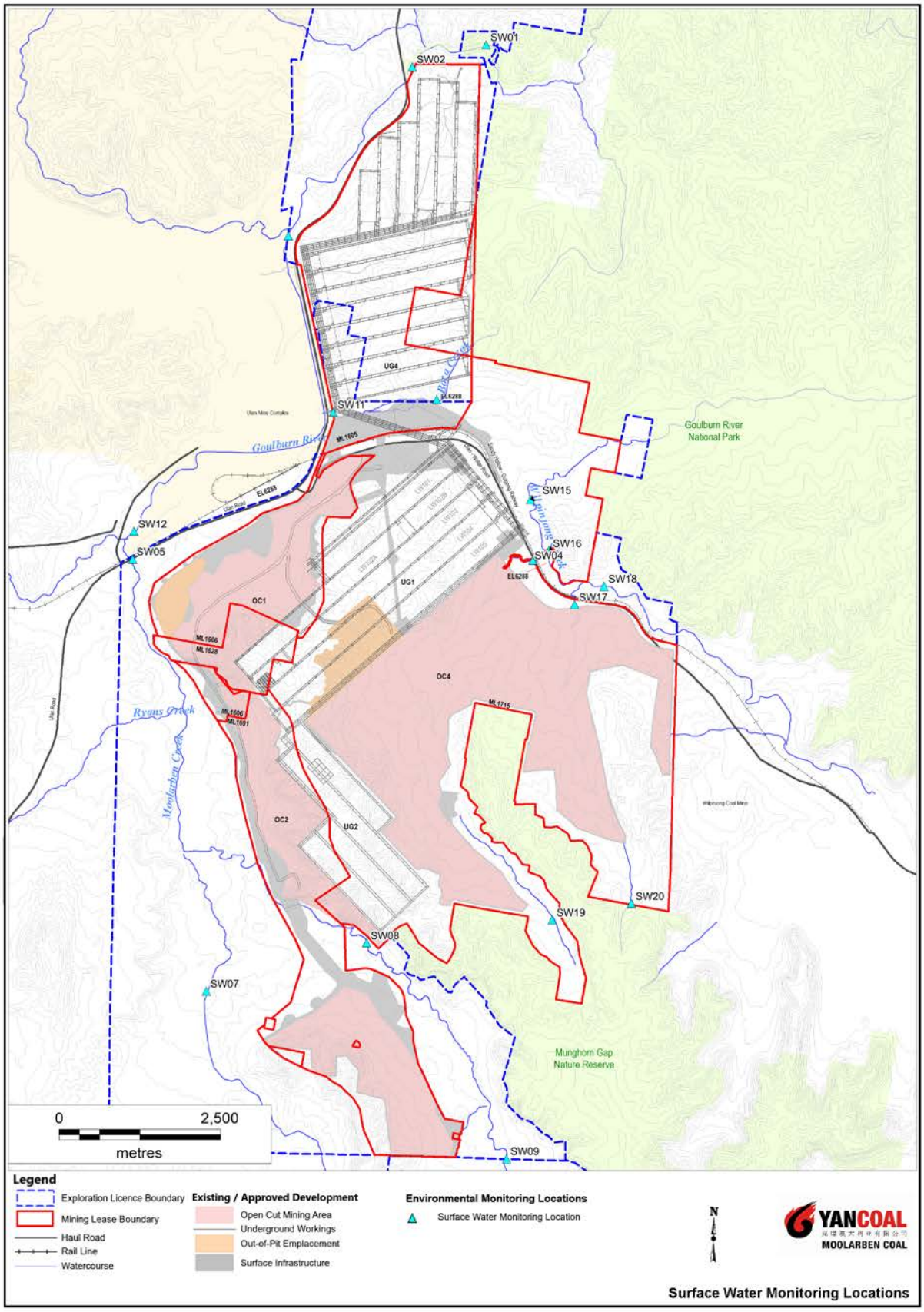


Figure 2-i Surface Water Monitoring Locations

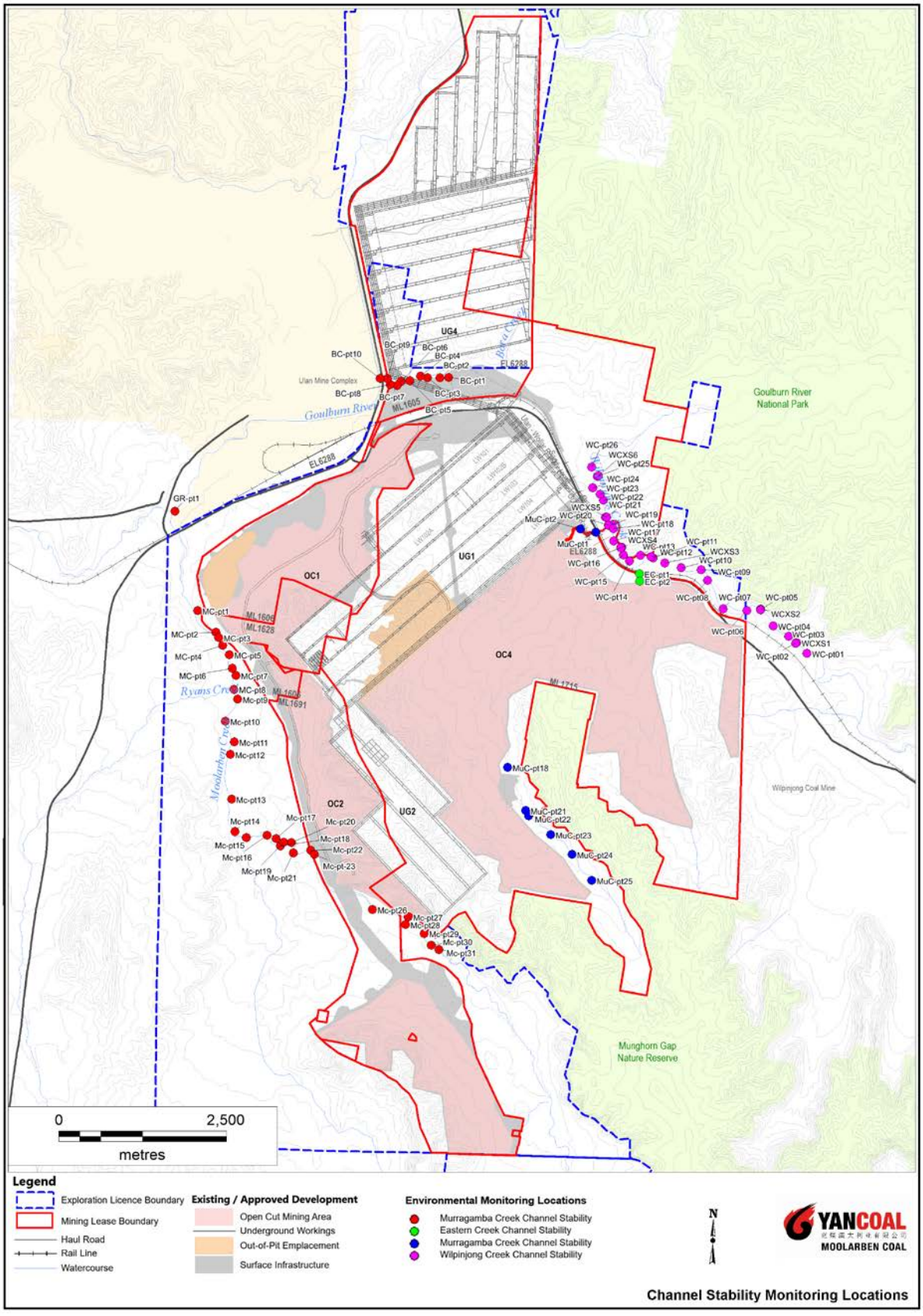


Figure 2-j Channel Stability Monitoring Locations

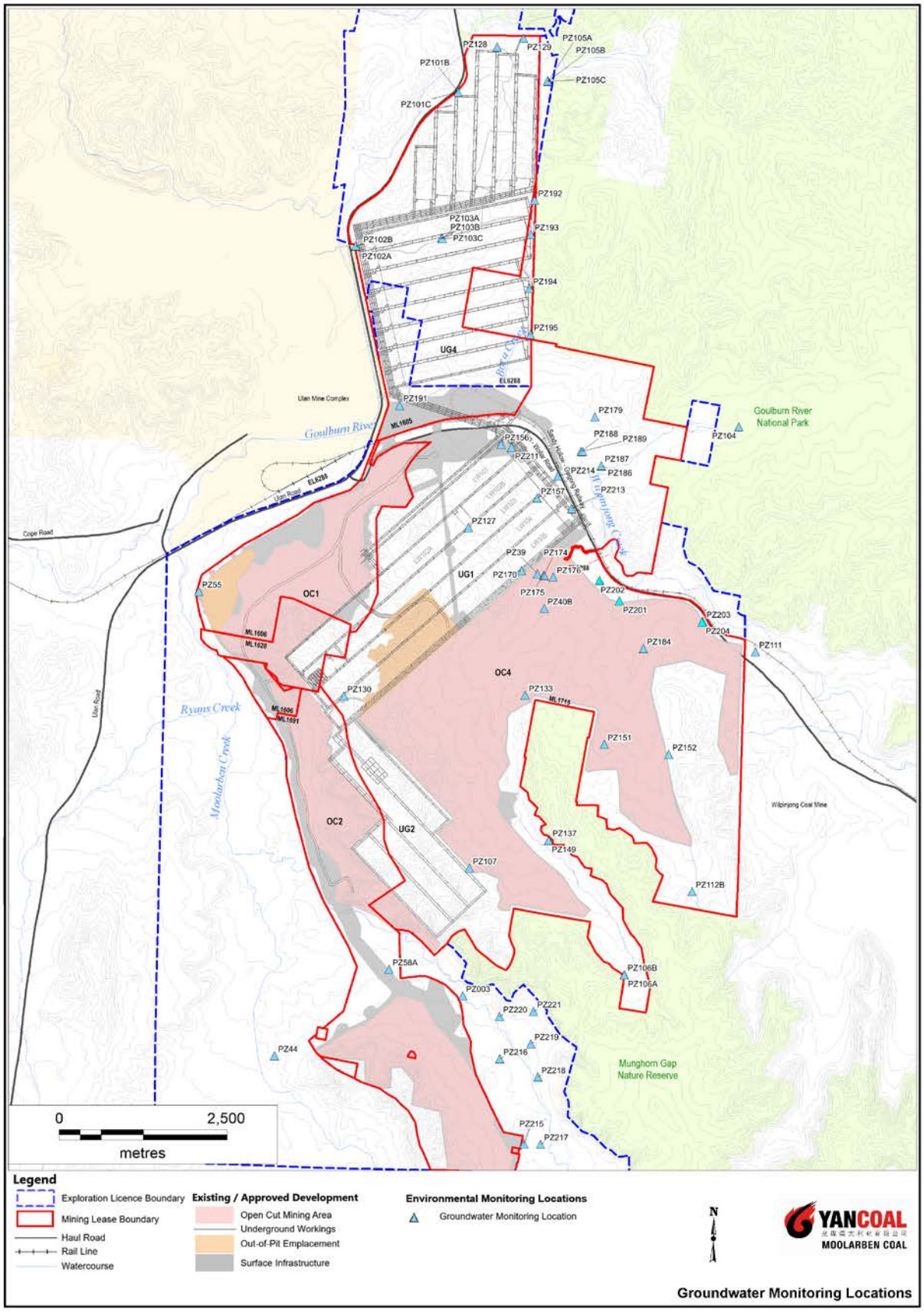


Figure 2-k Groundwater Monitoring Locations

Figure 2-l Rehabilitation Monitoring Locations

APPENDIX 3. MONITORING DATA

APPENDIX 3A. DAILY METEOROLOGICAL DATA (WS03)

Date	Temperature (2m) (ºC)		Temperature (10m) (ºC)		Relative Humidity (%)	Rain (mm)
	Min	Max	Min	Max	Average	
1/01/2019	18.3	36.5	19.4	35.2	44.1	0
2/01/2019	21.3	37.6	22.2	36.4	46.3	5
3/01/2019	16.6	35.8	17.4	34.6	53.5	0
4/01/2019	16.7	37.8	17.7	36.3	53.2	0
5/01/2019	19.3	37.5	19.4	35.6	54.9	0.4
6/01/2019	18.6	27.8	18.6	26.9	72.5	0
7/01/2019	18.8	29.3	18.6	28.6	70.6	0
8/01/2019	17.7	35.7	18.8	33.5	58.0	0
9/01/2019	19.1	34.7	19.3	33.4	59.8	2.2
10/01/2019	17.9	32.5	18.1	31.3	81.9	24.6
11/01/2019	18.3	32.5	18.2	31.1	79.4	13.2
12/01/2019	18.6	35.9	18.8	34.8	63.2	0
13/01/2019	19.9	32.4	19.9	32.1	59.5	0
14/01/2019	19.3	37.2	20.1	35.2	59.6	0
15/01/2019	19.4	39.8	20.6	38.9	45.0	0
16/01/2019	21.9	41.9	22.7	40.3	28.4	0
17/01/2019	20.4	41.3	22	39.8	45.9	0
18/01/2019	22.2	41.2	23	39.5	36.3	0
19/01/2019	21	37.7	20.9	36.8	49.8	0
20/01/2019	19.9	33.2	19.8	32.3	72.2	6
21/01/2019	17.7	26.3	18.1	26	87.6	6.2
22/01/2019	19.3	37.5	19.1	37.9	61.3	8.4
23/01/2019	19.3	34.8	19.3	33.6	77.6	6.8
24/01/2019	20.2	29.7	19.9	29.5	73.8	0
25/01/2019	19.7	37.7	20.4	36.4	73.8	0
26/01/2019	21.9	40.7	22.3	38.7	50.0	0
27/01/2019	21.7	39.4	21.7	37.9	51.0	0
28/01/2019	18.9	36.2	18.1	35.4	71.0	40.6
29/01/2019	21.9	35.3	20.9	34.5	61.2	0
30/01/2019	20.6	31.2	21.4	30.1	62.1	0
31/01/2019	21.1	34.2	22.2	32.5	52.6	0
1/02/2019	18.9	24.9	18.9	24.2	71.4	0
2/02/2019	18.8	29.4	19	29.1	72.6	0
3/02/2019	16.9	33.2	18	32.8	58.9	0
4/02/2019	16.9	35.8	18.3	34.7	49.2	0.4
5/02/2019	19.4	33.1	19.6	32.4	55.4	0
6/02/2019	17.3	31.4	18	30.6	56.1	0
7/02/2019	19.1	32.7	19	31.5	58.4	0.2
8/02/2019	17	32.9	16.9	31.6	65.3	3.6
9/02/2019	8.8	28.3	9.6	27.2	62.0	0.2
10/02/2019	9.7	29	9.7	27.9	45.7	0
11/02/2019	9.5	32	10.7	30.4	41.6	0
12/02/2019	10.6	33.7	11.4	32.5	30.8	0
13/02/2019	15.6	26.9	16.2	25.7	37.8	0
14/02/2019	12	27.4	13.9	26.5	57.9	0
15/02/2019	14	29.2	13.9	28.2	50.9	0
16/02/2019	12.1	31	13.6	30.1	53.4	0
17/02/2019	12.9	34.2	13.8	33.1	46.6	0
18/02/2019	13.9	37	15.2	35.5	34.7	0
19/02/2019	20.5	38.3	20.6	36.5	46.1	0
20/02/2019	17.2	33.8	18.6	32.4	61.2	0
21/02/2019	18	26.5	18	25.7	66.1	0
22/02/2019	13.8	24.9	14.7	24.3	59.7	0
23/02/2019	16.6	25.2	16.7	24.5	58.3	0

Date	Temperature (2m) (ºC)		Temperature (10m) (ºC)		Relative Humidity (%)	Rain (mm)
	Min	Max	Min	Max	Average	
24/02/2019	15	24.1	15.2	23.2	57.2	0
25/02/2019	9.7	25.6	10.7	24.9	60.4	0
26/02/2019	9.8	30.1	10.8	29.2	50.3	0
27/02/2019	11.2	28.3	12.1	27.5	51.3	0
28/02/2019	17.4	28	17.5	27.2	46.1	0
1/03/2019	16.1	28.7	17	28.2	46.7	0
2/03/2019	14.2	29.2	15.4	28.1	55.9	0
3/03/2019	13	32.2	14.2	30.6	57.3	0
4/03/2019	13.6	34.4	14.4	33.2	52.9	0
5/03/2019	14.6	34.6	15.5	33.1	46.7	0
6/03/2019	17.1	33.9	17.7	32.3	45.0	0
7/03/2019	15	22.4	15.2	21.4	60.5	0
8/03/2019	13.5	34.8	14	33	57.1	0
9/03/2019	17.7	32.6	18.6	31.2	66.9	1.2
10/03/2019	19.3	33.5	19.2	32.6	53.1	0
11/03/2019	16.1	33.2	17.7	31.8	37.7	0
12/03/2019	15.4	31.6	16.3	30.6	45.9	0.4
13/03/2019	12.8	28.6	14.4	27.8	59.7	0
14/03/2019	19	32.4	18.9	31	49.6	0
15/03/2019	10	27.6	12	26.6	47.5	0
16/03/2019	13.6	25.6	14.8	24.5	68.3	0
17/03/2019	15.2	23.3	15.3	22	86.6	39.8
18/03/2019	14.6	24.3	15	23.6	81.7	0.8
19/03/2019	12.3	26.6	12.7	25.9	74.5	0.2
20/03/2019	14.7	28.3	15.4	27.1	74.5	0
21/03/2019	17	29.4	17	28.4	70.5	0
22/03/2019	14.4	29.3	14.5	28.6	81.0	13
23/03/2019	12	34	11.8	32.9	79.2	4.8
24/03/2019	16.7	30.9	17.2	30	73.6	0
25/03/2019	17.4	21.9	17.4	22	89.6	20.4
26/03/2019	9.2	21.7	10.2	20.9	69.9	3.6
27/03/2019	8.2	23.4	9.4	23.1	65.8	0
28/03/2019	12.5	25.7	13.4	24.5	66.0	0
29/03/2019	12.7	26.2	13.5	24.9	70.5	1.6
30/03/2019	9	18.8	9.2	17.9	76.6	44.6
31/03/2019	4.9	17.1	5.7	16.5	64.1	0
1/04/2019	4.5	21	4.9	20.9	67.1	0
2/04/2019	9.5	20.7	10.2	20.5	78.5	0
3/04/2019	9.3	25	9.9	24.9	72.6	0
4/04/2019	9.8	24.2	10.8	23.9	70.8	0
5/04/2019	10.6	23	11.7	22.2	75.4	0
6/04/2019	11.2	27.3	11.9	26.6	67.6	0
7/04/2019	10.8	29.6	11.6	29.1	60.5	0
8/04/2019	10.6	29.9	12.1	29.2	57.7	0
9/04/2019	5.5	26.8	6.6	25.7	51.0	0
10/04/2019	5.2	19.4	6.2	19	65.1	0
11/04/2019	7.3	21.2	8.5	20.7	76.0	0
12/04/2019	8	23	8.8	21.8	79.8	0
13/04/2019	8.9	24.5	9.7	24.2	72.0	0
14/04/2019	9.7	21.6	10.2	20.9	70.9	0
15/04/2019	7.3	23.2	8.2	21.8	76.0	0
16/04/2019	8	22.5	8.8	22.4	74.9	0
17/04/2019	7.5	22.5	8.3	22.2	77.8	0.2
18/04/2019	7.6	25.5	8.3	24.9	72.6	0
19/04/2019	10.5	23.4	11.6	23.2	79.2	0
20/04/2019	12	24.2	13	23.9	79.8	0.2
21/04/2019	11.8	25	12.6	24.7	78.1	0
22/04/2019	10.6	26.8	12.4	25.2	77.5	0
23/04/2019	10.9	23.9	11.9	23.7	75.6	0

Date	Temperature (2m) (ºC)		Temperature (10m) (ºC)		Relative Humidity (%)	Rain (mm)
	Min	Max	Min	Max	Average	
24/04/2019	10.3	24.4	11.4	24.2	73.8	0
25/04/2019	10.6	26.9	11.2	25.9	68.9	0
26/04/2019	3.9	24.3	5.4	23.5	60.1	0
27/04/2019	0.5	20.8	1.5	19.9	63.6	0
28/04/2019	1.5	21.5	2.8	20.9	53.8	0
29/04/2019	2.6	21.2	3.6	21.1	75.9	0
30/04/2019	9.2	20.5	10.1	20.2	79.4	0.2
1/05/2019	13.7	21.6	14	21	74.2	0
2/05/2019	13.3	23.5	14.7	22.4	79.7	0
3/05/2019	13.5	20.7	14.1	20	90.5	12.8
4/05/2019	7.3	18.2	9.1	17.7	76.0	0.8
5/05/2019	4.4	18	5.2	17.7	73.2	0.2
6/05/2019	3.8	18.7	4.6	18.1	74.1	0
7/05/2019	1.3	19.2	2.4	18.5	72.9	0
8/05/2019	2.8	16.1	3.7	15.5	71.8	0.2
9/05/2019	-0.1	19.2	0.6	18.1	72.6	0
10/05/2019	2.8	12.8	3.7	12.1	83.9	3
11/05/2019	3.3	12.9	4.3	12.5	78.8	0.4
12/05/2019	-0.9	19.1	-0.3	18.3	78.2	0.2
13/05/2019	2.2	20.3	3.1	19.7	81.4	0
14/05/2019	4.7	20.6	5.6	20.3	75.1	0.2
15/05/2019	2.3	19.9	3	19.8	77.7	0
16/05/2019	4.5	20.9	5.3	20.1	83.1	0.2
17/05/2019	7.5	21.9	8.5	21.5	77.8	0
18/05/2019	4.9	21.2	5.7	20.6	80.0	0
19/05/2019	4.4	20	5.2	19.9	82.2	0.2
20/05/2019	5	21	5.9	20.9	77.5	0
21/05/2019	5.4	22.3	6.4	21.8	76.1	0
22/05/2019	5.1	23.6	6.1	23	73.7	0
23/05/2019	5.8	22.3	7.2	21.7	75.9	0
24/05/2019	3.7	21.4	4.6	20.8	74.7	0
25/05/2019	1.7	22.1	2.7	21.6	71.7	0.2
26/05/2019	4	18.6	6.1	18.1	75.4	0.6
27/05/2019	0.3	13.9	1.8	13.4	82.7	1.2
28/05/2019	-0.8	11.8	0.8	11.5	72.5	0
29/05/2019	5.9	12.6	6	12.3	69.2	1.4
30/05/2019	0.9	10.4	2	10.2	72.9	0
31/05/2019	-0.4	14.3	1.3	13.9	78.0	0
1/06/2019	-1.9	16.6	-0.7	16.5	74.6	0
2/06/2019	3.1	13	4.6	12.5	95.4	3.8
3/06/2019	4.4	9.8	4.2	9.4	88.9	4.8
4/06/2019	3.8	13	3.8	12.5	70.4	0.8
5/06/2019	0.6	14.4	1.6	14.2	77.8	0
6/06/2019	-1.7	16.5	-0.5	16.2	74.2	0
7/06/2019	-0.4	15.1	0.3	15	82.1	0
8/06/2019	6.3	14.3	7.5	14	90.8	0
9/06/2019	2.6	18	3.2	17.3	84.9	0
10/06/2019	3.1	19.3	3.6	19	83.0	0.2
11/06/2019	5.3	21	6.6	20.7	82.5	0
12/06/2019	3.2	20.9	4	20.4	77.5	0.2
13/06/2019	6.5	19.4	8.2	18.6	80.4	0.6
14/06/2019	0.9	16.8	1.3	16	86.1	0.2
15/06/2019	-2	15.4	-1.2	15.2	77.8	0.2
16/06/2019	-1.8	11.9	-1.2	11.7	87.8	0
17/06/2019	0.6	14.6	1.3	14.3	80.7	0
18/06/2019	1.4	14.6	4	13.9	79.0	0
19/06/2019	-2.2	13.6	-1.4	13.5	72.0	0
20/06/2019	-4.3	14.5	-3.5	13.6	73.6	0
21/06/2019	-4.9	11.8	-4.5	11.7	70.1	0

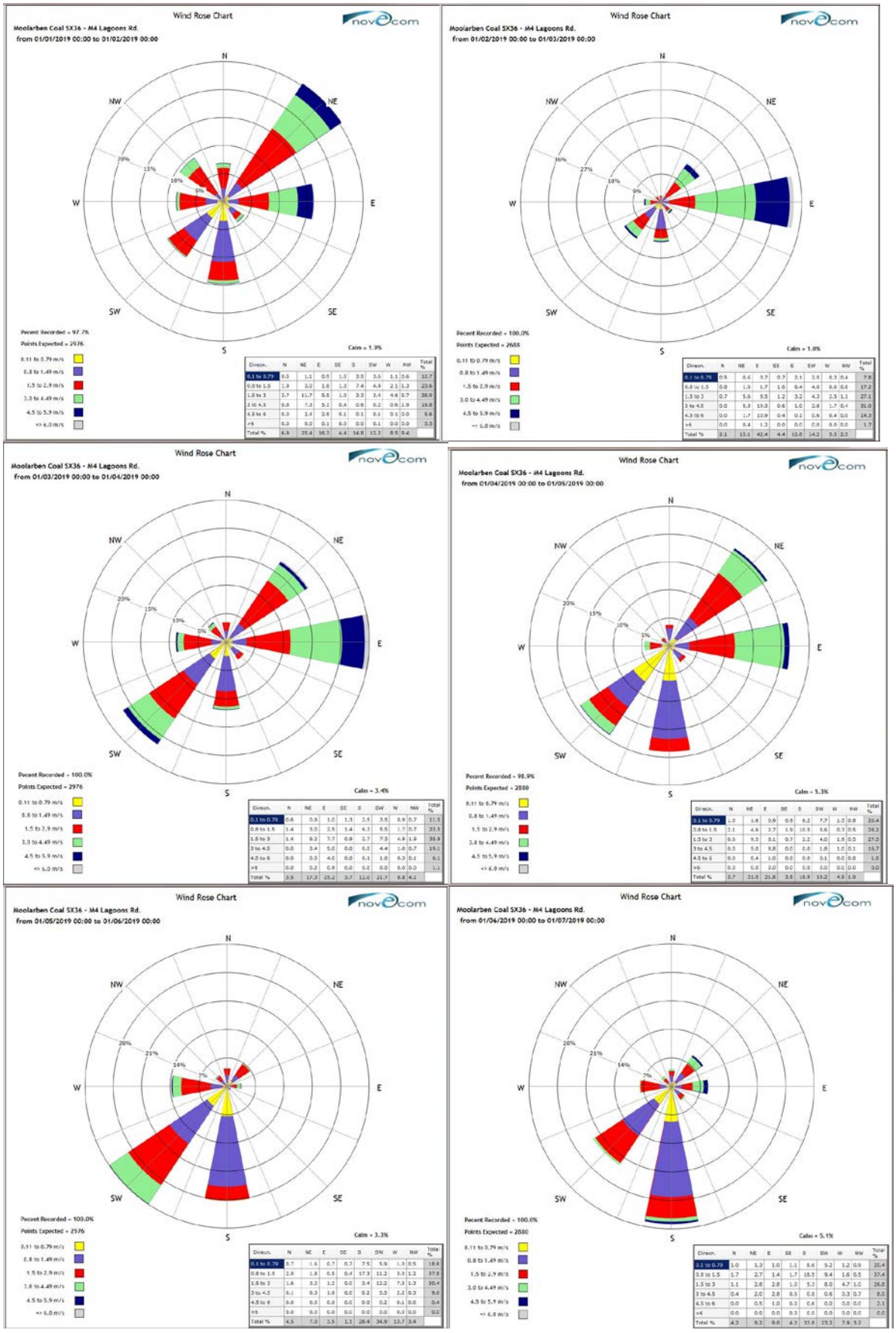
Date	Temperature (2m) (ºC)		Temperature (10m) (ºC)		Relative Humidity (%)	Rain
	Min	Max	Min	Max	Average	(mm)
22/06/2019	-5.2	13.8	-4.5	13.3	75.7	0
23/06/2019	-2.9	13.5	-2.1	13.2	75.5	0.2
24/06/2019	1.5	14.3	3	14.1	77.7	0
25/06/2019	6.4	14.8	7.3	14.8	82.0	0
26/06/2019	2.2	16.3	4.1	15.9	77.0	0
27/06/2019	5.6	16.5	8	16.3	80.3	0
28/06/2019	3	17.6	4.3	17.7	86.3	0
29/06/2019	2.8	19.5	3.8	18.6	72.7	0.2
30/06/2019	0.5	13.8	1.6	14.1	74.5	1
1/07/2019	-2.3	16.6	-1.7	16.9	58.2	0
2/07/2019	-0.7	18.6	-0.1	18.1	70.6	0
3/07/2019	-2.8	17.5	-1.9	17.4	73.2	0
4/07/2019	9.3	17.3	10	17	75.9	0.2
5/07/2019	10	17	10.2	16.9	71.4	0
6/07/2019	5.4	15.1	7.2	14.8	82.3	0
7/07/2019	4.9	17.1	6.9	16.7	81.5	0
8/07/2019	6.6	13.6	8.3	13.3	94.9	1.8
9/07/2019	-0.8	14.2	0.4	13.7	83.8	0.2
10/07/2019	-3.4	13	-2.8	12.1	79.6	0
11/07/2019	1.2	14.9	3.4	14.4	65.5	0
12/07/2019	-0.1	15.7	1.4	15.4	67.8	0
13/07/2019	5.8	11.1	6	11.2	57.9	0.2
14/07/2019	-1	10.5	0.5	10	66.9	0
15/07/2019	5.7	11.8	5.9	11.2	69.2	1
16/07/2019	0.2	14.7	2.3	14.2	69.1	0
17/07/2019	1.8	13.9	2.9	13.3	71.5	0
18/07/2019	-0.4	14.2	3.9	13.9	66.8	0
19/07/2019	-1.7	16.5	0.5	16.4	74.5	0
20/07/2019	-3.3	19.2	-2.4	18.8	67.2	0
21/07/2019	-1.6	20.8	-0.2	20.1	58.1	0
22/07/2019	2.9	21.5	4.6	20.5	56.0	0
23/07/2019	-0.9	18.4	0.6	17.9	50.8	0
24/07/2019	4.8	16.3	6.2	15.7	50.3	0
25/07/2019	-2.4	17.2	-1.7	17	67.1	0
26/07/2019	0	18.1	0.9	17.1	64.5	0
27/07/2019	0.3	17.8	1.4	17.2	62.1	0
28/07/2019	0.6	17.6	1.5	17.3	64.6	0
29/07/2019	-1.9	18.5	-1.1	17.8	70.1	0.2
30/07/2019	4.8	15.2	6.5	14.9	82.9	0
31/07/2019	2.3	14.7	4.7	14.3	81.2	0.2
1/08/2019	1.5	17.7	2.7	17	64.9	0
2/08/2019	-0.9	17.5	0.1	17	74.9	0
3/08/2019	-1.6	18.7	-0.8	18.2	62.2	0
4/08/2019	-4.5	18.6	-3.6	18.1	56.8	0
5/08/2019	-1.8	20	-0.8	19.2	56.6	0
6/08/2019	-4.5	19.1	-3.7	18.1	51.0	0
7/08/2019	-3.4	20.3	-2.2	19.6	47.7	0
8/08/2019	1.6	18.3	3.6	17.6	54.6	0
9/08/2019	2.3	12.1	4.5	11.4	57.0	0
10/08/2019	-0.7	8.3	0.5	7.6	75.9	3.4
11/08/2019	1.2	7.6	1.5	7.1	86.1	4.6
12/08/2019	-0.1	13.8	0.7	13.4	76.3	0.2
13/08/2019	-3.7	15.3	-3	14.7	68.2	0
14/08/2019	-5.7	16.4	-4.8	15.8	59.9	0
15/08/2019	-4.5	17.6	-3.6	17	57.6	0
16/08/2019	-3.4	21.6	-2.4	21.1	49.8	0
17/08/2019	1.7	21.1	2.9	20.5	38.0	0
18/08/2019	1	24.4	2.1	23.5	58.8	1.4
19/08/2019	-0.5	11.9	1.8	11.8	54.1	0

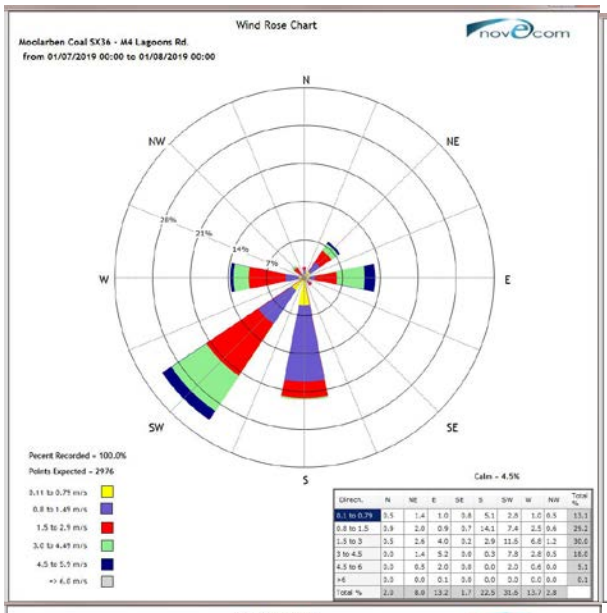
Date	Temperature (2m) (ºC)		Temperature (10m) (ºC)		Relative Humidity (%)	Rain (mm)
	Min	Max	Min	Max	Average	
20/08/2019	-0.5	14.7	1.7	14.3	57.8	0
21/08/2019	5.1	15.2	5.9	14.8	60.7	0
22/08/2019	3.7	15.8	5.9	15.3	56.9	0
23/08/2019	-2.3	17.6	-1.6	17.2	58.3	0
24/08/2019	-2.8	22.2	-1.8	21.2	53.0	0
25/08/2019	0.7	21.1	2.1	20.6	45.4	0
26/08/2019	3.9	21.2	5.4	20.1	58.0	0
27/08/2019	4.4	20.4	6.5	19.3	57.8	0
28/08/2019	1.9	18.1	3	17.3	59.7	0
29/08/2019	-0.5	17.5	0.4	16.8	56.9	0
30/08/2019	5.2	13.3	6.3	13	69.5	0
31/08/2019	3.6	17.5	5.7	17.4	71.8	0
1/09/2019	3.2	21.3	4	20.6	47.5	0
2/09/2019	1.6	21.6	2.7	20.8	47.3	0
3/09/2019	0.6	25.5	1.8	24.9	42.5	0
4/09/2019	4.2	26.9	5.3	26.2	36.8	0
5/09/2019	3.7	28.2	4.6	27.7	41.5	0
6/09/2019	3.7	30	5.1	28.8	57.3	0.6
7/09/2019	6.2	12.8	6.4	12.1	62.4	1.8
8/09/2019	7.3	13.9	7.4	13.3	53.0	0
9/09/2019	2.9	11.5	4.5	11.1	57.0	0.2
10/09/2019	-3.4	18	-2.6	17.5	54.4	0
11/09/2019	-0.1	21.1	1.4	20.1	56.8	0
12/09/2019	-1.3	23	-0.5	22.3	36.6	0
13/09/2019	5.2	24.8	7.3	24.1	26.9	0
14/09/2019	3.7	24.8	7.5	24.2	29.6	0
15/09/2019	0.9	26.7	2.6	25.8	34.9	0
16/09/2019	1.6	28.4	3.1	27.3	23.9	0
17/09/2019	6.6	14.9	6.6	15	88.0	24.6
18/09/2019	8.3	17.7	9.3	17.6	75.3	0
19/09/2019	7.6	21.1	8.5	20.9	73.7	0
20/09/2019	8.6	25	10.4	23.9	70.0	0
21/09/2019	12.7	24.7	13.5	23.8	63.1	0
22/09/2019	8.1	22.1	10.9	21	69.0	4
23/09/2019	2.8	18.1	3.4	17.5	52.9	0
24/09/2019	-1	19.4	-0.3	18.7	51.6	0
25/09/2019	1	21.6	2	20.5	51.3	0
26/09/2019	3.2	22.7	4.7	21.4	58.4	0
27/09/2019	2.1	22.6	2.9	22	47.3	0
28/09/2019	4.9	22.7	7.1	22.1	34.5	0
29/09/2019	3.1	22.5	4.2	21.8	51.4	0
30/09/2019	2.7	22.2	4.3	21.2	56.6	0
1/10/2019	11.1	22.2	12.1	21.6	51.1	0
2/10/2019	4.7	25.6	5.8	24.6	57.6	0
3/10/2019	5.4	28.2	6.8	27.5	46.2	0
4/10/2019	7.2	30.1	9	29.3	37.2	0
5/10/2019	13.8	23.1	13.9	22.5	71.6	0
6/10/2019	12	34	12	33.2	46.4	0
7/10/2019	12.6	33.2	13.7	32.1	33.1	0
8/10/2019	7.6	20.5	8	19.5	43.4	0
9/10/2019	0.8	20.5	1.5	19.8	49.3	0
10/10/2019	2.6	21.5	3.9	20.6	56.8	0
11/10/2019	6.9	19.5	8.4	18.2	76.7	7
12/10/2019	9.1	15.7	9	15.2	74.7	0
13/10/2019	3.9	20.7	5	19.7	64.1	0
14/10/2019	8.8	27.6	9.6	26.5	51.6	0
15/10/2019	7.9	31	9.3	30.1	44.1	0.4
16/10/2019	8.5	31.3	9.7	29.7	37.4	0
17/10/2019	8.4	23	10.4	22.1	49.2	0.2

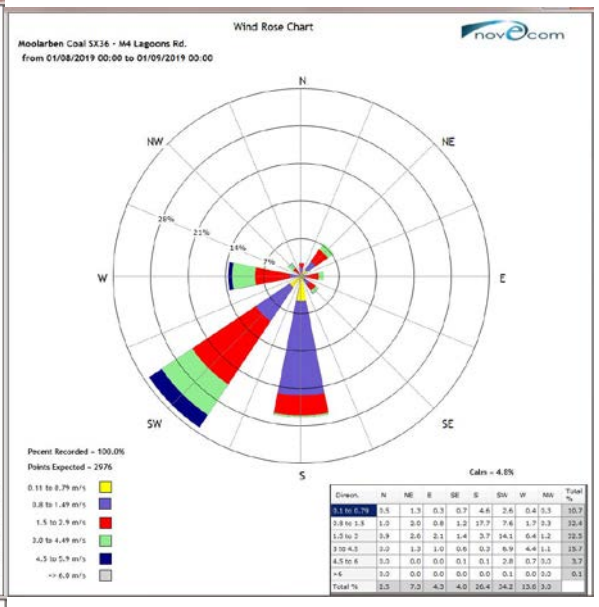
Date	Temperature (2m) (ºC)		Temperature (10m) (ºC)		Relative Humidity (%)	Rain (mm)
	Min	Max	Min	Max	Average	
18/10/2019	2.5	23.8	4	22.7	32.7	0
19/10/2019	2.9	25.8	4.2	24.9	29.7	0
20/10/2019	2.3	22.8	4	22.2	33.9	0
21/10/2019	3.3	26.2	4.7	25.4	41.2	0
22/10/2019	6.8	29.2	7.8	28.7	43.5	0
23/10/2019	7.7	30.8	9.4	29.1	40.7	0
24/10/2019	9.2	30.9	10.4	29.7	35.3	0
25/10/2019	10.1	33.1	12	31.8	30.5	0
26/10/2019	11.2	27.2	13.7	26.1	27.5	0
27/10/2019	2.9	24.5	4	23.5	29.8	0
28/10/2019	4.5	27.3	6	25.9	37.6	0
29/10/2019	7.8	30.3	8.6	28.6	49.2	0
30/10/2019	10.6	30.7	11.8	28.8	35.6	0
31/10/2019	12.1	32.3	13.9	30.8	33.6	0
1/11/2019	14.5	33	14.7	30.8	30.1	0
2/11/2019	12.4	30.6	14.1	28.9	42.6	0
3/11/2019	16.7	26.5	16.6	25.2	67.0	17
4/11/2019	12.8	23.9	12.9	23	67.3	0.4
5/11/2019	9.4	20.1	10.2	19.4	52.5	0
6/11/2019	4.4	25.9	5.2	24.9	46.0	0
7/11/2019	12	27.1	14.8	25.9	27.0	0
8/11/2019	11	25.7	13.1	24.9	39.7	0
9/11/2019	8.2	18.3	8.4	17.4	36.2	0
10/11/2019	6.6	23.7	8.2	22.8	38.0	0
11/11/2019	6.1	27.8	7.5	26.8	44.9	0
12/11/2019	6.7	33	8.8	32.1	28.2	0
13/11/2019	10.8	22.6	11.7	21.7	23.3	0
14/11/2019	5.3	26.1	6.5	25	33.2	0
15/11/2019	8.5	29	10.2	28.1	33.0	0
16/11/2019	8.3	28.8	9.6	27.6	28.3	0
17/11/2019	9.1	26.9	10.3	26	42.1	0
18/11/2019	9.6	28.8	10.9	27.9	49.2	0
19/11/2019	8.2	34.1	9.7	33.1	25.1	0
20/11/2019	12.5	32.1	14.4	31.1	44.6	0
21/11/2019	15	37	15	35.5	47.4	0
22/11/2019	18.9	37	20.6	35.4	32.4	0
23/11/2019	18	35.4	18.9	34.3	44.3	0
24/11/2019	17.6	28.5	17.7	27.4	66.7	0
25/11/2019	15	31	15.7	29.1	59.2	0
26/11/2019	13.2	32.6	13.7	30.9	42.4	1.8
27/11/2019	4.2	28.2	5.3	27.7	34.9	0
28/11/2019	7.6	34.1	8.9	32.5	32.5	0
29/11/2019	12.4	34.8	13.8	33.4	38.2	0
30/11/2019	16.5	33.4	18.3	31.8	29.1	0
1/12/2019	10.2	26.8	10.6	25.2	34.2	0
2/12/2019	9.8	16.9	9.6	16.4	60.5	6
3/12/2019	6.8	24.6	8.2	23.4	42.2	0
4/12/2019	8.1	28	10.4	26.9	34.5	0
5/12/2019	9.2	31.9	12.9	30.8	28.6	0
6/12/2019	10.1	31.9	11.5	30.9	24.9	0
7/12/2019	8.1	32.4	9.6	31.3	22.3	0
8/12/2019	12.5	33.8	14.4	32.6	41.5	0
9/12/2019	15.9	37.1	16.1	36	48.1	0
10/12/2019	14.9	40.4	16.5	39.1	30.1	0
11/12/2019	17.3	37.5	17.3	36.3	50.7	0
12/12/2019	16.8	33.6	16.9	32.6	50.4	0
13/12/2019	16.3	30.1	16.4	29	49.4	0
14/12/2019	11.8	32.7	12.8	31.6	41.4	0
15/12/2019	13.4	34.2	14.4	33.1	38.9	0

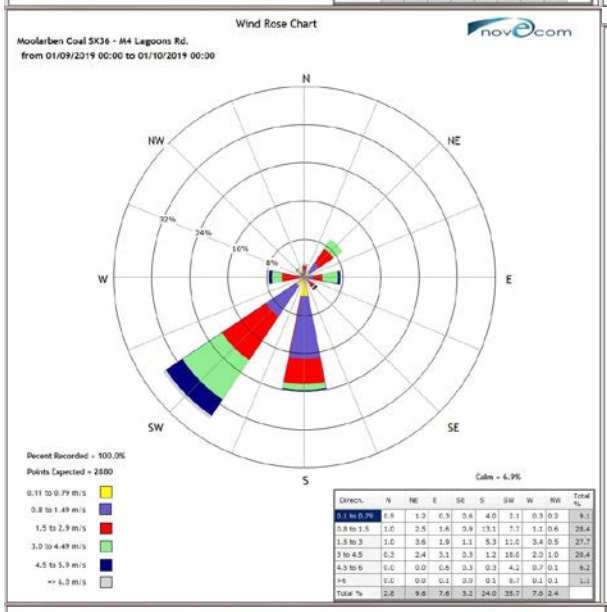
Date	Temperature (2m) (ºC)		Temperature (10m) (ºC)		Relative Humidity (%)	Rain (mm)
	Min	Max	Min	Max	Average	
16/12/2019	14.3	34.8	17.1	33.9	31.2	0
17/12/2019	14.4	30.7	14.5	29.8	49.5	0
18/12/2019	10.3	35	11.3	33.9	37.2	0
19/12/2019	14.6	39.1	16.2	38	27.6	0
20/12/2019	19.1	38.9	19.6	37.5	26.5	0
21/12/2019	15	42.5	15.9	41.4	38.1	0
22/12/2019	16.9	29.7	16.9	30.6	51.9	0
23/12/2019	16.1	27.5	16.1	26.7	58.9	0
24/12/2019	17.8	32.7	17.9	32.4	60.2	0
25/12/2019	19.3	31.4	19.4	30.6	54	0
26/12/2019	16.1	35.4	17.1	33.6	47.1	0
27/12/2019	16.6	35.3	17.8	34.3	34	0
28/12/2019	14.4	38.7	15.2	37.1	36	0
29/12/2019	15.2	40	16.4	38.6	24.6	0
30/12/2019	18	39.8	19.2	38.2	22.6	0
31/12/2019	18.8	39.7	20.7	38.3	22.2	0

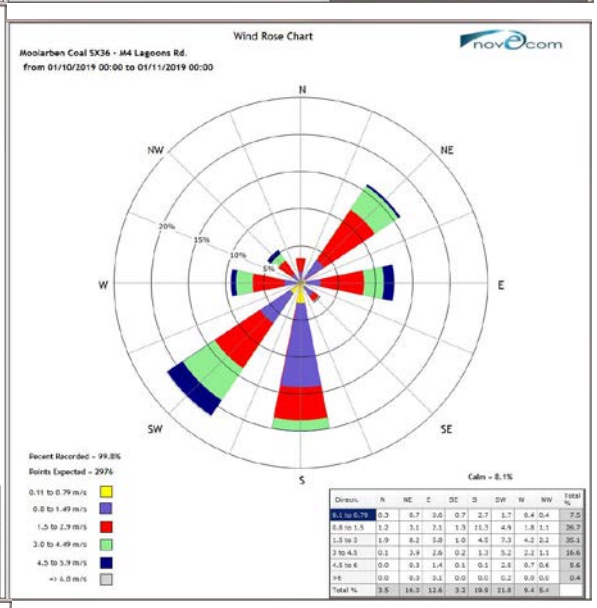
Figure 3-a Monthly Wind Rose (WS03)

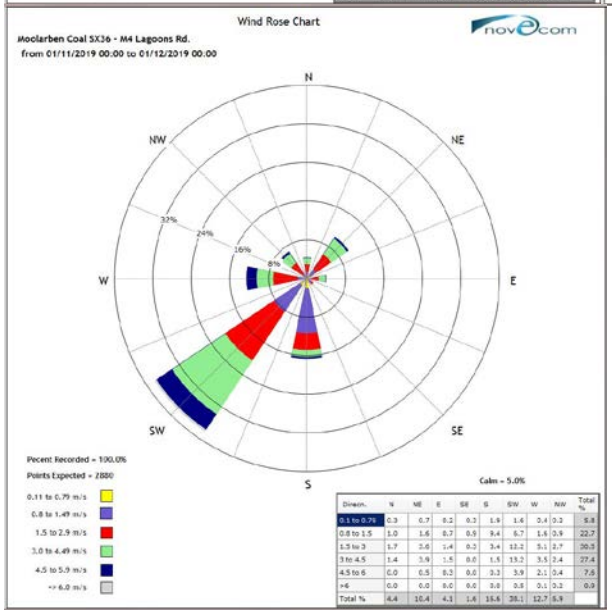


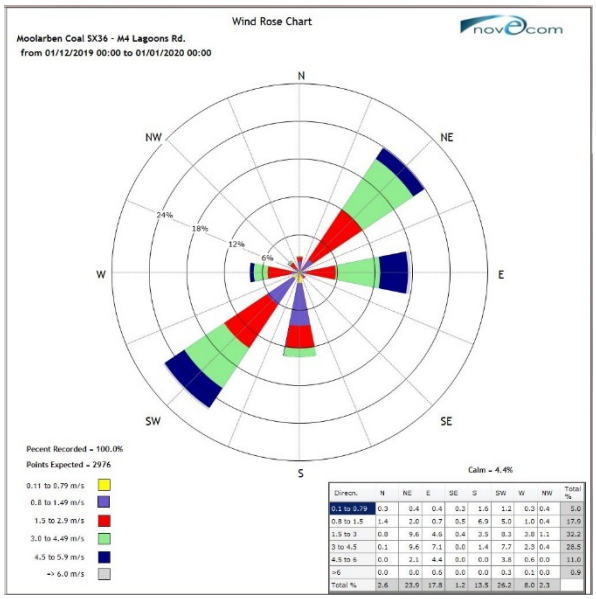

Wind Rose Chart
Moolarben Coal SX36 - M4 Lagoons Rd.
from 01/07/2019 00:00 to 01/08/2019 00:00
N
NE
E
SE
S
SW
W
NW
7%
14%
21%
28%
Pecent Recorded = 100.0%
Points Expected = 2976
0.11 to 0.79 m/s
0.8 to 1.49 m/s
1.5 to 2.9 m/s
3.0 to 4.49 m/s
4.5 to 5.9 m/s
=> 6.0 m/s
Calm = 4.5%


Wind Rose Chart
Moolarben Coal SX36 - M4 Lagoons Rd.
from 01/08/2019 00:00 to 01/09/2019 00:00
N
NE
E
SE
S
SW
W
NW
7%
14%
21%
28%
Pecent Recorded = 100.0%
Points Expected = 2976
0.11 to 0.79 m/s
0.8 to 1.49 m/s
1.5 to 2.9 m/s
3.0 to 4.49 m/s
4.5 to 5.9 m/s
=> 6.0 m/s
Calm = 4.8%


Wind Rose Chart
Moolarben Coal SX36 - M4 Lagoons Rd.
from 01/09/2019 00:00 to 01/10/2019 00:00
N
NE
E
SE
S
SW
W
NW
8%
16%
24%
32%
Pecent Recorded = 100.0%
Points Expected = 2880
0.11 to 0.79 m/s
0.8 to 1.49 m/s
1.5 to 2.9 m/s
3.0 to 4.49 m/s
4.5 to 5.9 m/s
=> 6.0 m/s
Calm = 6.9%


Wind Rose Chart
Moolarben Coal SX36 - M4 Lagoons Rd.
from 01/10/2019 00:00 to 01/11/2019 00:00
N
NE
E
SE
S
SW
W
NW
5%
10%
15%
20%
Pecent Recorded = 99.8%
Points Expected = 2976
0.11 to 0.79 m/s
0.8 to 1.49 m/s
1.5 to 2.9 m/s
3.0 to 4.49 m/s
4.5 to 5.9 m/s
=> 6.0 m/s
Calm = 8.1%


Wind Rose Chart
Moolarben Coal SX36 - M4 Lagoons Rd.
from 01/11/2019 00:00 to 01/12/2019 00:00
N
NE
E
SE
S
SW
W
NW
8%
16%
24%
32%
Pecent Recorded = 100.0%
Points Expected = 2880
0.11 to 0.79 m/s
0.8 to 1.49 m/s
1.5 to 2.9 m/s
3.0 to 4.49 m/s
4.5 to 5.9 m/s
=> 6.0 m/s
Calm = 5.0%


Wind Rose Chart
Moolarben Coal SX36 - M4 Lagoons Rd.
from 01/12/2019 00:00 to 01/01/2020 00:00
N
NE
E
SE
S
SW
W
NW
6%
12%
18%
24%
Pecent Recorded = 100.0%
Points Expected = 2976
0.11 to 0.79 m/s
0.8 to 1.49 m/s
1.5 to 2.9 m/s
3.0 to 4.49 m/s
4.5 to 5.9 m/s
=> 6.0 m/s
Calm = 4.4%

APPENDIX 3B. NOISE MONITORING RESULTS

Environmental Noise Monitoring – January 2019

4.3 Attended Noise Monitoring

Noise levels generated by activity at MCO are shown in Table 4.2 and Table 4.3 and are reproduced in Appendix B, generally in a format specified in the EPA guidelines *'Requirements for Publishing Pollution Monitoring Data'* (March 2012).

Table 4.2: $L_{Aeq,15minute}$ GENERATED BY MCO AGAINST IMPACT ASSESSMENT CRITERIA – JANUARY 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies?[1]	Measured MCO $L_{Aeq,15min}$ dB[2,3]	Modifying Factor where applicable from Section 4.2[4]	MCO $L_{Aeq,15min}$ dB with modifying factor if applicable[3,4]	Exceedance[3,5]
NA1	22/01/2019 11:47	0.8	A	43[6]	Yes	IA	NR	NR	Nil
NA6	21/01/2019 22:00	0.4	E	37	Yes	34	Nil	34	Nil
NA12	21/01/2019 22:30	0.9	E	35	Yes	32	Nil	32	Nil

Notes:

1. *Criterion may or may not apply due to meteorological conditions or the rounding of meteorological data values;*
2. *Estimated or measured $L_{Aeq,15minute}$ attributed to MCO. NM denotes MCO audible but not measurable, IA denotes inaudible;*
3. *Bold and red text indicate an exceedance of relevant criterion;*
4. *"NR" indicates that a modifying factor is not relevant for this measurement, as per the notes in Section 3.4;*
5. *NA in exceedance column means atmospheric conditions outside conditions specified in project approval and so criterion is not applicable, or, there is no applicable criterion; and*
6. *External criterion. A difference of 8 dB between internal and external criteria has been adopted at NA1 for consistency with previous versions of the NMP.*

As impact assessment criteria are more stringent than mitigation land acquisition criteria and MCO levels complied with impact assessment criteria in all measurements as shown in Table 4.2, no comparison against mitigation or land acquisition criteria is required.

Table 4.3: $L_{A1,1minute}$ GENERATED BY MCO AGAINST IMPACT ASSESSMENT CRITERIA – JANUARY 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies?	MCO $L_{A1,1min}$ dB	Exceedance
NA6	21/01/2019 22:00	0.4	E	45	Yes	40	Nil
NA12	21/01/2019 22:30	0.9	E	45	Yes	38	Nil

4.4 Attended Validation Noise Monitoring

Table 4.4 presents data recorded concurrently at the real-time noise monitor and attended monitoring locations.

Table 4.4: REAL-TIME VERSUS ATTENDED DATA COMPARISON – JANUARY 2019

Location	Start Date and Time	Real-time Noise Monitor Levels - dB						Attended Noise Monitoring Levels - dB					
		L_{A1}	L_{A10}	L_{A50}	L_{Aeq}	L_{A90}	$L_{Aeq,LF}$[1]	L_{A1}	L_{A10}	L_{A50}	L_{Aeq}	L_{A90}	MCO L_{Aeq}[2]
NA2/SX36	21/01/2019 23:00	47	45	44	44	43	39	42	38	35	36	33	37
NA3/SX35	21/01/2019 23:30	45	36	33	36	31	33	40	35	30	32	27	30
NA10/SX44	22/01/2019 00:00	39	38	36	37	35	36	41	37	32	34	28	34
NA12/SX39	21/01/2019 22:30	55	45	37	43	35	41	55	37	32	41	28	32

Notes:

1. *$L_{Aeq,LF}$ refers to $L_{Aeq,15minute}$ in the frequency range 20 to 630 Hz as measured by the real-time noise monitors; and*
2. *MCO L_{Aeq} refers to the estimated or measured $L_{Aeq,15minute}$ attributed to MCO during attended monitoring.*

6 SUMMARY

6.1 Attended Compliance Noise Monitoring

An attended noise survey around MCO was undertaken during the day period of 22 January and night period of 21/22 January 2019. The purpose of the attended survey was to quantify and describe the acoustic environment around the site and compare results with development consent conditions.

MCO complied with project specific criteria at all monitoring sites during the January 2019 survey. In accordance with Condition R4.2(b) of the EPL, no management actions have taken place at MCO as a result of attended monitoring as there were no exceedances recorded during the monitoring period.

Global Acoustics Pty Ltd

Environmental Noise Monitoring – February 2019

4.3 Attended Noise Monitoring

Noise levels generated by activity at MCO are shown in Table 4.2 and Table 4.3 and are reproduced in Appendix B, generally in a format specified in the EPA guidelines '*Requirements for Publishing Pollution Monitoring Data*' (March 2012).

Table 4.2: $L_{Aeq,15minute}$ GENERATED BY MCO AGAINST IMPACT ASSESSMENT CRITERIA – QUARTER 1 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies?[1]	Measured MCO $L_{Aeq,15min}$ dB[2,3]	Modifying Factor where applicable from Section 3.4[4]	MCO $L_{Aeq,15min}$ dB with modifying factor if applicable[3,4]	Exceedance[3,5]
NA1	05/02/2019 11:46	3.1	A	43[6]	No	IA	NR	NR	NA
NA6	04/02/2019 23:43	1.8	E	37	Yes	<30	NR	NR	Nil
NA12	05/02/2019 00:15	2.1	E	50	Yes	<25	NR	NR	Nil
GRNP	04/02/2019 22:00	3.5	E	50	No	<25	NR	NR	NA
MGNR	05/02/2019 01:35	1.1	F	50	Yes	IA	NR	NR	Nil

Notes:

1. *Criterion may or may not apply due to meteorological conditions or the rounding of meteorological data values;*
2. *Estimated or measured $L_{Aeq,15minute}$ attributed to MCO. NM denotes MCO audible but not measurable, IA denotes inaudible;*
3. *Bold and red text indicate an exceedance of relevant criterion;*
4. *"NR" indicates that a modifying factor is not relevant for this measurement, as per the notes in Section 3.4;*
5. *NA in exceedance column means atmospheric conditions outside conditions specified in project approval and so criterion is not applicable, or, there is no applicable criterion; and*
6. *External criterion. A difference of 8 dB between internal and external criteria has been adopted at NA1 for consistency with previous versions of the NMP.*

As impact assessment criteria are more stringent than mitigation land acquisition criteria and MCO levels complied with impact assessment criteria in all measurements as shown in Table 4.2, no comparison against mitigation or land acquisition criteria is required.

Table 4.3: $L_{A1,1minute}$ GENERATED BY MCO AGAINST IMPACT ASSESSMENT CRITERIA – QUARTER 1 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies?	MCO $L_{A1,1min}$ dB	Exceedance
NA6	04/02/2019 23:43	1.8	E	45	Yes	30	Nil
NA12	05/02/2019 00:15	2.1	E	45	Yes	<25	Nil

Cumulative noise levels generated by total mining activity are shown in Table 4.4. The mining-only $L_{Aeq,15minute}$ is compared to cumulative criteria contained in the Ulan Coal Mines project approval.

Table 4.4: $L_{Aeq,15minute}$ GENERATED BY ALL MINES AGAINST UCML CUMULATIVE CRITERIA – QUARTER 1 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies?	Cumulative $L_{Aeq,15min}$ dB[1]	Exceedance
NA11	04/02/2019 22:32	3.0	E	40	Yes	Nil	Nil

Notes:

1. *By definition, cumulative noise refers to two or more noise sources. If only one source of mining noise is audible then the measured cumulative noise is defined here as 'Nil'.*

4.4 Attended Validation Noise Monitoring

Table 4.5 presents data recorded concurrently at the real-time noise monitor and attended monitoring locations.

Table 4.5: REAL-TIME VERSUS ATTENDED DATA COMPARISON – QUARTER 1 2019

Location	Start Date and Time	Real-time Noise Monitor Levels - dB						Attended Noise Monitoring Levels - dB					
		L_{A1}	L_{A10}	L_{A50}	L_{Aeq}	L_{A90}	$L_{Aeq,LF}$[1]	L_{A1}	L_{A10}	L_{A50}	L_{Aeq}	L_{A90}	MCO L_{Aeq}[2]
NA2/SX36	04/02/2019 23:28	50	40	38	40	37	35	41	40	38	38	36	33
NA3/SX35	05/02/2019 00:45	43	36	33	34	27	30	46	44	39	41	27	22
NA10/SX44	05/02/2019 01:16	42	42	41	41	39	30	38	37	34	35	32	32
NA12/SX39	05/02/2019 00:15	51	36	32	38	30	34	40	36	31	33	29	<25

Notes:

1. *$L_{Aeq,LF}$ refers to $L_{Aeq,15minute}$ in the frequency range 20 to 630 Hz as measured by the real-time noise monitors; and*
2. *MCO L_{Aeq} refers to the estimated or measured $L_{Aeq,15minute}$ attributed to MCO during attended monitoring.*

6 SUMMARY

6.1 Attended Compliance Noise Monitoring

An attended noise survey around MCO was undertaken during the day period of 5 February and night period of 4/5 Febuary 2019. The purpose of the attended survey was to quantify and describe the acoustic environment around the site and compare results with development consent conditions.

MCO complied with project specific criteria at all monitoring sites during the quarterly Quarter 1 2019 survey. In accordance with Condition R4.2(b) of the EPL, no management actions have taken place at MCO as a result of attended monitoring as there were no exceedances recorded during the monitoring period.

Global Acoustics Pty Ltd

Environmental Noise Monitoring – March 2019

4.3 Attended Noise Monitoring

Noise levels generated by activity at MCO are shown in Table 4.2 and Table 4.3 and are reproduced in Appendix B, generally in a format specified in the EPA guidelines *'Requirements for Publishing Pollution Monitoring Data'* (March 2012).

Table 4.2: $L_{Aeq,15minute}$ GENERATED BY MCO AGAINST IMPACT ASSESSMENT CRITERIA – MARCH 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies?[1]	Measured MCO $L_{Aeq,15min}$ dB[2,3]	Modifying Factor where applicable from Section 4.2[4]	MCO $L_{Aeq,15min}$ dB with modifying factor if applicable[3,4]	Exceedance[3,5]
NA1	12/03/2019 10:33	2.9	B	43[6]	Yes	IA	NR	NR	Nil
NA6	11/03/2019 22:00	2.4	E	37	Yes	IA	NR	NR	Nil
NA12	11/03/2019 22:30	1.9	E	35	Yes	IA	NR	NR	Nil

Notes:

1. *Criterion may or may not apply due to meteorological conditions or the rounding of meteorological data values;*
2. *Estimated or measured $L_{Aeq,15minute}$ attributed to MCO. NM denotes MCO audible but not measurable, IA denotes inaudible;*
3. *Bold and red text indicate an exceedance of relevant criterion;*
4. *"NR" indicates that a modifying factor is not relevant for this measurement, as per the notes in Section 3.4;*
5. *NA in exceedance column means atmospheric conditions outside conditions specified in project approval and so criterion is not applicable, or, there is no applicable criterion; and*
6. *External criterion. A difference of 8 dB between internal and external criteria has been adopted at NA1 for consistency with previous versions of the NMP.*

As impact assessment criteria are more stringent than mitigation land acquisition criteria and MCO levels complied with impact assessment criteria in all measurements as shown in Table 4.2, no comparison against mitigation or land acquisition criteria is required.

Table 4.3: $L_{A1,1minute}$ GENERATED BY MCO AGAINST IMPACT ASSESSMENT CRITERIA – MARCH 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies?	MCO $L_{A1,1min}$ dB	Exceedance
NA6	11/03/2019 22:00	2.4	E	45	Yes	IA	Nil
NA12	11/03/2019 22:30	1.9	E	45	Yes	IA	Nil

4.4 Attended Validation Noise Monitoring

Table 4.4 presents data recorded concurrently at the real-time noise monitor and attended monitoring locations.

Table 4.4: REAL-TIME VERSUS ATTENDED DATA COMPARISON – MARCH 2019

Location	Start Date and Time	Real-time Noise Monitor Levels - dB						Attended Noise Monitoring Levels - dB					
		L_{A1}	L_{A10}	L_{A50}	L_{Aeq}	L_{A90}	$L_{Aeq,LF}$[1]	L_{A1}	L_{A10}	L_{A50}	L_{Aeq}	L_{A90}	MCO L_{Aeq}[2]
NA2/SX36	11/03/2019 23:00	41	35	23	31	18	27	41	36	24	31	18	<30
NA3/SX35	11/03/2019 23:30	42	25	17	38	16	34	31	27	21	24	19	IA
NA10/SX44	12/03/2019 00:00	50	49	41	45	39	12	57	52	40	47	37	IA
NA12/SX39	11/03/2019 22:30	45	33	29	32	27	29	43	33	30	32	27	IA

Notes:

1. *$L_{Aeq,LF}$ refers to $L_{Aeq,15minute}$ in the frequency range 20 to 630 Hz as measured by the real-time noise monitors; and*
2. *MCO L_{Aeq} refers to the estimated or measured $L_{Aeq,15minute}$ attributed to MCO during attended monitoring.*

6 SUMMARY

6.1 Attended Compliance Noise Monitoring

An attended noise survey around MCO was undertaken during the day period of 12 March and night period of 11/12 March 2019. The purpose of the attended survey was to quantify and describe the acoustic environment around the site and compare results with development consent conditions.

MCO complied with project specific criteria at all monitoring sites during the March 2019 survey. In accordance with Condition R4.2(b) of the EPL, no management actions have taken place at MCO as a result of attended monitoring as there were no exceedances recorded during the monitoring period.

Global Acoustics Pty Ltd

Environmental Noise Monitoring – April 2019

4.3 Attended Noise Monitoring

Noise levels generated by activity at MCO are shown in Table 4.2 and Table 4.3 and are reproduced in Appendix B, generally in a format specified in the EPA guidelines *'Requirements for Publishing Pollution Monitoring Data'* (March 2012).

Table 4.2: $L_{Aeq,15minute}$ GENERATED BY MCO AGAINST IMPACT ASSESSMENT CRITERIA – APRIL 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies?[1]	Measured MCO $L_{Aeq,15min}$ dB[2,3]	Modifying Factor where applicable from Section 4.2[4]	MCO $L_{Aeq,15min}$ dB with modifying factor if applicable[3,4]	Exceedance[3,5]
NA1	02/04/2019 11:24	4.1	D	43[6]	No	IA	NR	NR	NA
NA6	01/04/2019 22:23	3.2	D	37	No	<30	NR	NR	NA
NA12	01/04/2019 22:00	3.2	D	35	No	<30	NR	NR	NA

Notes:

1. *Criterion may or may not apply due to meteorological conditions or the rounding of meteorological data values;*
2. *Estimated or measured $L_{Aeq,15minute}$ attributed to MCO. NM denotes MCO audible but not measurable, IA denotes inaudible;*
3. *Bold and red text indicate an exceedance of relevant criterion;*
4. *"NR" indicates that a modifying factor is not relevant for this measurement, as per the notes in Section 3.4;*
5. *NA in exceedance column means atmospheric conditions outside conditions specified in project approval and so criterion is not applicable, or, there is no applicable criterion; and*
6. *External criterion. A difference of 8 dB between internal and external criteria has been adopted at NA1 for consistency with previous versions of the NMP.*

As impact assessment criteria are more stringent than mitigation land acquisition criteria and MCO levels complied with impact assessment criteria in all measurements as shown in Table 4.2, no comparison against mitigation or land acquisition criteria is required.

Table 4.3: $L_{A1minute}$ GENERATED BY MCO AGAINST IMPACT ASSESSMENT CRITERIA – APRIL 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies?	MCO $L_{A1,1min}$ dB	Exceedance
NA6	01/04/2019 22:23	3.2	D	45	No	33	NA
NA12	01/04/2019 22:00	3.2	D	45	No	32	NA

4.4 Attended Validation Noise Monitoring

Table 4.4 presents data recorded concurrently at the real-time noise monitor and attended monitoring locations.

Table 4.4: REAL-TIME VERSUS ATTENDED DATA COMPARISON – APRIL 2019

Location	Start Date and Time	Real-time Noise Monitor Levels - dB						Attended Noise Monitoring Levels - dB					
		L_{A1}	L_{A10}	L_{A50}	L_{Aeq}	L_{A90}	$L_{Aeq,LF}$[1]	L_{A1}	L_{A10}	L_{A50}	L_{Aeq}	L_{A90}	MCO L_{Aeq}[2]
NA2/SX36	01/04/2019 23:30	45	40	37	38	35	34	39	37	34	35	33	34
NA3/SX35	01/04/2019 23:00	48	43	37	40	34	36	45	40	35	37	32	31
NA10/SX44	02/04/2019 00:00	53	51	48	48	43	28	38	34	31	32	28	26
NA12/SX39	01/04/2019 22:00	51	44	36	40	33	39	50	41	34	39	31	<30

Notes:

1. *$L_{Aeq,LF}$ refers to $L_{Aeq,15minute}$ in the frequency range 20 to 630 Hz as measured by the real-time noise monitors; and*
2. *MCO L_{Aeq} refers to the estimated or measured $L_{Aeq,15minute}$ attributed to MCO during attended monitoring.*

6 SUMMARY

6.1 Attended Compliance Noise Monitoring

An attended noise survey around MCO was undertaken during the day period of 2 April and night period of 1/2 April 2019. The purpose of the attended survey was to quantify and describe the acoustic environment around the site and compare results with development consent conditions.

MCO complied with project specific criteria at all monitoring sites during the April 2019 survey. In accordance with Condition R4.2(b) of the EPL, no management actions have taken place at MCO as a result of attended monitoring as there were no exceedances recorded during the monitoring period.

Global Acoustics Pty Ltd

Environmental Noise Monitoring – May 2019

4.3 Attended Noise Monitoring

Noise levels generated by activity at MCO are shown in Table 4.2 and Table 4.3 and are reproduced in Appendix B, generally in a format specified in the EPA guidelines *'Requirements for Publishing Pollution Monitoring Data'* (March 2012).

Table 4.2: $L_{Aeq,15minute}$ GENERATED BY MCO AGAINST IMPACT ASSESSMENT CRITERIA – QUARTER 2 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies?[4]	Measured MCO $L_{Aeq,15min}$ dB[2,3]	Modifying Factor where applicable from Section 3.4[4]	MCO $L_{Aeq,15min}$ dB with modifying factor if applicable[2,4]	Exceedance[3,5]
NA1	14/05/2019 09:34	0.6	D	43	Yes	IA	NR	IA	Nil
NA6	13/05/2019 23:22	0.0	F	37	Yes	<30	NR	<30	Nil
NA12	13/05/2019 23:46	0.7	F	35	Yes	<30	NR	<30	Nil
GRNP	13/05/2019 22:00	0.0	F	50	Yes	<30	NR	<30	Nil
MGNR	14/05/2019 01:31	0.0	F	50	Yes	IA	NR	IA	Nil

Notes:

1. *Criterion may or may not apply due to meteorological conditions or the rounding of meteorological data values;*
2. *Estimated or measured $L_{Aeq,15minute}$ attributed to MCO. NM denotes MCO audible but not measurable, IA denotes inaudible;*
3. *Bold and red text indicate an exceedance of relevant criterion;*
4. *"NR" indicates that a modifying factor is not relevant for this measurement, as per the notes in Section 3.4;*
5. *NA in exceedance column means atmospheric conditions outside conditions specified in project approval and so criterion is not applicable, or, there is no applicable criterion; and*
6. *External criterion. A difference of 8 dB between internal and external criteria has been adopted at NA1 for consistency with previous versions of the NMP.*

As impact assessment criteria are more stringent than mitigation land acquisition criteria and MCO levels complied with impact assessment criteria in all measurements as shown in Table 4.2, no comparison against mitigation or land acquisition criteria is required.

Table 4.3: $L_{A1,1minute}$ GENERATED BY MCO AGAINST IMPACT ASSESSMENT CRITERIA – QUARTER 2 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies?	MCO $L_{A1,1min}$ dB	Exceedance
NA6	13/05/2019 23:22	0.0	F	45	Yes	<30	Nil
NA12	13/05/2019 23:46	0.7	F	45	Yes	<30	Nil

Cumulative noise levels generated by total mining activity are shown in Table 4.4. The mining-only $L_{Aeq,15minute}$ is compared to cumulative criteria contained in the Ulan Coal Mines project approval.

Table 4.4: $L_{Aeq,15minute}$ GENERATED BY ALL MINES AGAINST UCML CUMULATIVE CRITERIA – QUARTER 2 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies?	Cumulative $L_{Aeq,15min}$ dB[1]	Exceedance
NA11	13/05/2019 22:33	0	4.1	40	Yes	Nil	Nil

Notes:

1. *By definition, cumulative noise refers to two or more noise sources. If only one source of mining noise is audible then the measured cumulative noise is defined here as 'Nil'.*

4.4 Attended Validation Noise Monitoring

Table 4.5 presents data recorded concurrently at the real-time noise monitor and attended monitoring locations.

Table 4.5: REAL-TIME VERSUS ATTENDED DATA COMPARISON – QUARTER 2 2019

Location	Start Date and Time	Real-time Noise Monitor Levels - dB						Attended Noise Monitoring Levels - dB					
		L_{A1}	L_{A10}	L_{A50}	L_{Aeq}	L_{A90}	$L_{Aeq,LF}$[1]	L_{A1}	L_{A10}	L_{A50}	L_{Aeq}	L_{A90}	MCO L_{Aeq}[2]
NA2/SX36	13/05/2019 23:00	48	42	37	40	34	37	46	41	36	38	33	33
NA3/SX35	14/05/2019 00:15	58	38	30	42	26	38	45	35	28	33	24	<25
NA10/SX44	14/05/2019 00:45	40	38	36	36	33	36	39	37	34	35	32	33
NA12/SX39	13/05/2019 23:46	46	41	29	35	25	31	45	39	27	34	24	<30

Notes:

1. *$L_{Aeq,LF}$ refers to $L_{Aeq,15minute}$ in the frequency range 20 to 630 Hz as measured by the real-time noise monitors; and*
2. *MCO L_{Aeq} refers to the estimated or measured $L_{Aeq,15minute}$ attributed to MCO during attended monitoring.*

6 SUMMARY

6.1 Attended Compliance Noise Monitoring

An attended noise survey around MCO was undertaken during the day period of 14 May and night period of 13/14 May 2019. The purpose of the attended survey was to quantify and describe the acoustic environment around the site and compare results with development consent conditions.

MCO complied with project specific criteria at all monitoring sites during the quarterly Quarter 2 2019 survey. In accordance with Condition R4.2(b) of the EPL, no management actions have taken place at MCO as a result of attended monitoring as there were no exceedances recorded during the monitoring period.

Global Acoustics Pty Ltd

Environmental Noise Monitoring – June 2019

4.3 Attended Noise Monitoring

Noise levels generated by activity at MCO are shown in Table 4.2 and Table 4.3 and are reproduced in Appendix B, generally in a format specified in the EPA guidelines *'Requirements for Publishing Pollution Monitoring Data'* (March 2012).

Table 4.2: $L_{Aeq,15minute}$ GENERATED BY MCO AGAINST IMPACT ASSESSMENT CRITERIA – JUNE 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies [1]	MCO L_{Aeq} dB [2]	Exceedance dB [3]
NA1	18/06/2019 10:55	1.8	B	43[4]	Yes	IA	Nil
NA6	17/06/2019 22:23	1.5	D	37	Yes	28	Nil
NA12	17/06/2019 22:00	1.3	D	35	Yes	<25	Nil

Notes:

1. *Noise emission limits do not apply during periods of rainfall or winds greater than 3 metres per second (at a height of 10 metres);*
2. *Site-only $L_{Aeq,15minute}$ attributed to MCO;*
3. *NA in exceedance column means criterion is not applicable due to atmospheric conditions outside those specified in project approval(s); and*
4. *External criterion. A difference of 8 dB between internal and external criteria has been adopted at NA1 for consistency with previous versions of the NMP.*

As impact assessment criteria are more stringent than mitigation land acquisition criteria and MCO levels complied with impact assessment criteria in all measurements as shown in Table 4.2, no comparison against mitigation or land acquisition criteria is required.

Table 4.3: $L_{A1,1minute}$ GENERATED BY MCO AGAINST IMPACT ASSESSMENT CRITERIA – JUNE 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies [1]	MCO $L_{A1,1min}$ dB [2]	Exceedance dB [3]
NA6	17/06/2019 22:23	1.5	D	45	Yes	34	Nil
NA12	17/06/2019 22:00	1.3	D	45	Yes	26	Nil

Notes:

1. *Noise emission limits do not apply during periods of rainfall or winds greater than 3 metres per second (at a height of 10 metres);*
2. *Site-only $L_{A1,1minute}$ attributed to MCO; and*
3. *NA in exceedance column means criterion is not applicable due to atmospheric conditions outside those specified in project approval(s).*

4.4 Attended Validation Noise Monitoring

Table 4.4 presents data recorded concurrently at the real-time noise monitor and attended monitoring locations.

Table 4.4: REAL-TIME VERSUS ATTENDED DATA COMPARISON – JUNE 2019

Location	Start Date and Time	Real-time Noise Monitor Levels – dB						Attended Noise Monitoring Levels – dB					
		L_{A1}	L_{A10}	L_{A50}	L_{Aeq}	L_{A90}	$L_{Aeq,LF}$ [1]	L_{A1}	L_{A10}	L_{A50}	L_{Aeq}	L_{A90}	MCO L_{Aeq} [2]
NA2/SX36	17/06/2019 23:15	43	39	36	37	34	36	42	39	35	36	33	35
NA3/SX35	17/06/2019 22:45	50	45	38	41	30	37	51	46	39	42	32	NM
NA10/SX44	18/06/2019 00:00	30	25	22	23	20	16	28	23	18	21	17	<20
NA12/SX39	17/06/2019 22:00	45	38	28	34	25	31	45	37	26	33	23	<25

Notes:

1. *$L_{Aeq,LF}$ refers to $L_{Aeq,15minute}$ in the frequency range 20 to 630 Hz as measured by the real-time noise monitors; and*
2. *MCO L_{Aeq} refers to the estimated or measured $L_{Aeq,15minute}$ attributed to MCO during attended monitoring.*

4.5 Atmospheric Conditions

Atmospheric condition data measured by the operator during each measurement using a Kestrel hand-held weather meter is shown in Table 4.5. The wind speed, direction and temperature were measured at approximately 1.8 metres. Attended noise monitoring is not undertaken during rain or hail.

Table 4.5: MEASURED ATMOSPHERIC CONDITIONS – JUNE 2019

Location	Start Date and Time	Temperature °C	Wind Speed m/s	Wind Direction ° MN[1]	Cloud Cover eighths
NA1	18/06/2019 10:55	16	0.7	280	8
NA2	17/06/2019 23:15	9	0.0	-	7
NA3	17/06/2019 22:45	11	0.0	-	4
NA6	17/06/2019 22:23	9	0.0	-	3
NA10	18/06/2019 00:00	10	0.0	-	7
NA12	17/06/2019 22:00	11	0.0	-	6

Notes:

1. *"-" indicates calm conditions at monitoring location.*

Meteorological data from the MCO AWS station was used to determine compliance with specified noise

6 SUMMARY

6.1 Attended Compliance Noise Monitoring

A monthly attended noise survey around MCO was undertaken during the day period of 18 June and night period of 17/18 June 2019. The purpose of the survey was to quantify and describe the acoustic environment around the site and compare results with development consent conditions.

MCO complied with project specific criteria at all monitoring sites during the June 2019 survey. In accordance with Condition R4.2(b) of the EPL, no management actions have taken place at MCO as a result of attended monitoring as there were no exceedances recorded during the monitoring period.

Global Acoustics Pty Ltd

Environmental Noise Monitoring – July 2019

4.3 Attended Noise Monitoring

Noise levels generated by activity at MCO are shown in Table 4.3 and Table 4.4 and are reproduced in Appendix B, generally in a format specified in the EPA guidelines '*Requirements for Publishing Pollution Monitoring Data*' (March 2012).

Table 4.3: $L_{Aeq,15minute}$ GENERATED BY MCO AGAINST IMPACT ASSESSMENT CRITERIA – JULY 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies [1]	MCO L_{Aeq} dB [2]	Exceedance dB [3]
NA1	02/07/2019 11:06	0.7	E	43	Yes	IA	Nil
NA6	01/07/2019 22:00	0.0	F	37	Yes	33	Nil
NA12	01/07/2019 22:30	0.8	F	35	Yes	27	Nil

Notes:

1. *Noise emission limits do not apply during periods of rainfall, winds speeds greater than 3 metres/second at 10 metres above ground level, stability category F temperature inversion conditions and wind speeds greater than 2 metres/second at 10 metres above ground level, or stability category G temperature inversion conditions;*
2. *Site-only $L_{Aeq,15minute}$ attributed to MCO, including modifying factors if applicable;*
3. *NA in exceedance column means criterion is not applicable due to atmospheric conditions outside those specified in EPL; and*
4. *External criterion. A difference of 8 dB between internal and external criteria has been adopted at NA1 for consistency with previous versions of the NMP.*

As impact assessment criteria are more stringent than land acquisition or noise mitigation criteria and MCO levels complied with impact assessment criteria in all measurements as shown in Table 4.3, no comparison against mitigation or land acquisition criteria is required.

Table 4.4: $L_{A1,1minute}$ GENERATED BY MCO AGAINST IMPACT ASSESSMENT CRITERIA – JULY 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies [1]	MCO $L_{A1,1min}$ dB [2]	Exceedance dB [3]
NA6	01/07/2019 22:00	0.0	F	45	Yes	38	Nil
NA12	01/07/2019 22:30	0.8	F	45	Yes	32	Nil

Notes:

1. *Noise emission limits do not apply during periods of rainfall, winds speeds greater than 3 metres/second at 10 metres above ground level, stability category F temperature inversion conditions and wind speeds greater than 2 metres/second at 10 metres above ground level, or stability category G temperature inversion conditions;*
2. *Site-only $L_{A1,1minute}$ attributed to MCO; and*
3. *NA in exceedance column means criterion is not applicable due to atmospheric conditions outside those specified in EPL.*

4.4 Attended Validation Noise Monitoring

Table 4.5 presents data recorded concurrently at the real-time noise monitor and attended monitoring locations.

Table 4.5: REAL-TIME VERSUS ATTENDED DATA COMPARISON – JULY 2019

Location	Start Date and Time	Real-time Noise Monitor Levels – dB						Attended Noise Monitoring Levels – dB					
		L_{A1}	L_{A10}	L_{A50}	L_{Aeq}	L_{A90}	$L_{Aeq,LF}$ [1]	L_{A1}	L_{A10}	L_{A50}	L_{Aeq}	L_{A90}	MCO L_{Aeq} [2]
NA2/SX36	01/07/2019 23:00	45	43	39	40	35	39	46	43	39	40	35	39
NA3/SX35	01/07/2019 23:30	51	41	31	38	29	35	46	39	32	36	28	28
NA10/SX44	02/07/2019 00:00	45	40	37	38	35	38	41	40	37	38	35	38
NA12/SX39	01/07/2019 22:30	43	35	29	33	27	30	39	31	28	29	25	27

Notes:

1. *$L_{Aeq,LF}$ refers to $L_{Aeq,15minute}$ in the frequency range 20 to 630 Hz as measured by the real-time noise monitors; and*
2. *MCO L_{Aeq} refers to the site-only $L_{Aeq,15minute}$ attributed to MCO during attended monitoring.*

4.5 Atmospheric Conditions

Atmospheric condition data measured by the operator during each measurement using a Kestrel hand-held weather meter is shown in Table 4.6. The wind speed, direction and temperature were measured at approximately 1.8 metres. Attended noise monitoring is not undertaken during rain or hail.

Table 4.6: MEASURED ATMOSPHERIC CONDITIONS – JULY 2019

Location	Start Date and Time	Temperature °C	Wind Speed m/s	Wind Direction °MN [1]	Cloud Cover eighths
NA1	02/07/2019 11:06	19	0.0	-	2
NA2	01/07/2019 23:00	4	0.0	-	3
NA3	01/07/2019 23:30	8	0.0	-	0
NA6	01/07/2019 22:00	11	0.0	-	3
NA10	02/07/2019 00:00	5	0.0	-	0
NA12	01/07/2019 22:30	6	0.6	230	3

Notes:

1. *"-" indicates calm conditions at monitoring location.*

6 SUMMARY

A monthly attended noise survey around MCO was undertaken during the day period of 2 July and night period of 1/2 July 2019. The purpose of the survey was to quantify and describe the acoustic environment around the site and compare results with development consent conditions.

MCO complied with project specific criteria at all monitoring sites during the July 2019 survey. In accordance with Condition R4.2(b) of the EPL, no management actions have taken place at MCO as a result of attended monitoring as there were no exceedances recorded during the monitoring period.

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Environmental Noise Monitoring – August 2019

4.3 Attended Noise Monitoring

Noise levels generated by activity at MCO are shown in Table 4.2 and Table 4.3 and are reproduced in Appendix B, generally in a format specified in the EPA guidelines '*Requirements for Publishing Pollution Monitoring Data*' (March 2012).

Table 4.2: $L_{Aeq,15minute}$ GENERATED BY MCO AGAINST IMPACT ASSESSMENT CRITERIA – QUARTER 3 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies [1]	MCO L_{Aeq} dB [2]	Exceedance dB [3]
NA1	02/08/2019 13:23	1.5	A	43[4]	Yes	IA	Nil
NA6	01/08/2019 23:52	0.0	G	37	No	35	NA
NA12	02/08/2019 00:45	0.0	G	35	No	26	NA
GRNP	01/08/2019 22:00	1.9	G	50	No	<35	NA
MGNR	02/08/2019 01:47	0.0	G	50	No	<25	NA

Notes:

1. *As detailed in the EPL, noise emission limits apply under all meteorological conditions except:*
   - *Wind speeds greater than 3 m/s at 10 metres above ground level; or*
   - *Stability class F temperature inversion conditions, and wind speeds greater than 2 m/s at 10 metres above ground level; or*
   - *Stability class G temperature inversions;*
2. *Site-only $L_{Aeq,15minute}$ attributed to MCO, including modifying factors if applicable;*
3. *NA in exceedance column means criterion is not applicable due to atmospheric conditions outside those specified in EPL; and*
4. *External criterion. A difference of 8 dB between internal and external criteria has been adopted at NA1 for consistency with previous versions of the NMP.*

As impact assessment criteria are more stringent than land acquisition or noise mitigation criteria and MCO levels complied with impact assessment criteria in all measurements as shown in Table 4.2, no comparison against mitigation or land acquisition criteria is required.

Table 4.3: $L_{A1,1minute}$ GENERATED BY MCO AGAINST IMPACT ASSESSMENT CRITERIA – QUARTER 3 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies [1]	MCO $L_{A1,1min}$ dB [2]	Exceedance dB [3]
NA6	01/08/2019 23:52	0.0	G	45	No	39	NA
NA12	02/08/2019 00:45	0.0	G	45	No	31	NA

Notes:

1. *As detailed in the EPL, noise emission limits apply under all meteorological conditions except:*
   - *Wind speeds greater than 3 m/s at 10 metres above ground level; or*
   - *Stability class F temperature inversion conditions, and wind speeds greater than 2 m/s at 10 metres above ground level; or*
   - *Stability class G temperature inversions;*
2. *Site-only $L_{A1,1minute}$ attributed to MCO; and*
3. *NA in exceedance column means criterion is not applicable due to atmospheric conditions outside those specified in EPL.*

Cumulative noise levels generated by total mining activity are shown in Table 4.4. The mining-only $L_{Aeq,15minute}$ is compared to cumulative criteria contained in the Ulan Coal Mines project approval.

Table 4.4: $L_{Aeq,15minute}$ GENERATED BY ALL MINES AGAINST UCML CUMULATIVE CRITERIA – QUARTER 3 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies?	Cumulative $L_{Aeq,15min}$ dB [1]	Exceedance
NA11	01/08/2019 22:45	0.7	G	40	No	Nil	NA

Notes:

1. *By definition, cumulative noise refers to two or more noise sources. If only one source of mining noise is audible then the measured cumulative noise is defined here as "Nil".*

4.4 Attended Validation Noise Monitoring

Table 4.5 presents data recorded concurrently at the real-time noise monitor and attended monitoring locations.

Table 4.5: REAL-TIME VERSUS ATTENDED DATA COMPARISON – QUARTER 3 2019

Location	Start Date and Time	Real-time Noise Monitor Levels - dB						Attended Noise Monitoring Levels - dB					
		L_{A1}	L_{A10}	L_{A50}	L_{Aeq}	L_{A90}	$L_{Aeq,LF}$ [1]	L_{A1}	L_{A10}	L_{A50}	L_{Aeq}	L_{A90}	MCO L_{Aeq} [2]
NA2/SX36	01/08/2019 23:30	43	41	39	40	37	39	44	42	40	40	38	40
NA3/SX35	02/08/2019 00:15	45	40	32	36	26	33	47	42	32	38	25	28
NA10/SX44	02/08/2019 01:15	34	29	26	27	24	26	30	27	24	25	22	25
NA12/SX39	02/08/2019 00:45	39	36	30	32	27	31	39	35	29	32	25	26

Notes:

1. *$L_{Aeq,LF}$ refers to $L_{Aeq,15minute}$ in the frequency range 20 to 630 Hz as measured by the real-time noise monitors; and*
2. *MCO L_{Aeq} refers to the estimated or measured $L_{Aeq,15minute}$ attributed to MCO during attended monitoring..*

6 SUMMARY

Global Acoustics was engaged by MCO to conduct a quarterly noise survey of operations at Moolarben Coal Mine. The purpose of the survey was to quantify and describe the acoustic environment around the site and compare results with specified limits.

Attended environmental noise monitoring described in this report was undertaken for Quarter 3 2019 during the day period of 2 August and night period of 1/2 August 2019.

MCO complied with project specific criteria at all monitoring sites during the quarterly Quarter 3 2019 survey. In accordance with Condition R4.2(b) of the EPL, no management actions have taken place at MCO as a result of attended monitoring as there were no exceedances recorded during the monitoring period.

Global Acoustics Pty Ltd

Environmental Noise Monitoring – September 2019

4.3 Attended Noise Monitoring

Noise levels from MCO in the absence of other noise sources are shown in Table 4.2 and Table 4.3, and are reproduced in Appendix B in a format generally specified in the EPA guidelines *'Requirements for Publishing Pollution Monitoring Data'* (March 2012). Discussion as to the noise sources responsible for these measured levels is provided in Section 5 of this report.

Table 4.2: $L_{Aeq,15minute}$ GENERATED BY MCO AGAINST IMPACT ASSESSMENT CRITERIA – SEPTEMBER 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies [1]	MCO L_{Aeq} dB [2]	Exceedance dB [3]
NA1	11/09/2019 11:06	0.5	A	43[4]	Yes	NM	Nil
NA6	10/09/2019 22:00	2.4	E	37	Yes	32	Nil
NA12	10/09/2019 22:29	2.2	E	35	Yes	<30	Nil

Notes:

1. *As detailed in the EPL, noise emission limits apply under all meteorological conditions except:*
   - *Wind speeds greater than 3 m/s at 10 metres above ground level; or*
   - *Stability class F temperature inversion conditions, and wind speeds greater than 2 m/s at 10 metres above ground level; or*
   - *Stability class G temperature inversions;*
2. *Site-only $L_{Aeq,15minute}$ attributed to MCO, including modifying factors if applicable;*
3. *NA in exceedance column means criterion was not applicable due to atmospheric conditions outside those specified in EPL; and*
4. *External criterion. A difference of 8 dB between the internal and external criterion has been adopted at NA1 for consistency with previous versions of the NMP.*

As impact assessment criteria are more stringent than land acquisition or noise mitigation criteria and MCO levels complied with impact assessment criteria in all measurements as shown in Table 4.2, no comparison against mitigation or land acquisition criteria is required.

Table 4.3: $L_{A1,1minute}$ GENERATED BY MCO AGAINST IMPACT ASSESSMENT CRITERIA – SEPTEMBER 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies [1]	MCO $L_{A1,1min}$ dB [2]	Exceedance dB [3]
NA6	10/09/2019 22:00	2.4	E	45	Yes	42	Nil
NA12	10/09/2019 22:29	2.2	E	45	Yes	35	Nil

Notes:

1. *As detailed in the EPL, noise emission limits apply under all meteorological conditions except:*
   - *Wind speeds greater than 3 m/s at 10 metres above ground level; or*
   - *Stability class F temperature inversion conditions, and wind speeds greater than 2 m/s at 10 metres above ground level; or*
   - *Stability class G temperature inversions;*
2. *Site-only $L_{A1,1minute}$ attributed to MCO; and*
3. *NA in exceedance column means criterion was not applicable due to atmospheric conditions outside those specified in EPL.*

4.4 Attended Validation Noise Monitoring

Table 4.4 presents data recorded concurrently at the real-time noise monitor and attended monitoring locations.

Table 4.4: REAL-TIME VERSUS ATTENDED DATA COMPARISON – SEPTEMBER 2019

Location	Start Date and Time	Real-time Noise Monitor Levels – dB						Attended Noise Monitoring Levels – dB					
		L_{A1}	L_{A10}	L_{Aeq}	L_{A50}	L_{A90}	$L_{Aeq,LF}$ [1]	L_{A1}	L_{A10}	L_{Aeq}	L_{A50}	L_{A90}	MCO L_{Aeq} [2]
NA2/SX36	10/09/19 23:00	49	39	39	35	33	37	40	37	35	34	33	35
NA3/SX35	10/09/19 23:30	NR	NR	NR	NR	NR	NR	43	36	34	31	28	<30
NA10/SX44	11/10/19 00:00	30	25	24	23	21	21	35	26	25	21	19	<20
NA12/SX39	10/09/19 22:30	52	38	39	32	29	36	41	35	32	29	27	<30

Notes:

1. *$L_{Aeq,LF}$ refers to $L_{Aeq,15minute}$ in the frequency range 20 to 630 Hz as measured by the real-time noise monitors; and*
2. *MCO L_{Aeq} refers to the site-only $L_{Aeq,15minute}$ attributed to MCO during attended monitoring.*
3. *NR refers to data that was not recorded by the logger.*

4.5 Atmospheric Conditions

Atmospheric condition data measured by the operator during each measurement using a Kestrel hand-held weather meter is shown in Table 4.5. The wind speed, direction and temperature were measured at approximately 1.8 metres. Attended noise monitoring is not undertaken during rain hail, or wind speeds above 5 m/s at microphone height.

Table 4.5: MEASURED ATMOSPHERIC CONDITIONS – SEPTEMBER 2019

Location	Start Date and Time	Temperature °C	Wind Speed m/s	Wind Direction ° Magnetic North[1]	Cloud Cover 1/8s
NA1	11/09/2019 11:06	17	0.6	345	0
NA2	10/09/2019 22:58	5	0.4	90	0
NA3	10/09/2019 23:29	8	2.0	80	0
NA6	10/09/2019 22:00	9	1.5	90	0
NA10	11/09/2019 00:03	6	0.0	-	0
NA12	10/09/2019 22:29	7	1.6	90	0

Notes:

1. *"-" indicates calm conditions at monitoring location.*

Meteorological data used for compliance assessment is sourced from the WCP AWS.

6 SUMMARY

Global Acoustics was engaged by MCO to conduct a monthly noise survey of operations at Moolarben Coal Mine. The purpose of the survey was to quantify and describe the acoustic environment around the site and compare results with specified limits.

Monthly attended environmental noise monitoring described in this report was undertaken during the day period of 11 September and night period of 10/11 September 2019.

MCO complied with project specific criteria at all monitoring sites during the September 2019 survey. In accordance with Condition R4.2(b) of the EPL, no management actions have taken place at MCO as a result of attended monitoring as there were no exceedances recorded during the monitoring period.

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Environmental Noise Monitoring – October 2019

4.3 Attended Noise Monitoring

Noise levels from MCO in the absence of other noise sources are shown in Table 4.2 and Table 4.3, and are reproduced in Appendix B in a format generally specified in the EPA guidelines '*Requirements for Publishing Pollution Monitoring Data*' (March 2012). Discussion as to the noise sources responsible for these measured levels is provided in Section 5 of this report.

Table 4.2: $L_{Aeq,15minute}$ GENERATED BY MCO AGAINST IMPACT ASSESSMENT CRITERIA – OCTOBER 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies [1]	MCO L_{Aeq} dB [2]	Exceedance dB [3]
NA1	02/10/2019 09:00	2.6	A	43[4]	Yes	IA	Nil
NA6	01/10/2019 22:00	0.7	F	37	Yes	32	Nil
NA12	01/10/2019 22:30	1.2	F	35	Yes	28	Nil

Notes:

1. *As detailed in the EPL, noise emission limits apply under all meteorological conditions except:*
   - *Wind speeds greater than 3 m/s at 10 metres above ground level; or*
   - *Stability class F temperature inversion conditions, and wind speeds greater than 2 m/s at 10 metres above ground level; or*
   - *Stability class G temperature inversions;*
2. *Site-only $L_{Aeq,15minute}$ attributed to MCO, including modifying factors if applicable;*
3. *NA in exceedance column means criterion was not applicable due to atmospheric conditions outside those specified in EPL; and*
4. *External criterion. A difference of 8 dB between the internal and external criterion has been adopted at NA1 for consistency with previous versions of the NMP.*

As impact assessment criteria are more stringent than land acquisition or noise mitigation criteria and MCO levels complied with impact assessment criteria in all measurements as shown in Table 4.2, no comparison against mitigation or land acquisition criteria is required.

Table 4.3: $L_{A1,1minute}$ GENERATED BY MCO AGAINST IMPACT ASSESSMENT CRITERIA – OCTOBER 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies [1]	MCO $L_{A1,1min}$ dB [2]	Exceedance dB [3]
NA6	01/10/2019 22:00	0.7	F	45	Yes	39	Nil
NA12	01/10/2019 22:30	1.2	F	45	Yes	32	Nil

Notes:

1. *As detailed in the EPL, noise emission limits apply under all meteorological conditions except:*
   - *Wind speeds greater than 3 m/s at 10 metres above ground level; or*
   - *Stability class F temperature inversion conditions, and wind speeds greater than 2 m/s at 10 metres above ground level; or*
   - *Stability class G temperature inversions;*
2. *Site-only $L_{A1,1minute}$ attributed to MCO; and*
3. *NA in exceedance column means criterion was not applicable due to atmospheric conditions outside those specified in EPL.*

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4.4 Attended Validation Noise Monitoring

Table 4.4 presents data recorded concurrently at the real-time noise monitor and attended monitoring locations.

Table 4.4: REAL-TIME VERSUS ATTENDED DATA COMPARISON – OCTOBER 2019

Location	Start Date and Time	Real-time Noise Monitor Levels – dB						Attended Noise Monitoring Levels – dB					
		L_{A1}	L_{A10}	L_{Aeq}	L_{A50}	L_{A90}	$L_{Aeq,LF}$ [1]	L_{A1}	L_{A10}	L_{Aeq}	L_{A50}	L_{A90}	MCO L_{Aeq} [2]
NA2/SX36	01/10/2019 23:00	42	40	38	38	36	38	40	38	36	35	34	36
NA3/SX35	01/10/2019 23:30	47	37	36	33	31	35	43	38	35	32	29	31
NA10/SX44	02/10/2019 00:00	38	34	30	27	25	29	34	30	28	26	24	28
NA12/SX39	01/10/2019 22:30	NR	NR	NR	NR	NR	NR	45	35	33	29	26	28

Notes:

1. *$L_{Aeq,LF}$ refers to $L_{Aeq,15minute}$ in the frequency range 20 to 630 Hz as measured by the real-time noise monitors; and*
2. *MCO L_{Aeq} refers to the site-only $L_{Aeq,15minute}$ attributed to MCO during attended monitoring; and*
3. *NR indicates data was not recorded by real-time monitoring station.*

4.5 Atmospheric Conditions

Atmospheric condition data measured by the operator during each measurement using a Kestrel hand-held weather meter is shown in Table 4.5. The wind speed, direction and temperature were measured at approximately 1.8 metres. Attended noise monitoring is not undertaken during rain hail, or wind speeds above 5 m/s at microphone height.

Table 4.5: MEASURED ATMOSPHERIC CONDITIONS – OCTOBER 2019

Location	Start Date and Time	Temperature ° C	Wind Speed m/s	Wind Direction ° Magnetic North[1]	Cloud Cover 1/8s
NA1	02/10/2019 09:00	22	1.3	250	0
NA2	01/10/2019 23:00	11	0.0	-	0
NA3	01/10/2019 23:30	13	1.2	100	0
NA6	01/10/2019 22:00	14	1.6	30	0
NA10	02/10/2019 00:00	9	0.0	-	0
NA12	01/10/2019 22:30	13	0.0	-	0

Notes:

1. *"-" indicates calm conditions at monitoring location.*

Meteorological data used for compliance assessment is sourced from the WCP AWS.

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6 SUMMARY

Global Acoustics was engaged by MCO to conduct a monthly noise survey of operations at Moolarben Coal Mine. The purpose of the survey was to quantify and describe the acoustic environment around the site and compare results with specified limits.

Monthly attended environmental noise monitoring described in this report was undertaken during the day period of 2 October and night period of 1/2 October 2019.

MCO complied with project specific criteria at all monitoring sites during the October 2019 survey. In accordance with Condition R4.2(b) of the EPL, no management actions have taken place at MCO as a result of attended monitoring as there were no exceedances recorded during the monitoring period.

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Environmental Noise Monitoring – November 2019

4.3 Attended Noise Monitoring

Noise levels from MCO in the absence of other noise sources are shown in Table 4.2 and Table 4.3, and are reproduced in Appendix B in a format generally specified in the EPA guidelines '*Requirements for Publishing Pollution Monitoring Data*' (March 2012). Discussion as to the noise sources responsible for these measured levels is provided in Section 5 of this report.

Table 4.2: $L_{Aeq,15minute}$ GENERATED BY MCO AGAINST IMPACT ASSESSMENT CRITERIA – QUARTER 4 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies [1]	MCO L_{Aeq} dB [2]	Exceedance dB [3]
NA1	19/11/2019 10:42	3.3	A	43[4]	No	IA	NA
NA6	18/11/2019 23:43	0.8	F	37	Yes	IA	Nil
NA12	19/11/2019 01:16	0.0	G	35	No	IA	NA
GRNP	18/11/2019 22:43	0.6	G	50	No	33	NA
MGNR	19/11/2019 02:35	0.0	G	50	No	IA	NA

Notes:

1. *As detailed in the EPL, noise emission limits apply under all meteorological conditions except:*
   - *Wind speeds greater than 3 m/s at 10 metres above ground level; or*
   - *Stability class F temperature inversion conditions, and wind speeds greater than 2 m/s at 10 metres above ground level; or*
   - *Stability class G temperature inversions;*
2. *Site-only $L_{Aeq,15minute}$ attributed to MCO, including modifying factors if applicable;*
3. *NA in exceedance column means criterion was not applicable due to atmospheric conditions outside those specified in EPL; and*
4. *External criterion. A difference of 8 dB between the internal and external criterion has been adopted at NA1 for consistency with previous versions of the NMP.*

As impact assessment criteria are more stringent than land acquisition or noise mitigation criteria and MCO levels complied with impact assessment criteria in all measurements as shown in Table 4.2, no comparison against mitigation or land acquisition criteria is required.

Table 4.3: $L_{A1,1minute}$ GENERATED BY MCO AGAINST IMPACT ASSESSMENT CRITERIA – QUARTER 4 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies [1]	MCO $L_{A1,1min}$ dB [2]	Exceedance dB [3]
NA6	18/11/2019 23:43	0.8	F	45	Yes	IA	Nil
NA12	19/11/2019 01:16	0.0	G	45	No	IA	NA

Cumulative noise levels generated by total mining activity are shown in Table 4.4. The mining-only $L_{Aeq,15minute}$ is compared to cumulative criteria contained in the Ulan Coal Mines project approval.

Table 4.4: $L_{Aeq,15minute}$ GENERATED BY ALL MINES AGAINST UCML CUMULATIVE CRITERIA – QUARTER 4 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies?	Cumulative $L_{Aeq,15min}$ dB[1]	Exceedance
NA11	18/11/2019 23:16	0.0	G	40	No	Nil	NA

Notes:

1. *By definition, cumulative noise refers to two or more noise sources. If only one source of mining noise is audible then the measured cumulative noise is defined here as 'Nil'.*

4.4 Attended Validation Noise Monitoring

Table 4.5 presents data recorded concurrently at the real-time noise monitor and attended monitoring locations.

Table 4.5: REAL-TIME VERSUS ATTENDED DATA COMPARISON – QUARTER 4 2019

Location	Start Date and Time	Real-time Noise Monitor Levels - dB						Attended Noise Monitoring Levels - dB					
		L_{A1}	L_{A10}	L_{Aeq}	L_{A50}	L_{A90}	$L_{Aeq,LF}$ [1]	L_{A1}	L_{A10}	L_{Aeq}	L_{A50}	L_{A90}	MCO L_{Aeq} [2]
NA2/SX36	19/11/2019 00:45	36	29	25	19	15	23	36	29	26	22	19	<20
NA3/SX35	19/11/2019 00:15	28	21	19	16	15	18	31	23	21	18	17	IA
NA10/SX44	19/11/2019 01:46	33	20	21	19	18	14	36	21	24	17	16	IA
NA12/SX39	19/11/2019 01:16	42	34	30	22	13	26	43	35	32	25	16	IA

Notes:

1. *$L_{Aeq,LF}$ refers to $L_{Aeq,15minute}$ in the frequency range 20 to 630 Hz as measured by the real-time noise monitors; and*
2. *MCO L_{Aeq} refers to the estimated or measured $L_{Aeq,15minute}$ attributed to MCO during attended monitoring..*

6 SUMMARY

Global Acoustics was engaged by MCO to conduct a quarterly noise survey of operations at Moolarben Coal Mine. The purpose of the survey was to quantify and describe the acoustic environment around the site and compare results with specified limits.

Attended environmental noise monitoring described in this report was undertaken for Quarter 4 2019 during the day period of 19 November and night period of 18/19 November 2019.

MCO complied with project specific criteria at all monitoring sites during the quarterly Quarter 4 2019 survey. In accordance with Condition R4.2(b) of the EPL, no management actions have taken place at MCO as a result of attended monitoring as there were no exceedances recorded during the monitoring period.

Global Acoustics Pty Ltd

Environmental Noise Monitoring – December 2019

4.3 Attended Noise Monitoring

Noise levels from MCO in the absence of other noise sources are shown in Table 4.2 and Table 4.3, and are reproduced in Appendix B in a format generally specified in the EPA guidelines '*Requirements for Publishing Pollution Monitoring Data*' (March 2012). Discussion as to the noise sources responsible for these measured levels is provided in Section 5 of this report.

Table 4.2: $L_{Aeq,15minute}$ GENERATED BY MCO AGAINST IMPACT ASSESSMENT CRITERIA – DECEMBER 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies [1]	MCO L_{Aeq} dB [2]	Exceedance dB [3]
NA1	10/12/2019 10:50	2.8	A	43[4]	Yes	IA	Nil
NA6	09/12/2019 22:26	0.9	G	37	No	<20	NA
NA12	09/12/2019 22:00	0.8	G	35	No	IA	NA

Notes:

1. *As detailed in the EPL, noise emission limits apply under all meteorological conditions except:*
   - *Wind speeds greater than 3 m/s at 10 metres above ground level; or*
   - *Stability class F temperature inversion conditions, and wind speeds greater than 2 m/s at 10 metres above ground level; or*
   - *Stability class G temperature inversions;*
2. *Site-only $L_{Aeq,15minute}$ attributed to MCO, including modifying factors if applicable;*
3. *NA in exceedance column means criterion was not applicable due to atmospheric conditions outside those specified in EPL; and*
4. *External criterion. A difference of 8 dB between the internal and external criterion has been adopted at NA1 for consistency with previous versions of the NMP.*

As impact assessment criteria are more stringent than land acquisition or noise mitigation criteria and MCO levels complied with impact assessment criteria in all measurements as shown in Table 4.2, no comparison against mitigation or land acquisition criteria is required.

Table 4.3: $L_{A1,1minute}$ GENERATED BY MCO AGAINST IMPACT ASSESSMENT CRITERIA – DECEMBER 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion dB	Criterion Applies [1]	MCO $L_{A1,1min}$ dB [2]	Exceedance dB [3]
NA6	09/12/2019 22:26	0.9	G	45	No	<20	NA
NA12	09/12/2019 22:00	0.8	G	45	No	IA	NA

Notes:

1. *As detailed in the EPL, noise emission limits apply under all meteorological conditions except:*
   - *Wind speeds greater than 3 m/s at 10 metres above ground level; or*
   - *Stability class F temperature inversion conditions, and wind speeds greater than 2 m/s at 10 metres above ground level; or*
   - *Stability class G temperature inversions;*
2. *Site-only $L_{A1,1minute}$ attributed to MCO; and*
3. *NA in exceedance column means criterion was not applicable due to atmospheric conditions outside those specified in EPL.*

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4.4 Attended Validation Noise Monitoring

Table 4.4 presents data recorded concurrently at the real-time noise monitor and attended monitoring locations.

Table 4.4: REAL-TIME VERSUS ATTENDED DATA COMPARISON – DECEMBER 2019

Location	Start Date and Time	Real-time Noise Monitor Levels – dB						Attended Noise Monitoring Levels – dB					
		L_{A1}	L_{A10}	L_{Aeq}	L_{A50}	L_{A90}	$L_{Aeq,LF}$ [1]	L_{A1}	L_{A10}	L_{Aeq}	L_{A50}	L_{A90}	MCO L_{Aeq} [2]
NA2/SX36	09/12/2019 23:30	43	41	39	39	37	32	40	38	36	36	34	34
NA3/SX35	09/12/2019 23:00	44	40	36	33	25	24	45	41	37	34	28	<25
NA10/SX44	10/12/2019 00:00	37	33	30	29	25	24	34	30	27	26	24	26
NA12/SX39	09/12/2019 22:00	40	35	31	26	18	19	40	35	30	24	16	IA

Notes:

1. *$L_{Aeq,LF}$ refers to $L_{Aeq,15minute}$ in the frequency range 20 to 630 Hz as measured by the real-time noise monitors; and*
2. *MCO L_{Aeq} refers to the site-only $L_{Aeq,15minute}$ attributed to MCO during attended monitoring.*

4.5 Atmospheric Conditions

Atmospheric condition data measured by the operator during each measurement using a Kestrel hand-held weather meter is shown in Table 4.5. The wind speed, direction and temperature were measured at approximately 1.8 metres. Attended noise monitoring is not undertaken during rain hail, or wind speeds above 5 m/s at microphone height.

Table 4.5: MEASURED ATMOSPHERIC CONDITIONS – DECEMBER 2019

Location	Start Date and Time	Temperature ° C	Wind Speed m/s	Wind Direction ° Magnetic North[1]	Cloud Cover 1/8s
NA1	10/12/2019 10:50	25	0.5	260	0
NA2	09/12/2019 23:30	22	0.0	-	0
NA3	09/12/2019 23:00	27	0.0	-	0
NA6	09/12/2019 22:26	25	0.0	-	0
NA10	10/12/2019 00:00	21	0.0	-	0
NA12	09/12/2019 22:00	27	0.0	-	0

Notes:

1. *"-" indicates calm conditions at monitoring location.*

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6 SUMMARY

Global Acoustics was engaged by MCO to conduct a monthly noise survey of operations at Moolarben Coal Mine. The purpose of the survey was to quantify and describe the acoustic environment around the site and compare results with specified limits.

Monthly attended environmental noise monitoring described in this report was undertaken during the day period of 10 December and night period of 9/10 December 2019.

MCO complied with project specific criteria at all monitoring sites during the December 2019 survey. In accordance with Condition R4.2(b) of the EPL, no management actions have taken place at MCO as a result of attended monitoring as there were no exceedances recorded during the monitoring period.

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APPENDIX 3C. BLAST MONITORING DATA

Date	Time	BM1 Ulan School		BM5 Ridge Road	
		Ground Vibration (mm/s)	Blast Overpressure (dBL)	Ground Vibration (mm/s)	Blast Overpressure (dBL)
2/01/2019	16:15	0.16	89.1	0.48	96.7
4/01/2019	16:14	0.25	96.3	0.18	91.3
7/01/2019	16:07	0.23	107.6	0.14	103.7
9/01/2019	16:07	0.13	92.5	0.10	89.9
10/01/2019	16:06	0.23	99.0	0.21	105.5
18/01/2019	16:39	0.27	107.2	0.14	95.6
18/01/2019	16:45	0.39	99.6	0.24	99.0
22/01/2019	12:07	0.10	89.2	0.30	90.8
22/01/2019	16:17	0.19	90.8	0.13	94.1
26/01/2019	16:02	0.07	84.1	0.20	94.6
30/01/2019	13:09	0.26	90.7	0.71	95.4
31/01/2019	16:11	0.09	93.2	0.27	88.1
1/02/2019	12:00	0.10	99.2	0.32	114.5
6/02/2019	16:12	0.37	107.6	0.15	104.1
12/02/2019	12:23	0.21	112.2	0.30	107.0
12/02/2019	12:32	0.10	112	0.14	97.7
16/02/2019	16:10	0.33	103.7	0.20	95.7
18/02/2019	16:15	0.13	97.0	0.13	87.5
21/02/2019	12:11	0.24	114.5	0.29	105.5
25/02/2019	16:10	0.25	99.1	0.46	107.7
1/03/2019	12:05	0.17	90.5	0.21	100.0
4/03/2019	16:05	0.18	103.9	0.07	97.1
4/03/2019	16:10	0.28	96.9	0.22	95.8
7/03/2019	12:08	0.20	104.2	0.08	108.7
9/03/2019	12:01	0.15	94.1	0.25	100.9
11/03/2019	16:02	0.25	100.3	0.16	91.1
14/03/2019	16:09	0.15	96.4	0.20	95.6
15/03/2019	16:08	0.11	99.2	0.06	97.5
15/03/2019	16:20	0.15	91.5	0.07	102.2
18/03/2019	16:12	0.15	90.0	0.17	94.6
20/03/2019	12:07	0.28	107.0	0.28	99.8
25/03/2019	16:17	0.34	100.5	0.16	90.1
28/03/2019	15:59	0.16	94.0	0.12	98.3
29/03/2019	15:53	0.19	101.3	0.14	93.5
3/04/2019	12:46	0.18	95.6	0.09	88.3
3/04/2019	12:52	0.12	89.3	0.14	81.9
4/04/2019	16:08	0.18	96.4	0.15	98.5
6/04/2019	16:04	0.15	85.7	0.45	94.5
8/04/2019	12:27	0.14	86.8	0.35	97.2
9/04/2019	13:40	0.22	103.2	0.39	94.6
11/04/2019	12:10	0.30	111.2	0.11	111.3
13/04/2019	16:15	0.08	91.9	0.29	98.2
16/04/2019	16:20	0.32	97.9	0.58	103.3
23/04/2019	15:59	0.46	93.6	0.70	103.1
26/04/2019	16:15	0.23	102.4	0.20	101.0
27/04/2019	16:15	0.21	105.0	0.21	95.4
29/04/2019	12:09	0.23	105.1	0.12	98.4

Date	Time	BM1 Ulan School		BM5 Ridge Road	
		Ground Vibration (mm/s)	Blast Overpressure (dBL)	Ground Vibration (mm/s)	Blast Overpressure (dBL)
29/04/2019	12:14	0.16	100.7	0.13	102.3
6/05/2019	16:05	0.29	108.8	0.30	97.1
8/05/2019	13:11	0.09	96.6	0.05	86.5
10/05/2019	16:16	0.27	96.3	0.33	96.1
13/05/2019	15:57	0.24	82.5	0.80	87.3
18/05/2019	16:06	0.08	88.6	0.19	101.5
20/05/2019	16:01	0.23	90.3	0.43	91.9
22/05/2019	16:00	0.22	89.6	0.19	78.1
25/05/2019	15:53	0.05	82.1	0.17	85.1
27/05/2019	12:00	0.09	97.8	0.23	100.8
27/05/2019	16:10	0.14	85.8	0.15	84.1
29/05/2019	16:20	0.32	101.8	0.30	94.6
3/06/2019	12:03	0.09	97.9	0.16	93.6
3/06/2019	12:15	0.20	100.0	0.10	93.3
5/06/2019	12:22	0.23	111.8	0.28	95.8
7/06/2019	12:30	0.24	109.0	0.14	100.1
7/06/2019	12:41	0.30	101.9	0.16	99.8
8/06/2019	16:41	0.10	86.7	0.08	76.1
12/06/2019	16:43	0.24	87.2	0.30	82.7
13/06/2019	16:40	0.29	91.6	0.22	76.1
17/06/2019	16:30	0.20	103.6	0.19	96.8
22/06/2019	16:01	0.11	96.6	0.10	94.7
24/06/2019	12:05	0.17	100.5	0.27	103.2
1/07/2019	12:27	0.31	112.7	0.30	104.4
2/07/2019	16:00	0.80	94.5	0.34	109.3
2/07/2019	16:52	0.04	83.6	0.12	85.9
3/07/2019	16:10	0.05	102.0	0.30	99.2
6/07/2019	12:06	0.15	105.0	0.13	106.4
8/07/2019	12:21	0.25	97.9	0.24	100.9
10/07/2019	12:12	0.14	88.4	0.17	78.4
13/07/2019	12:04	0.06	106.4	0.04	97.5
16/07/2019	13:12	0.09	99.5	0.19	99.4
17/07/2019	16:43	0.30	99.4	0.37	95.0
19/07/2019	12:03	0.08	94.9	0.22	96.9
23/07/2019	16:11	0.53	103.5	0.25	93.0
24/07/2019	12:07	0.14	97.3	0.09	91.3
26/07/2019	13:13	0.12	99.1	0.07	93.4
26/07/2019	13:23	0.22	101.4	0.20	99.0
29/07/2019	12:09	0.05	84.5	0.05	80.6
1/08/2019	16:09	0.25	108.7	0.15	95.4
3/08/2019	16:08	0.20	95.8	0.35	92.3
5/08/2019	16:48	0.13	88.0	0.20	81.6
6/08/2019	16:52	0.22	94.2	0.15	80.6
15/08/2019	12:07	0.09	86.7	0.05	102.5
15/08/2019	16:27	0.10	89.2	0.12	87.9
17/08/2019	12:24	0.20	97.2	0.26	91.0
21/08/2019	17:00	0.21	102.9	0.24	99.5
23/08/2019	12:14	0.14	102.2	0.11	100.5
23/08/2019	12:21	0.10	90.2	0.05	81.9

Date	Time	BM1 Ulan School		BM5 Ridge Road	
		Ground Vibration (mm/s)	Blast Overpressure (dBL)	Ground Vibration (mm/s)	Blast Overpressure (dBL)
28/08/2019	15:59	0.16	97.8	0.23	95.0
31/08/2019	16:07	0.08	99.5	0.08	87.1
31/08/2019	16:12	0.1	98.0	0.12	96.5
2/09/2019	12:00	0.13	91.4	0.15	107.5
11/09/2019	16:00	0.10	92.0	0.11	93.3
13/09/2019	12:06	0.30	106.0	0.27	88.3
13/09/2019	15:57	0.04	83.4	0.09	89.8
17/09/2019	12:15	0.15	98.4	0.16	97.1
18/09/2019	16:09	0.23	98.7	0.13	102.2
20/09/2019	13:19	0.14	90.0	0.09	84.5
20/09/2019	13:23	0.06	94.2	0.10	98.2
21/09/2019	16:00	0.08	89.2	0.12	85.5
23/09/2019	12:13	0.14	99.9	0.10	113.4
28/09/2019	16:06	0.09	103.8	0.13	85.6
30/09/2019	12:06	0.21	94.3	0.15	94.1
1/10/2019	12:12	0.14	103.2	0.12	98.1
4/10/2019	12:02	0.04	95.7	0.30	105.2
10/10/2019	12:05	0.51	114.1	0.18	106.0
10/10/2019	12:05	0.17	114.1	0.05	102.4
12/10/2019	12:06	0.06	95.5	0.09	88.1
14/10/2019	12:06	0.13	87.1	0.07	100.9
17/10/2019	12:22	0.09	105.6	0.19	98.9
19/10/2019	11:59	0.42	107.6	0.18	98.7
21/10/2019	11:58	0.27	97.6	0.17	88.2
22/10/2019	15:58	0.22	99.0	0.23	107.0
25/10/2019	16:06	0.58	99.0	0.05	95.0
28/10/2019	16:05	0.09	97.0	0.20	104.6
31/10/2019	16:01	0.24	111.0	0.09	106.0
1/11/2019	11:57	0.11	98.0	0.07	95.7
2/11/2019	15:53	0.31	87.8	0.21	88.0
2/11/2019	16:04	0.11	88.9	0.08	98.9
4/11/2019	12:11	0.12	99.9	0.09	93.5
4/11/2019	12:16	0.12	89.8	0.08	106.3
5/11/2019	16:00	0.08	93.3	0.07	95.5
7/11/2019	16:03	0.08	111.5	0.05	110.4
9/11/2019	16:08	0.23	96.6	0.15	102.1
9/11/2019	16:13	0.21	91.6	0.18	108.1
11/11/2019	12:04	0.16	99.6	0.10	94.4
12/11/2019	12:09	0.28	101.5	0.18	111.7
18/11/2019	12:58	0.06	97.3	0.03	94.2
20/11/2019	12:17	0.07	94.0	0.07	91.9
21/11/2019	12:07	0.23	103.5	0.13	99.9
21/11/2019	12:12	0.41	90.6	0.24	98.8
22/11/2019	16:02	0.05	93.4	0.03	98.7
23/11/2019	12:10	0.14	96.7	0.23	94.2
27/11/2019	16:06	0.15	102.5	0.33	99.9
29/11/2019	16:06	0.06	91.4	0.06	107.6
2/12/2019	12:07	0.12	105.9	0.07	98.8
5/12/2019	12:01	0.27	99.6	0.11	100.1

Date	Time	BM1 Ulan School		BM5 Ridge Road	
		Ground Vibration (mm/s)	Blast Overpressure (dBL)	Ground Vibration (mm/s)	Blast Overpressure (dBL)
7/12/2019	12:04	0.22	90.5	0.08	94.0
9/12/2019	11:59	0.13	88.2	0.13	89.6
11/12/2019	16:01	0.07	91.4	0.04	86.6
12/12/2019	12:18	0.02	81.1	0.01	83.4
12/12/2019	15:59	0.08	94.0	0.18	98.4
13/12/2019	16:02	0.15	91.6	0.09	95.9
18/12/2019	12:13	0.20	99.7	0.15	119.0
19/12/2019	15:59	0.06	103.3	0.07	90.2
23/12/2019	12:06	0.24	95.0	0.09	92.5
23/12/2019	16:01	0.07	96.0	0.10	92.7
28/12/2019	16:09	0.19	101.6	0.11	96.8
30/12/2019	16:21	0.14	91.7	0.08	90.7

APPENDIX 3D. AIR QUALITY DATA

Table A : Summary of the MCO Air Quality-Monitoring Program

Monitoring Parameter	Monitoring Location	Frequency	Justification
Dust Deposition	DG01 – Bobadeen	Every 30 days ± 2 days	Background monitoring north of the Moolarben Coal Complex.
	DG04 – Ulan Village	Every 30 days ± 2 days	Representative of nearest non-mine owned residences to the north-west of the Moolarben Coal Complex.
	DG05 – Glenmoor	Every 30 days ± 2 days	Representative of nearest non-mine owned residences to the south-west and west of the Moolarben Coal Complex.
	DG06 – Barcoo	Every 30 days ± 2 days	Representative of mine owned residences to the south, south-west and west of the Moolarben Coal Complex.
	DG07 – Hillside	Every 30 days ± 2 days	Representative of mine owned residences to the south of the Moolarben Coal Complex.
	DG08 – Croydon	Every 30 days ± 2 days	Representative of mine owned residences to the south of the Moolarben Coal Complex.
	DG09 – Wilga	Every 30 days ± 2 days	Representative of non-mine owned residences to the south-west and west of the Moolarben Coal Complex.
	DG11 – Ridge Road	Every 30 days ± 2 days	Representative of non-mine owned residences to the south-west and west of the Moolarben Coal Complex.
	DG12 – Ulan-Wollar Rd	Every 30 days ± 2 days	Representative of mine owned land east of the Moolarben Coal Complex.
	DG 13 – Winchester Cres	Every 30 days ± 2 days	Representative of non-mine owned residences to the southwest and west of the Moolarben Coal Complex
	DG 14 – Murragamba Valley	Every 30 days ± 2 days	Representative of mine owned land to the south of the Moolarben Coal Complex.
HVAS – PM10	PM 01 (Ulan Village)	Every 6 days	Indicative of potential impacts to nearest non-mine owned residences to the north-west of the Moolarben Coal Complex.
	PM 02 (Ridge Road)	Every 6 days	Background monitoring south-west and west of the Moolarben Coal Complex.
Real Time PM_{10}	TEOM 01 (Ulan School)	Real Time PM_{10}	Real time monitoring at Ulan Public School.
	TEOM 04 (Ulan Road)	Real Time PM_{10}	Real time monitoring representative of nearest non-mine owned residences to the west of the Moolarben Coal Complex.
	TEOM 07 (Ulan Road)	Real Time PM_{10}	Real time monitoring representative of non-mine owned residences to the south-west of and west of the Moolarben Coal Complex.
	TEOM 06 (Ulan-Wollar Rd)	Real Time PM_{10}	Real time monitoring not representative of private residences, used to measure “upwind” air quality.
Real Time $PM_{2.5}$	TEOM 07 (Ulan Road)	Real Time $PM_{2.5}$	Real time monitoring representative of non-mine owned residences to the south-west of and west of the Moolarben Coal Complex.

Table B : Summary of the MCO Air Quality-Monitoring Program – Dust Deposition

Dust Gauge	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19
DG1	2.1	0.7	4.7C	0.8	0.7	0.3	0.4	1.1	1.2	1.9	1.4	3.3
DG4	1.9	1.6	2.8	0.5	1.2	0.7	0.9	1.0	1.7	3.0	3.4	2.4
DG5	2.3	1.8	0.9	0.9	1.0	0.7	1.4	0.4	1.8	1.8	3.0	1.9
DG6	1.3	1.6	1.1	1.8	1.0	0.6	0.6	0.8	1.1	2.7	3.2	1.9
DG7	2.7	1.1	1.1	1.1	0.7	0.5	0.6	0.4	1.5	2.7	2.3	1.2
DG8	2.7	1.0	3.2	1.5	1.2	0.4	0.5	0.8	1.8	2.2	3.8	3.0
DG9	2.2	0.9	3.1	1.8	1.1	0.4	1.0	0.4	1.5	1.9	2.5	1.4
DG11	3.7	1.8	2.4	2.3	0.9	0.4	1.3	0.9	1.4	2.8	4.4C	2.1
DG12	2.3	1.3	1.8	0.2	1.7	1.7	1.5	1.8	2.2	^	2.1	1.5
DG13	2.6	1.6	2.2	1.5	1.4	0.4	0.9	0.9	1.3	2.3	2.2	5.3C
DG14	2.4	1.8	1.7	10.2C	4.7C	0.8	0.3	1.1	2.9	2.7	2.6	2.6

^ Dust gauge bottle damaged – no sample available

C – Dust gauge deemed contaminated after analysis of influencing factors. These factors include an ash residue result of <50%, the presence of bird droppings or other contaminants such as insects in the dust gauge and analysis of historical results from the dust gauge.

Figure 3-b 2015 to 2019 Dust Depositional Results

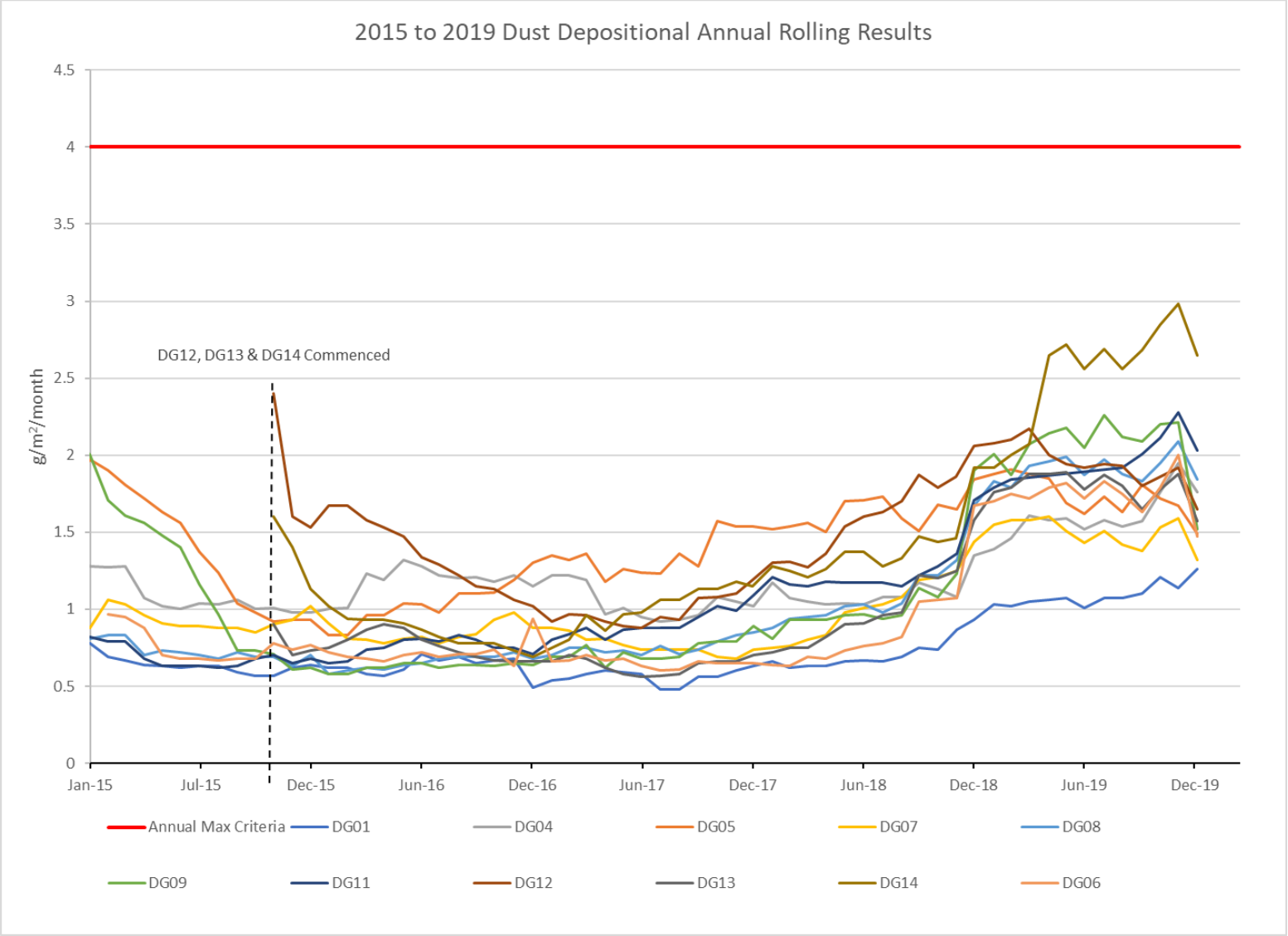


Table 3: TEOM Monitoring Data

Date	Ulan School TEOM01 EPL 17	Lagoons Road TEOM04	Ulan Road TEOM07 EPL27		Ulan-Wollar Road TEOM06* EPL15	Comment
	PM10 Daily Result (24hr Average Limit = 50µg/m³)			PM2.5 Daily Result (24hr Average Limit = 25µg/m³)	PM10 Daily Result (µg/m³)	
1/01/2019	21.1	27.9	22.9		20.1	
2/01/2019	31.4	36.9	30.7		33.8	
3/01/2019	23.2	21.8	21.5		22.0	
4/01/2019	21.5	28.3	27.4		4.3	
5/01/2019	16.8	26.3	25.0		26.1	
6/01/2019	11.1	15.2	12.4		6.7	
7/01/2019	7.9	14.1	8.8		4.3	
8/01/2019	16.7	19.0	16.6		13.2	
9/01/2019	24.6	25.8	23.6		15.1	
10/01/2019	17.6	29.0	-		15.8	Equipment breakdown.
11/01/2019	12.5	21.5	-		8.9	Equipment breakdown.
12/01/2019	20.1	24.4	-		15.4	Equipment breakdown.
13/01/2019	25.1	29.2	-		18.6	Equipment breakdown.
14/01/2019	19.9	24.8	-		15.2	Equipment breakdown.
15/01/2019	29.2	34.3	-		28.7	Equipment breakdown.
16/01/2019	61.6	49.6	-		-	Equipment breakdown & Power Outage.
17/01/2019	38.0	46.4	37.9		-	Power outage.
18/01/2019	28.0	33.8	30.8		28.3	
19/01/2019	29.8	38.1	32.0		33.9	
20/01/2019	11.2	22.5	15.5		11.9	
21/01/2019	8.7	11.1	9.0		5.0	
22/01/2019	20.6	23.6	19.2		21.9	
23/01/2019	-	10.8	10.1		-	Power outage.
24/01/2019	22.5	25.8	19.2		17.5	
25/01/2019	21.8	26.2	21.4		19.9	
26/01/2019	23.0	25.9	23.3		-	Power outage.
27/01/2019	28.7	31.8	27.6		31.2	
28/01/2019	19.2	29.8	22.1		13.0	
29/01/2019	-	-	-		15.6	Power outage.
30/01/2019	15.3	16.3	18.6		22.4	
31/01/2019	14.7	19.6	20.0		29.8	
1/02/2019	13.9	14.6	9.3		3.3	
2/02/2019	9.9	13.5	7.4		5.6	
3/02/2019	14.2	17.6	13.6		9.3	
4/02/2019	24.7	29.8	21.3		37.2	
5/02/2019	29.8	32.0	19.6		18.3	
6/02/2019	19.3	18.9	10.1		6.8	
7/02/2019	14.6	20.7	12.5		9.6	
8/02/2019	11.7	14.7	14.5		18.7	
9/02/2019	14.7	19.4	19.6		11.6	
10/02/2019	20.7	24.9	22.2		4.2	
11/02/2019	14.5	24.3	19.9		6.5	
12/02/2019	27.9	36.8	39.6		5.4	

Date	Ulan School TEOM01 EPL 17	Lagoons Road TEOM04	Ulan Road TEOM07 EPL27		Ulan-Wollar Road TEOM06* EPL15	Comment
	PM10 Daily Result (24hr Average Limit = 50µg/m³)			PM2.5 Daily Result (24hr Average Limit = 25µg/m³)	PM10 Daily Result (µg/m³)	
13/02/2019	65.5	73.0	74.2		5.4	
14/02/2019	40.0	48.5	30.9		4.6	
15/02/2019	25.4	30.4	18.5		16.1	
16/02/2019	14.9	23.9	12.8		9.4	
17/02/2019	15.6	24.3	19.9		14.8	
18/02/2019	30.5	39.9	39.0		36.7	
19/02/2019	42.0	45.7	51.6		42.3	
20/02/2019	15.8	22.0	-		18.3	Power outage during installation of PM2.5
21/02/2019	12.2	12.0	7.1	3.7	3.5	
22/02/2019	13.0	13.9	7.7	3.3	10.6	
23/02/2019	10.3	10.1	6.9	3.4	7.7	
24/02/2019	17.6	20.7	11.8	4.3	14.3	
25/02/2019	19.7	26.9	16.2	6.9	14.8	
26/02/2019	18.1	22.1	14.5	5.4	18.4	
27/02/2019	23.1	26.4	17.8	6.5	24.2	
28/02/2019	16.3	16.2	10.4	4.0	8.1	
1/03/2019	17.1	20.8	10.7	8.0	9.2	
2/03/2019	11.8	20.4	10.2	5.5	9.7	
3/03/2019	15.7	29.8	14.2	9.0	13.5	
4/03/2019	21.1	26.1	19.4	6.8	25.0	
5/03/2019	30.4	39.3	35.3	9.4	49.3	
6/03/2019	101.4	95.7	78.7	13.6	102.5	Extraordinary Event
7/03/2019	24.9	31.7	17.9	8.8	12.7	
8/03/2019	22.7	31.3	20.8	4.1	20.3	
9/03/2019	23.0	26.6	22.8	9.3	26.3	
10/03/2019	19.4	29.6	31.9	9.8	22.9	
11/03/2019	89.5	54.4	45.8	7.0	65.7	Extraordinary Event
12/03/2019	27.6	32.8	29.5	6.8	34.8	
13/03/2019	29.9	38.5	24.2	10.5	28.4	
14/03/2019	19.1	23.7	24.5	9.7	23.7	
15/03/2019	24.6	30.3	16.3	6.2	35.7	
16/03/2019	10.9	19.0	7.5	4.7	7.0	
17/03/2019	7.9	11.9	5.2	2.0	6.2	
18/03/2019	8.4	9.5	8.9	5.4	9.6	
19/03/2019	9.7	10.9	8.0	6.8	11.7	
20/03/2019	12.2	15.2	11.2	8.6	8.2	
21/03/2019	9.3	15.7	6.3	3.9	-	Power outage.
22/03/2019	9.8	12.9	13.6	7.8	3.0	
23/03/2019	9.9	14.6	10.5	6.2	7.3	
24/03/2019	18.0	20.9	16.8	7.3	19.1	
25/03/2019	10.0	13.7	11.0	4.9	10.3	
26/03/2019	22.2	25.2	23.6	6.1	24.2	
27/03/2019	21.3	24.3	15.8	5.8	16.0	
28/03/2019	16.7	22.4	14.2	5.4	12.3	
29/03/2019	17.4	23.1	17.3	8.0	14.5	

Date	Ulan School TEOM01 EPL 17	Lagoons Road TEOM04	Ulan Road TEOM07 EPL27		Ulan-Wollar Road TEOM06* EPL15	Comment
	PM10 Daily Result (24hr Average Limit = 50µg/m³)			PM2.5 Daily Result (24hr Average Limit = 25µg/m³)	PM10 Daily Result (µg/m³)	
30/03/2019	30.2	28.3	25.0	5.5	30.2	
31/03/2019	50.8	56.7	54.9	9.0	56.7	Extraordinary Event
1/04/2019	9.6	12.4	6.2	2.9	8.7	
2/04/2019	6.6	11.5	4.7	2.6	4.2	
3/04/2019	8.9	13.2	7.4	2.1	6.1	
4/04/2019	13.5	16.1	9.3	4.8	10.1	
5/04/2019	13.9	14.8	11.2	6.3	8.1	
6/04/2019	11.3	16.0	14.5	6.8	13.0	
7/04/2019	16.2	20.2	18.6	4.2	25.5	
8/04/2019	22.5	28.2	30.8	5.8	32.9	
9/04/2019	16.2	21.2	17.0	3.5	28.4	
10/04/2019	39.7	36.4	27.0	7.5	28.6	
11/04/2019	15.2	19.0	10.9	4.6	10.2	
12/04/2019	13.0	19.0	14.5	6.2	11.6	
13/04/2019	19.1	24.9	21.7	13.2	22.9	
14/04/2019	23.8	32.7	29.4	20.9	25.5	
15/04/2019	16.6	22.8	15.9	10.6	11.9	
16/04/2019	14.1	19.7	16.7	11.6	16.3	
17/04/2019	24.0	16.8	9.6	4.7	30.7	
18/04/2019	41.1	29.2	13.2	6.8	51.2	Hazard reduction burn at GRNP
19/04/2019	20.8	19.5	14.6	8.4	30.4	
20/04/2019	15.2	18.6	13.6	8.3	15.7	
21/04/2019	11.9	19.1	9.9	4.9	10.0	
22/04/2019	14.3	20.4	13.2	4.9	18.0	
23/04/2019	17.7	21.1	21.7	6.4	18.3	
24/04/2019	8.3	18.8	9.4	5.1	7.5	
25/04/2019	15.0	22.5	19.4	4.3	31.4	
26/04/2019	17.6	21.8	23.4	6.6	33.1	
27/04/2019	38.9	54.3	47.5	10.0	45.3	Extraordinary Event
28/04/2019	16.5	21.8	23.9	5.8	27.7	
29/04/2019	24.3	31.6	20.7	9.6	28.4	
30/04/2019	19.2	23.5	16.9	8.1	14.5	
1/05/2019	18.9	21.0	13.1	6.1	16.9	
2/05/2019	23.7	17.9	12.4	6.2	11.6	
3/05/2019	10.3	13.9	12.2	7.1	10.8	
4/05/2019	1.3	3.8	5.5	2.9	6.3	
5/05/2019	3.8	5.5	4.5	2.8	6.5	
6/05/2019	4.5	6.1	7.2	3.3	7.3	
7/05/2019	6.9	7.7	10.4	4.3	11.4	
8/05/2019	16.3	16.9	21.6	5.7	22.2	
9/05/2019	10.7	18.1	14.9	5.6	13.9	
10/05/2019	11.6	12.6	12.6	6.0	16.8	
11/05/2019	3.2	6.0	4.8	3.1	6.8	
12/05/2019	6.6	9.5	8.1	4.6	5.8	
13/05/2019	16.0	14.6	9.5	4.1	14.6	

Date	Ulan School TEOM01 EPL 17	Lagoons Road TEOM04	Ulan Road TEOM07 EPL27		Ulan-Wollar Road TEOM06* EPL15	Comment
	PM10 Daily Result (24hr Average Limit = 50µg/m³)			PM2.5 Daily Result (24hr Average Limit = 25µg/m³)	PM10 Daily Result (µg/m³)	
14/05/2019	7.9	12.2	9.0	5.3	15.3	
15/05/2019	14.9	19.4	11.8	6.1	19.8	
16/05/2019	21.9	18.2	13.6	7.0	15.2	
17/05/2019	19.3	20.9	12.1	5.9	18.8	
18/05/2019	12.8	17.3	13.3	7.7	18.5	
19/05/2019	14.2	16.9	13.3	8.3	16.2	
20/05/2019	18.4	15.6	14.4	5.7	14.9	
21/05/2019	14.6	14.8	16.4	5.3	20.2	
22/05/2019	15.7	16.9	12.5	4.8	23.1	
23/05/2019	19.6	25.3	20.2	7.9	22.9	
24/05/2019	16.3	20.7	18.8	9.7	21.5	
25/05/2019	11.4	20.2	18.0	5.4	20.5	
26/05/2019	7.1	10.1	10.8	5.3	16.0	
27/05/2019	7.4	7.6	7.1	2.8	10.2	
28/05/2019	10.2	11.3	11.0	5.1	12.8	
29/05/2019	9.1	10.6	8.3	3.1	10.9	
30/05/2019	5.4	6.4	6.0	3.2	6.7	
31/05/2019	6.7	7.2	7.1	3.5	7.0	
1/06/2019	10.2	16.9	7.9	4.2	11.6	
2/06/2019	12.4	14.7	11.5	8.4	17.4	
3/06/2019	2.7	4.7	8.0	6.1	2.9	
4/06/2019	3.4	4.9	4.0	2.5	4.1	
5/06/2019	5.3	8.1	5.3	3.7	6.3	
6/06/2019	9.4	9.8	10.0	3.5	10.4	
7/06/2019	14.5	14.4	8.5	4.2	16.7	
8/06/2019	12.5	16.3	13.2	5.2	13.4	
9/06/2019	3.9	12.2	11.4	6.5	7.1	
10/06/2019	5.3	8.0	8.1	5.3	13.4	
11/06/2019	8.4	16.1	9.6	3.9	15.1	
12/06/2019	15.8	14.4	15.1	6.3	22.6	
13/06/2019	10.9	9.2	8.9	4.3	25.4	
14/06/2019	4.1	6.1	6.1	3.8	6.5	
15/06/2019	4.9	8.4	5.9	3.1	11.4	
16/06/2019	12.6	17.6	12.4	5.5	23.0	
17/06/2019	8.8	10.5	6.8	4.1	22.7	
18/06/2019	5.3	7.6	12.1	3.4	13.3	
19/06/2019	7.7	11.6	8.7	4.2	11.4	
20/06/2019	16.8	18.7	15.1	5.8	21.1	
21/06/2019	7.0	9.7	10.7	6.2	15.4	
22/06/2019	7.8	11.3	7.1	3.8	13.1	
23/06/2019	10.4	11.3	5.5	2.1	10.2	
24/06/2019	13.6	7.6	4.1	2.6	11.9	
25/06/2019	7.9	7.8	4.0	2.0	6.2	
26/06/2019	12.2	11.0	6.0	3.9	9.3	
27/06/2019	17.9	-	4.6	2.2	4.7	Equipment breakdown.

Date	Ulan School TEOM01 EPL 17	Lagoons Road TEOM04	Ulan Road TEOM07 EPL27		Ulan-Wollar Road TEOM06* EPL15	Comment
	PM10 Daily Result (24hr Average Limit = 50µg/m³)			PM2.5 Daily Result (24hr Average Limit = 25µg/m³)	PM10 Daily Result (µg/m³)	
28/06/2019	5.5	15.6	6.4	2.4	9.1	
29/06/2019	14.6	10.5	10.5	4.3	13.1	
30/06/2019	6.0	7.9	12.4	6.3	11.9	
1/07/2019	11.8	27.1	13.8	3.0	16.6	
2/07/2019	17.1	19.0	15.7	5.5	28.2	
3/07/2019	2.5	24.8	7.9	3.6	22.9	
4/07/2019	4.0	14.7	4.8	2.3	5.5	
5/07/2019	7.0	12.8	3.1	1.3	4.0	
6/07/2019	6.5	12.7	3.4	1.4	3.1	
7/07/2019	10.4	21.0	6.9	2.8	11.0	
8/07/2019	6.3	13.7	5.9	3.8	11.1	
9/07/2019	3.3	5.0	6.6	3.5	4.5	
10/07/2019	5.6	6.5	6.8	3.6	9.5	
11/07/2019	8.1	10.9	11.4	4.2	13.0	
12/07/2019	10.6	10.5	9.5	3.4	12.3	
13/07/2019	7.3	11.0	7.7	2.6	18.8	
14/07/2019	4.4	7.9	9.7	4.2	12.0	
15/07/2019	3.8	6.3	5.1	2.4	9.2	
16/07/2019	5.8	6.4	5.7	3.3	13.1	
17/07/2019	4.3	6.0	6.6	3.1	12.5	
18/07/2019	6.3	8.2	9.1	2.4	11.9	
19/07/2019	10.8	11.6	15.0	4.1	15.8	
20/07/2019	10.8	20.8	15.4	5.0	17.4	
21/07/2019	13.9	15.2	13.6	5.1	33.3	
22/07/2019	19.6	15.2	15.7	4.8	38.4	
23/07/2019	13.0	14.1	14.6	4.5	27.1	
24/07/2019	13.1	12.9	13.0	3.8	18.1	
25/07/2019	14.5	21.3	13.9	4.5	15.5	
26/07/2019	17.4	18.2	20.1	6.1	27.9	
27/07/2019	13.4	15.6	13.3	4.6	24.1	
28/07/2019	11.3	16.0	11.7	4.8	23.6	
29/07/2019	12.3	15.6	13.7	4.1	28.6	
30/07/2019	7.9	9.2	5.9	2.9	11.8	
31/07/2019	10.3	8.4	5.9	3.3	8.1	
1/08/2019	11.3	15.4	8.3	3.8	17.8	
2/08/2019	15.4	24.5	12.2	6.1	21.4	
3/08/2019	12.6	15.5	16.0	6.4	30.2	
4/08/2019	10.7	16.3	14.9	5.3	19.8	
5/08/2019	19.2	23.2	17.2	6.6	54.2	
6/08/2019	22.7	25.5	19.7	7.4	38.9	
7/08/2019	18.3	25.5	24.1	10.1	31.1	
8/08/2019	23.3	27.0	27.5	7.1	44.6	
9/08/2019	28.9	31.1	27.9	5.4	35.7	
10/08/2019	6.5	10.0	7.9	2.9	10.6	
11/08/2019	4.3	7.0	4.7	2.3	5.4	

Date	Ulan School TEOM01 EPL 17	Lagoons Road TEOM04	Ulan Road TEOM07 EPL27		Ulan-Wollar Road TEOM06* EPL15	Comment
	PM10 Daily Result (24hr Average Limit = 50µg/m³)			PM2.5 Daily Result (24hr Average Limit = 25µg/m³)	PM10 Daily Result (µg/m³)	
12/08/2019	4.6	5.6	3.2	2.3	8.9	
13/08/2019	6.9	5.9	4.2	2.7	9.5	
14/08/2019	7.4	8.8	5.3	2.7	12.5	
15/08/2019	7.7	10.4	9.2	3.3	17.7	
16/08/2019	9.8	12.8	12.8	3.5	22.1	
17/08/2019	11.3	18.2	14.1	6.5	18.4	
18/08/2019	30.6	29.2	23.4	6.2	29.9	
19/08/2019	25.9	28.9	24.0	6.2	36.2	
20/08/2019	8.9	10.2	7.8	2.8	13.2	
21/08/2019	9.7	11.5	11.3	2.5	21.2	
22/08/2019	10.2	12.0	9.5	1.9	21.0	
23/08/2019	14.8	26.9	18.1	6.3	14.4	
24/08/2019	19.8	28.2	33.3	14.3	38.0	
25/08/2019	16.0	21.5	20.8	7.3	31.8	
26/08/2019	24.4	28.2	23.4	11.3	31.5	
27/08/2019	21.9	19.7	18.7	6.8	17.2	
28/08/2019	16.4	14.6	11.9	4.3	27.9	
29/08/2019	12.8	10.6	-	-	28.9	Power outage.
30/08/2019	8.6	5.2	3.3	2.0	5.7	
31/08/2019	9.3	8.7	5.4	2.7	5.9	
1/09/2019	10.3	10.8	9.9	2.9	16.9	
2/09/2019	15.5	11.1	13.1	2.5	24.7	
3/09/2019	25.5	19.8	18.8	4.3	29.6	
4/09/2019	26.1	23.8	21.7	4.9	47.4	
5/09/2019	24.6	25.4	15.5	3.3	-	Equipment breakdown.
6/09/2019	94.9	80.4	62.3	7.8	-	Equipment breakdown. Extraordinary Event
7/09/2019	11.4	13.5	11.2	3.5	16.9	
8/09/2019	5.0	8.1	5.1	1.5	15.2	
9/09/2019	9.2	9.4	7.8	3.9	16.3	
10/09/2019	9.9	11.6	7.2	2.9	14.5	
11/09/2019	15.8	19.5	16.7	5.1	23.6	
12/09/2019	16.4	17.6	20.0	6.4	33.2	
13/09/2019	20.6	21.2	24.6	8.1	29.7	
14/09/2019	9.6	15.6	13.9	6.6	28.2	
15/09/2019	15.6	20.5	21.8	7.9	40.5	
16/09/2019	24.4	28.0	22.9	7.0	45.8	
17/09/2019	6.1	9.7	3.1	1.1	8.2	
18/09/2019	5.3	5.5	2.0	1.3	7.2	
19/09/2019	16.5	16.5	11.3	6.7	19.0	
20/09/2019	13.4	18.3	7.8	4.2	13.3	
21/09/2019	38.0	45.1	36.8	16.5	38.2	
22/09/2019	27.6	29.6	25.1	11.3	41.9	
23/09/2019	11.0	11.8	11.0	2.7	22.6	
24/09/2019	9.1	8.9	8.1	2.4	16.6	
25/09/2019	11.3	15.4	12.0	3.2	16.5	

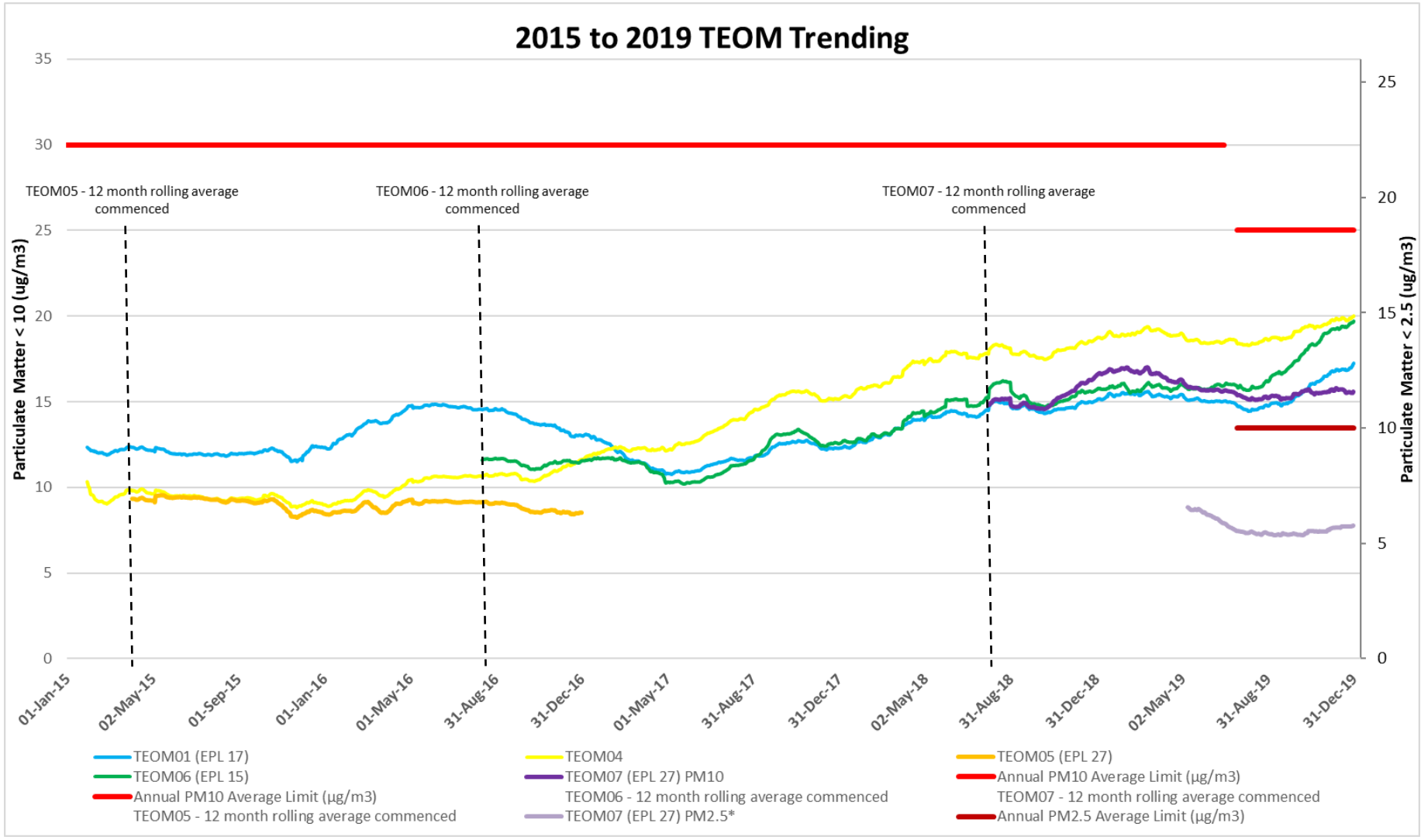
Date	Ulan School TEOM01 EPL 17	Lagoons Road TEOM04	Ulan Road TEOM07 EPL27		Ulan-Wollar Road TEOM06* EPL15	Comment
	PM10 Daily Result (24hr Average Limit = 50µg/m³)			PM2.5 Daily Result (24hr Average Limit = 25µg/m³)	PM10 Daily Result (µg/m³)	
26/09/2019	17.2	17.8	12.8	5.2	22.1	
27/09/2019	17.0	16.5	19.0	3.8	30.5	
28/09/2019	12.5	15.0	11.7	2.6	28.6	
29/09/2019	23.9	18.5	14.6	4.4	29.5	
30/09/2019	23.0	24.8	14.2	5.8	32.3	
1/10/2019	18.0	21.0	14.3	7.0	17.7	
2/10/2019	19.4	20.8	15.3	5.4	23.8	
3/10/2019	19.5	26.3	19.4	6.7	41.4	
4/10/2019	27.4	28.8	21.3	5.3	55.3	
5/10/2019	20.7	27.2	17.3	8.7	22.6	
6/10/2019	17.1	21.5	22.3	8.1	25.6	
7/10/2019	43.4	49.6	44.2	7.8	75.5	
8/10/2019	32.7	30.2	21.2	3.3	34.0	
9/10/2019	10.8	13.1	8.0	3.1	16.5	
10/10/2019	18.7	21.2	11.3	4.6	18.5	
11/10/2019	10.8	14.0	7.3	4.1	11.1	
12/10/2019	7.5	7.5	3.4	2.3	6.8	
13/10/2019	9.4	13.7	6.2	3.2	10.3	
14/10/2019	15.2	18.1	9.9	4.6	19.4	
15/10/2019	23.4	16.4	11.9	-	40.9	Maintenance requiring equipment shutdown
16/10/2019	-	14.2	-	-	30.9	Maintenance requiring equipment shutdown
17/10/2019	-	34.5	24.4	4.8	51.0	Equipment breakdown following maintenance.
18/10/2019	-	15.5	13.4	2.2	25.9	Equipment breakdown following maintenance
19/10/2019	40.4	41.1	36.3	6.1	63.4	
20/10/2019	14.0	11.6	11.7	3.3	22.1	
21/10/2019	26.1	27.0	17.3	6.6	36.2	
22/10/2019	24.8	24.0	18.9	8.8	22.0	
23/10/2019	33.8	31.7	29.9	15.2	48.7	
24/10/2019	31.0	26.3	29.5	12.8	45.8	
25/10/2019	81.6	67.0	76.2	34.7	83.5	Extraordinary Event
26/10/2019	78.2	76.6	80.3	30.6	94.7	Extraordinary Event
27/10/2019	32.2	25.4	31.8	11.1	48.3	
28/10/2019	37.1	38.0	44.5	20.4	40.7	
29/10/2019	49.0	45.2	-	-	49.8	Equipment breakdown.
30/10/2019	44.1	42.4	-	-	58.6	Equipment breakdown.
31/10/2019	41.0	36.0	-	-	48.0	Equipment breakdown.
1/11/2019	51.3	50.1	-	-	56.7	Equipment breakdown. Extraordinary Event
2/11/2019	33.1	30.6	-	-	43.1	Equipment breakdown.
3/11/2019	19.9	16.8	-	-	19.2	Equipment breakdown.
4/11/2019	7.4	5.9	-	-	9.6	Equipment breakdown.
5/11/2019	8.7	7.3	-	-	12.5	Equipment breakdown.
6/11/2019	13.2	11.6	10.7	2.7	15.9	
7/11/2019	40.4	37.1	34.9	5.8	53.0	

Date	Ulan School TEOM01 EPL 17	Lagoons Road TEOM04	Ulan Road TEOM07 EPL27		Ulan-Wollar Road TEOM06* EPL15	Comment
	PM10 Daily Result (24hr Average Limit = 50µg/m³)			PM2.5 Daily Result (24hr Average Limit = 25µg/m³)	PM10 Daily Result (µg/m³)	
8/11/2019	82.2	82.8	72.1	10.0	98.4	Extraordinary Event
9/11/2019	17.2	16.1	13.2	1.8	29.5	
10/11/2019	17.6	17.9	13.7	3.2	27.3	
11/11/2019	14.4	14.8	14.1	3.5	18.2	
12/11/2019	144.1	141.6	140.5	29.1	179.1	Extraordinary Event
13/11/2019	26.2	20.9	28.2	12.0	33.5	
14/11/2019	27.3	23.0	15.3	0.4	28.7	
15/11/2019	28.6	25.4	-	-	44.1	Equipment breakdown.
16/11/2019	22.6	20.8	-	-	41.5	Equipment breakdown.
17/11/2019	55.6	60.1	-	-	57.1	Equipment breakdown. Extraordinary Event
18/11/2019	39.5	37.1	-	-	44.8	Equipment breakdown.
19/11/2019	32.7	29.2	-	-	67.1	Equipment breakdown.
20/11/2019	103.3	121.8	-	-	114.2	Equipment breakdown. Extraordinary Event
21/11/2019	66.5	68.7	50.0	35.2	65.0	Extraordinary Event
22/11/2019	186.8	176.7	149.2	34.5	215.7	Extraordinary Event
23/11/2019	100.8	101.1	84.8	33.8	103.6	Extraordinary Event
24/11/2019	30.4	33.8	26.3	16.5	30.0	
25/11/2019	28.1	23.7	24.7	14.9	32.1	
26/11/2019	309.4	307.9	253.4	31.1	391.8	Extraordinary Event
27/11/2019	26.5	18.8	16.3	4.4	37.6	
28/11/2019	42.4	49.2	38.0	16.9	65.8	
29/11/2019	135.0	110.0	99.0	47.0	130.9	Extraordinary Event
30/11/2019	85.9	85.4	71.5	11.7	116.6	Extraordinary Event
1/12/2019	61.3	56.2	51.9	7.4	91.8	Extraordinary Event
2/12/2019	90.0	88.0	71.4	10.1	111.1	Extraordinary Event
3/12/2019	29.9	29.6	25.9	6.1	44.9	
4/12/2019	26.0	23.7	21.3	4.7	57.4	
5/12/2019	33.1	38.9	38.9	6.5	69.5	
6/12/2019	43.2	47.9	40.4	6.7	94.5	
7/12/2019	17.9	18.0	16.0	4.7	52.4	
8/12/2019	103.6	150.9	178.5	159.4	143.4	Extraordinary Event
9/12/2019	97.0	115.1	191.4	141.2	105.9	Extraordinary Event
10/12/2019	62.8	72.0	104.4	58.5	105.4	Extraordinary Event
11/12/2019	176.1	199.2	245.0	195.3	183.0	Extraordinary Event
12/12/2019	98.8	90.2	167.4	129.2	107.1	Extraordinary Event
13/12/2019	76.8	84.9	129.8	98.8	75.3	Extraordinary Event
14/12/2019	33.3	43.3	57.5	20.1	41.2	Extraordinary Event
15/12/2019	110.7	115.3	162.1	124.1	139.5	Extraordinary Event
16/12/2019	70.3	81.0	98.3	58.9	85.8	Extraordinary Event
17/12/2019	81.4	117.5	181.9	142.0	82.6	Extraordinary Event
18/12/2019	59.3	73.6	101.6	70.7	72.5	Extraordinary Event
19/12/2019	99.2	90.9	118.7	76.5	144.3	Extraordinary Event
20/12/2019	171.9	211.9	255.7	221.0	195.8	Extraordinary Event
21/12/2019	71.5	81.0	102.2	66.3	84.6	Extraordinary Event
22/12/2019	177.8	178.7	202.0	159.1	182.5	Extraordinary Event

Date	Ulan School TEOM01 EPL 17	Lagoons Road TEOM04	Ulan Road TEOM07 EPL27		Ulan-Wollar Road TEOM06* EPL15	Comment
	PM10 Daily Result (24hr Average Limit = 50µg/m³)			PM2.5 Daily Result (24hr Average Limit = 25µg/m³)	PM10 Daily Result (µg/m³)	
23/12/2019	52.8	55.2	75.7	51.4	61.5	Extraordinary Event
24/12/2019	70.0	88.7	109.3	86.4	68.1	Extraordinary Event
25/12/2019	32.4	38.6	51.1	34.7	31.4	Extraordinary Event
26/12/2019	52.9	64.5	81.9	63.4	63.3	Extraordinary Event
27/12/2019	72.6	92.8	102.6	82.1	80.8	Extraordinary Event
28/12/2019	39.6	46.8	57.9	35.2	37.8	Extraordinary Event
29/12/2019	35.3	34.9	35.2	10.8	55.2	
30/12/2019	45.6	58.0	77.8	49.3	62.7	Extraordinary Event
31/12/2019	43.5	45.6	50.0	10.2	47.9	

* TEOM06 is used to measure “upwind” air quality when wind is in the direction of private residences. It is not representative of private residences.

Figure 3-c 2015 to 2019 TEOM Rolling Average



** TEOM07 PM2.5 has not recorded 12 months of data*

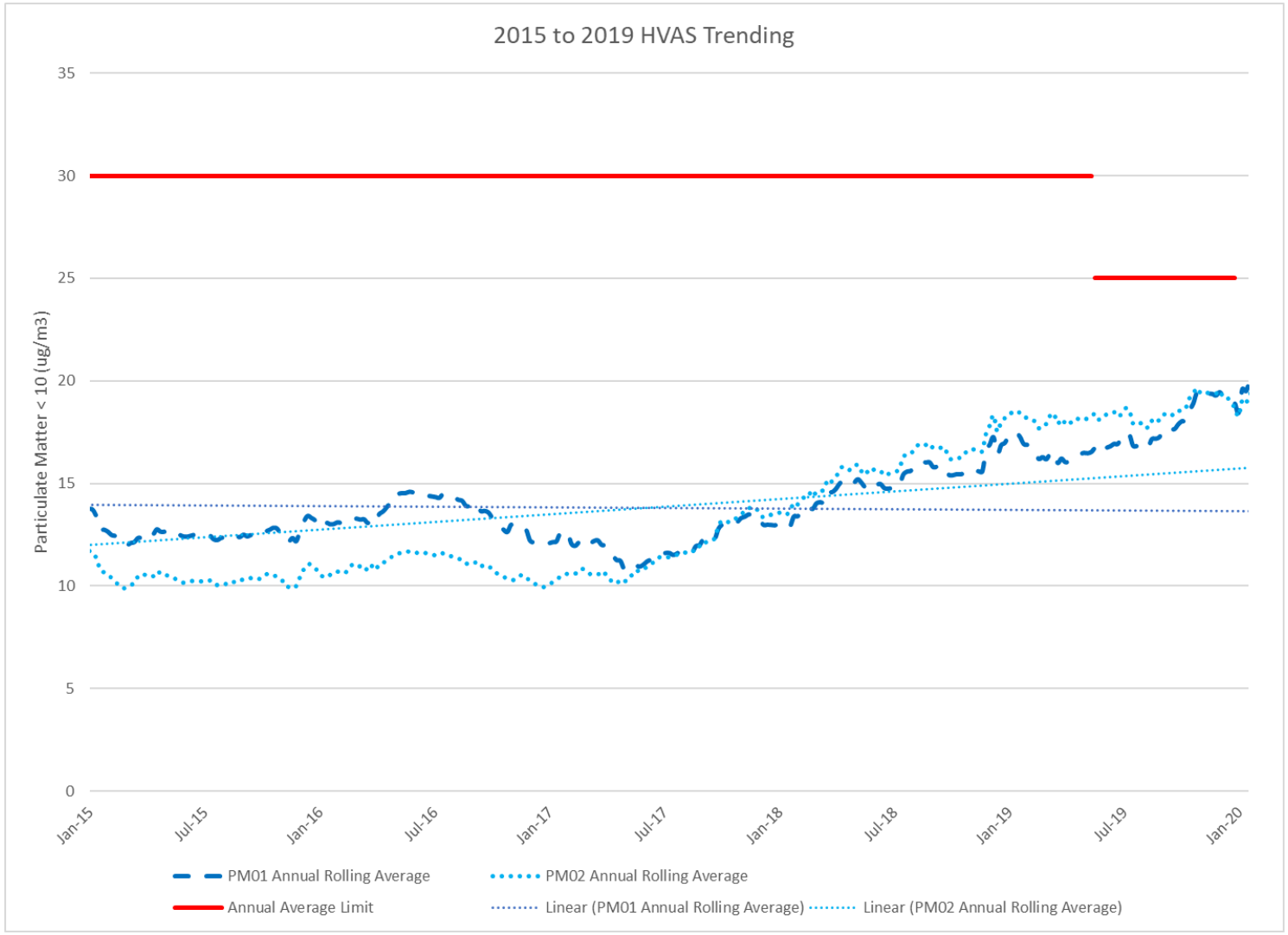
Table 4: HVAS monitoring results

	PM01	PM02
Sampling Date	Particulate Matter <10 µm (µg/m³)	Particulate Matter <10 µm (µg/m³)
02-Jan-19	43	39
08-Jan-19	24	21
14-Jan-19	25	26
20-Jan-19	16	21
26-Jan-19	27	32
01-Feb-19	18	18
07-Feb-19	16	21
13-Feb-19	93c	78c
19-Feb-19	53c	58c
25-Feb-19	24	27
03-Mar-19	20	26
09-Mar-19	29	35
15-Mar-19	28	27
21-Mar-19	14	16
27-Mar-19	21	22
02-Apr-19	8	8
08-Apr-19	26	27
14-Apr-19	28	36
20-Apr-19	19	19
26-Apr-19	21	23
02-May-19	16	16
08-May-19	17	16
14-May-19	8	11
20-May-19	15	16
26-May-19	7	8
01-Jun-19	11	12
07-Jun-19	13	10
13-Jun-19	11	8
19-Jun-19	8	7
25-Jun-19	10	4
01-Jul-19	27	17
07-Jul-19	15	22
13-Jul-19	7	7
19-Jul-19	10	9
25-Jul-19	16	17
31-Jul-19	12	5
06-Aug-19	22	19
12-Aug-19	5	2
18-Aug-19	32	32
24-Aug-19	19	25
30-Aug-19	12	2
05-Sep-19	21	18
11-Sep-19	17	15

	PM01	PM02
Sampling Date	**Particulate Matter <10 µm (µg/m³)**	**Particulate Matter <10 µm (µg/m³)**
17-Sep-19	4	4
23-Sep-19	9	9
29-Sep-19	24	19
05-Oct-19	20	21
11-Oct-19	10	9
17-Oct-19	40	39
23-Oct-19	38	34
29-Oct-19	49	41
04-Nov-19	6	5
10-Nov-19	12	14
16-Nov-19	21	20
22-Nov-19	184c	186c
28-Nov-19	51c	69c
04-Dec-19	31	33
10-Dec-19	79c	103c
16-Dec-19	94c	108c
22-Dec-19	229c	239c
28-Dec-19	52c	68c

c - Result attributable to regional Extraordinary Events

Figure 3-d 2015 to 2019 HVAS Trending



APPENDIX 3E. BIODIVERSITY MONITORING DATA

2019 Autumn Flora Monitoring Results

BOA	Plot Number	MZ	Native Overstorey Species	Native Mid Storey Species	Native ground cover (Grasses)	Native Ground Cover (Shrubs)	Native Ground Cover (Other)	Exotic Ground Cover	Litter	Bare soil	Crypto	# Hollow Barring Trees	Logs (m)
BOA 1	1a	MZ1	33.8	0	16	0	4	0	64	8	8	0	35
BOA 1	1b	MZ1	37.1	0	20	0	0	0	74	6	0	0	1
BOA 1	2c	MZ1	37.8	1.5	14	6	8	0	72	0	0	0	34
BOA 1	4a	MZ2	1.1	4	20	0	12	8	28	24	8	0	0
BOA 1	5a	MZ1	41.7	7.3	14	10	4	0	68	2	2	0	95
BOA 1	5c	MZ1	23	3.5	0	0	6	0	40	50	6	1	40
BOA 1	6a	MZ1	16.1	3	6	6	6	0	76	6	0	1	50
BOA 1	6b	MZ1	20.5	5	0	2	4	0	70	24	0	6	80
BOA 1	7a	MZ2	0.3	5.4	24	10	0	0	36	22	8	0	20
BOA 1	14a	MZ1	27.6	3.2	10	6	24	0	56	4	0	0	26
BOA 1	24a	MZ2	0	0	20	2	6	20	22	30	0	0	0
BOA 2	13e	MZ1	11	4.5	0	6	6	0	62	32	0	0	0
BOA 2	11a	MZ1	28.6	3	2	0	16	0	72	10	0	2	271
BOA 2	11c	MZ1	24.6	1.1	4	4	0	0	90	0	2	1	32
BOA 2	11d	MZ1	22	0.3	0	14	2	0	76	0	18	0	34
BOA 2	13a	MZ1	20	0.5	0	2	6	0	32	6	54	2	9
BOA 3	1e	MZ1	18.5	0	12	4	2	0	54	16	12	0	40
BOA 3	5e	MZ1	19	3.1	8	4	0	0	70	4	12	0	45
BOA 3	1f	MZ1	9.5	6	16	30	6	0	76	8	2	0	5
BOA 3	1h	MZ1	8	0	50	4	6	0	36	4	0	0	25
BOA 3	4f	MZ2	0	1	52	6	4	0	18	20	0	0	0
BOA 3	6d	MZ1	14	0.3	0	0	28	0	60	12	0	4	45
BOA 3	8a	MZ1	14	0	2	8	0	0	50	8	30	1	45

BOA	Plot Number	MZ	Native Overstorey Species	Native Mid Storey Species	Native ground cover (Grasses)	Native Ground Cover (Shrubs)	Native Ground Cover (Other)	Exotic Ground Cover	Litter	Bare soil	Crypto	# Hollow Barring Trees	Logs (m)
BOA 3	8d	MZ1	11.5	0.3	4	12	4	0	70	10	0	0	60
BOA 3	15a	MZ1	0.6	8.2	6	10	26	0	20	28	8	5	30
BOA 3	16a	MZ1	0.5	1.5	0	12	6	0	42	12	40	0	0
BOA 3	17a	MZ1	13	0.5	0	4	6	0	42	10	26	2	25
BOA 3	17b	MZ1	21	2	0	10	14	0	74	2	12	0	45
BOA 3	17c	MZ1	20.5	2.8	2	18	2	0	70	12	8	2	10
BOA 3	19b	MZ1	10	0.2	22	14	0	0	46	4	14	0	0
BOA 3	19c	MZ1	8.5	2.2	2	4	6	0	66	20	4	3	90
Bobadeen	Mod9_Fl1	MZ1	18.7	0	22	0	4	0	74	0	0	1	150
Bobadeen	Mod9_Fl3	MZ2	3.7	0	24	0	2	0	30	44	0	0	0
Bobadeen	Mod9_Fl5	MZ2	0	0	42	0	2	26	20	10	0	0	0
Bobadeen	Mod9_Fl9	MZ2	0	2	56	0	2	14	22	6	0	0	0
Bobadeen	Mod9_Fl2	MZ2	0.1	0	60	0	0	12	28	0	0	0	0
Bobadeen	Mod9_Fl4	MZ2	0	0	52	0	4	6	26	12	0	0	0
Bobadeen	Mod9_Fl6	MZ2	0	0	26	0	12	0	62	0	0	1	52
Bobadeen	Mod9_Fl7	MZ2	3.9	0	20	0	10	6	50	14	0	0	47
Bobadeen	Mod9_Fl8	MZ2	0	0	30	0	0	14	56	0	0	0	0
Clarkes	Mod9_Fl24	MZ1	24.2	0	6	0	10	0	84	6	0	0	12
Clarkes	Mod9_Fl25	MZ1	15.5	85	4	2	10	0	78	6	0	0	42
Clifford	Mod9_Fl19	MZ1	29.1	0	2	2	4	0	78	12	2	1	107
Clifford	Mod9_Fl17	MZ1	28	2.4	10	6	2	0	76	6	0	0	14
Clifford	Mod9_Fl21	MZ1	23.2	5.2	22	2	0	0	66	4	6	0	8
Clifford	Mod9_Fl22	MZ1	38.9	4.9	14	0	0	0	78	4	4	0	52
Clifford	Mod9_Fl20	MZ1	22.7	1.8	2	4	18	0	70	6	0	1	52
Clifford	Mod9_Fl15	MZ2	0	0	56	0	6	0	34	4	0	0	0
Clifford	Mod9_Fl16	MZ2	13	0	4	0	10	0	54	34	0	0	0
Clifford	Mod9_Fl18	MZ1	18.4	5.6	8	0	0	0	78	12	0	1	18

BOA	Plot Number	MZ	Native Overstorey Species	Native Mid Storey Species	Native ground cover (Grasses)	Native Ground Cover (Shrubs)	Native Ground Cover (Other)	Exotic Ground Cover	Litter	Bare soil	Crypto	# Hollow Barring Trees	Logs (m)
Clifford	Mod9_Fl23	MZ2	14.5	0.5	20	0	0	0	78	2	0	0	5
Dun Dun East	Stage2_Fl70	MZ2	0	0	48	0	0	34	0	18	0	0	0
Dun Dun East	Stage2_Fl71	MZ2	0	0	50	0	0	18	2	30	0	0	0
Dun Dun East	Stage2_Fl19	MZ1	15	0	42	2	0	2	34	20	0	0	62
Dun Dun East	Stage2_Fl20	MZ1	3.3	0.1	54	0	2	0	24	20	0	3	35
Dun Dun East	Stage2_Fl21	MZ1	13.4	0.4	10	12	2	0	66	10	0	3	122
Dun Dun East	Stage2_Fl22	MZ1	16.5	0	2	0	0	0	98	0	0	3	93
Dun Dun East	Stage2_Fl23	MZ1	10.6	0.7	22	8	6	4	50	5	0	4	108
Dun Dun East	Stage2_Fl24	MZ1	5.5	0.3	18	6	0	0	50	26	0	3	115
Dun Dun East	Stage2_Fl25	MZ1	15.5	2.4	14	0	10	0	74	2	0	0	91
Dun Dun East	Stage2_Fl26	MZ1	10.5	0	6	0	2	0	84	8	0	4	111
Dun Dun East	Stage2_Fl27	MZ1	11	0	6	0	6	0	76	12	0	0	4
Dun Dun East	Stage2_Fl28	MZ1	11.5	0	4	0	0	0	84	12	0	5	98
Dun Dun East	Stage2_Fl29	MZ1	19.3	1.1	8	2	0	0	76	14	0	8	101
Dun Dun East	Stage2_Fl30	MZ1	11.2	0.2	26	0	14	0	38	20	2	0	312
Dun Dun East	Stage2_Fl31	MZ2	0	0	50	0	0	2	8	40	0	0	0
Dun Dun East	Stage2_Fl32	MZ2	0	0	48	0	0	0	0	52	0	0	0
Dun Dun East	Stage2_Fl33	MZ2	0	0	54	0	2	0	2	42	0	0	0
Dun Dun East	Stage2_Fl34	MZ2	0	0	52	0	0	22	6	20	0	0	2
Dun Dun East	Stage2_Fl35	MZ2	0	0	44	0	6	8	4	38	0	0	0
Dun Dun East	Stage2_Fl36	MZ2	5	0.1	24	0	0	2	50	24	0	2	93
Dun Dun East	Stage2_Fl37	MZ2	0.4	0	56	0	4	8	10	22	0	0	0
Dun Dun East	Stage2_Fl38	MZ2	0	0	54	0	4	6	10	26	0	0	0
Dun Dun West	Stage2_Fl10	MZ1	12	0	6	0	4	0	66	24	0	3	102
Dun Dun West	Stage2_Fl11	MZ1	15.9	1.2	24	4	18	0	48	6	0	3	154
Dun Dun West	Stage2_Fl12	MZ1	18.2	0	0	0	2	0	96	2	0	2	118
Dun Dun West	Stage2_Fl13	MZ2	0	0	72	0	4	8	2	14	0	1	54

BOA	Plot Number	MZ	Native Overstorey Species	Native Mid Storey Species	Native ground cover (Grasses)	Native Ground Cover (Shrubs)	Native Ground Cover (Other)	Exotic Ground Cover	Litter	Bare soil	Crypto	# Hollow Barring Trees	Logs (m)
Dun Dun West	Stage2_Fl14	MZ2	1.5	0	62	6	2	0	8	22	0	0	62
Dun Dun West	Stage2_Fl15	MZ2	0	0	60	2	2	18	10	8	0	0	28
Dun Dun West	Stage2_Fl16	MZ2	0	0	60	6	4	2	0	28	0	0	33
Dun Dun West	Stage2_Fl17	MZ2	0	0	64	8	2	6	8	10	0	0	60
Dun Dun West	Stage2_Fl18	MZ2	0	0	0	0	10	78	12	0	0	0	107
Dun Dun West	Stage2_Fl7	MZ1	10.9	6.1	6	0	0	0	76	18	0	7	66
Dun Dun West	Stage2_Fl72	MZ2	0	0	62	0	2	0	4	32	0	0	43
Dun Dun West	Stage2_Fl73	MZ2	0	0	28	0	0	50	8	14	0	0	29
Dun Dun West	Stage2_Fl8	MZ1	13.6	0.5	58	2	0	18	20	2	0	0	80
Dun Dun West	Stage2_Fl9	MZ1	7.5	1.4	26	2	2	0	50	20	0	3	134
Elward	Mod9_Fl12	MZ1	24.2	4.4	32	2	0	0	60	6	0	10	132
Elward	Mod9_Fl10	MZ1	20	44	0	0	4	0	78	18	0	4	47
Elward	Mod9_Fl13	MZ1	40.6	0	0	0	0	0	88	10	2	1	208
Elward	Mod9_Fl11	MZ1	1.1	18	4	6	4	0	56	30	0	0	6
Elward	Mod9_Fl14	MZ2	3.2	12.9	38	0	12	0	32	18	0	0	0
Libertus	Stage2_Fl39	MZ1	28	3.1	0	2	6	0	78	8	6	2	111
Libertus	Stage2_Fl40	MZ1	51.8	0.3	2	8	0	0	90	0	0	0	0
Libertus	Stage2_Fl41	MZ2	1	0	52	0	20	4	16	8	0	0	0
Moolarmoo	Mod9_Fl32	MZ1	23.2	0.01	4	0	16	0	48	32	0	0	60
Moolarmoo	Mod9_Fl33	MZ1	18.8	0	8	0	14	0	24	54	0	0	40
Moolarmoo	Mod9_Fl34	MZ2	0	0	78	0	0	6	10	6	0	0	2
Moolarmoo	Mod9_Fl35	MZ2	0	0	50	0	2	8	36	2	0	0	0
Old Bobadeen	Stage2_Fl49	MZ1	11.7	0	6	0	6	0	74	14	0	0	0
Old Bobadeen	Stage2_Fl50	MZ2	0	0	34	0	2	0	34	30	0	0	0
Old Bobadeen	Stage2_Fl51	MZ2	0	0	40	0	2	0	50	8	0	0	1
Old Bobadeen	Stage2_Fl52	MZ2	0	0	40	0	14	0	34	12	0	0	0
Old Bobadeen	Stage2_Fl53	MZ2	0	0	4	0	2	24	46	24	0	0	0

BOA	Plot Number	MZ	Native Overstorey Species	Native Mid Storey Species	Native ground cover (Grasses)	Native Ground Cover (Shrubs)	Native Ground Cover (Other)	Exotic Ground Cover	Litter	Bare soil	Crypto	# Hollow Barring Trees	Logs (m)
Old Bobadeen	Stage2_Fl54	MZ2	0	0	30	0	0	14	42	14	0	0	0
Old Bobadeen	Stage2_Fl55	MZ2	0	0	22	0	0	18	46	14	0	0	0
Old Bobadeen	Stage2_Fl66	MZ2	0	0	16	0	0	0	48	36	0	0	0
Old Bobadeen	Stage2_Fl67	MZ2	0	0	38	0	0	0	34	28	0	0	0
Onsite Offset	Stage2_Fl58	MZ1	35	1.5	0	4	6	0	88	2	0	0	154
Onsite Offset	Stage2_Fl59	MZ1	24	0	12	0	0	0	86	2	0	2	51
Onsite Offset	Stage2_Fl60	MZ1	19.5	2.4	2	12	0	0	62	24	0	4	80
Onsite Offset	Stage2_Fl61	MZ2	0	0	24	0	30	0	22	24	0	0	12
Onsite Offset	Stage2_Fl62	MZ2	0	7.2	34	0	16	6	14	30	0	0	0
Onsite Offset	Stage2_Fl63	MZ2	0.7	9	46	0	6	8	32	6	2	0	0
Onsite Offset	Stage2_Fl64	MZ2	0	0	42	0	2	18	24	14	0	0	0
Onsite Offset	Stage2_Fl68	MZ2	0	0	46	0	2	6	24	22	0	0	0
Onsite Offset	Stage2_Fl69	MZ2	0	0	42	0	0	0	20	34	4	0	0
Property 24 & 25	Mod9_Fl29	MZ1	22	0.5	26	2	6	0	66	0	0	0	34
Property 24 & 25	Mod9_Fl31	MZ2	0	0	52	0	10	0	12	32	0	0	0
Property 24 & 25	Mod9_Fl30	MZ2	0	0	8	0	28	0	8	56	0	0	0
Property 5	Mod9_Fl28	MZ1	20	2	20	0	10	0	60	10	0	0	290
Property 5	Mod9_Fl27	MZ2	0	0	36	0	0	24	38	0	0	0	0
Property 5	Mod9_Fl26	MZ2	0	0	34	0	0	28	38	0	0	0	12
Ulan 18	Stage2_Fl43	MZ2	0	0	68	0	2	10	10	10	0	0	0
Ulan 18	Stage2_Fl44	MZ2	0	0	26	0	0	34	20	20	0	0	0
Ulan 18	Stage2_Fl45	MZ2	0	0	2	0	0	56	14	28	0	0	0
Ulan 18	Stage2_Fl47	MZ1	21.3	0.7	2	4	0	0	62	14	18	3	12
Ulan 18	Stage2_Fl48	MZ1	25.7	0.1	12	0	0	0	66	22	0	2	118
Ulan 18	Stage2_Fl65	MZ2	0	0	62	0	2	6	0	30	0	0	2.5

2019 Spring Flora Monitoring Results

BOA	Plot Number	MZ	Native Overstorey Species	Native Mid Storey Species	Native ground cover (Grasses)	Native Ground Cover (Shrubs)	Native Ground Cover (Other)	Exotic Ground Cover	Litter	Bare soil	Crypto	# Hollow Barring Trees	Logs (m)
BOA1	2d	MZ1	18	0	4	0	4	0	88	4	0	0	60
BOA1	4b	MZ2	0	5	26	0	0	4	42	38	0	0	0
BOA1	5b	MZ1	14.8	1	0	4	0	0	90	6	0	0	25
BOA1	7b	MZ2	5.5	0	8	2	18	0	28	24	10	0	0
BOA1	9a	MZ2	0	4.5	34	0	0	0	12	54	0	0	0
BOA1	9b	MZ2	2	0	12	0	0	0	20	70	0	0	0
BOA1	14b	MZ1	6.5	3	12	6	10	0	56	16	0	0	0
BOA1	21a	MZ2	0	0	34	2	2	0	10	38	2	0	0
BOA1	21b	MZ2	0	0	18	0	20	0	32	16	12	0	0
BOA1	24b	MZ2	0	0	44	2	2	0	30	22	0	0	0
BOA2	10b	MZ1	2	1.7	0	34	0	0	32	34	0	0	60
BOA2	11b	MZ1	14.5	2	0	12	6	0	70	12	0	2	60
BOA2	13g	MZ1	14	0	0	0	4	0	90	6	0	4	200
BOA2	13h	MZ1	14.7	2.9	2	4	6	0	78	4	4	5	55
BOA2	25a	MZ2	0	3.2	10	6	2	0	30	52	0	0	0
BOA2	25b	MZ2	5	3.7	6	4	0	0	70	16	4	0	0
BOA3	4e	MZ2	2.5	0	64	0	0	4	32	12	2	0	0
BOA3	5h	MZ1	15	0.9	8	0	8	0	80	4	0	0	50
BOA3	6c	MZ1	13.5	10	4	2	4	0	64	24	4	4	40
BOA3	8c	MZ1	18	1.6	0	4	0	0	92	4	0	4	115
BOA3	15b	MZ1	2.5	2.8	0	2	90	0	4	4	0	6	2
BOA3	16b	MZ1	14.2	0.2	12	34	0	0	34	16	14	0	20
BOA3	17d	MZ1	1	0.3	0	8	6	0	28	26	36	0	2
BOA3	19a	MZ1	41	5	6	4	2	0	46	36	6	4	40

BOA	Plot Number	MZ	Native Overstorey Species	Native Mid Storey Species	Native ground cover (Grasses)	Native Ground Cover (Shrubs)	Native Ground Cover (Other)	Exotic Ground Cover	Litter	Bare soil	Crypto	# Hollow Barring Trees	Logs (m)
Bobadeen	Mod9_Fl1	MZ1	21	0	12	0	4	0	72	12	0	1	93
Bobadeen	Mod9_Fl2	MZ2	0	0	46	0	4	18	32	0	0	0	0
Bobadeen	Mod9_Fl3	MZ2	3.3	6.1	4	0	0	2	58	36	0	0	0
Bobadeen	Mod9_Fl4	MZ2	0	0	50	0	0	8	38	6	0	0	0
Bobadeen	Mod9_Fl5	MZ2	0	0	16	0	2	40	34	8	0	0	0
Bobadeen	Mod9_Fl6	MZ2	0	0	10	0	14	0	68	6	2	0	24
Bobadeen	Mod9_Fl7	MZ2	13.7	0	14	0	0	8	70	8	0	1	47
Bobadeen	Mod9_Fl8	MZ2	0	0	10	0	0	18	72	0	0	0	0
Bobadeen	Mod9_Fl9	MZ2	0	1.2	16	2	0	18	60	2	2	0	0
Clarkes	Mod9_Fl15	MZ2	0	0	26	0	0	2	64	8	0	0	0
Clarkes	Mod9_Fl16	MZ2	13.7	0	6	0	0	0	62	32	0	0	0
Clarkes	Mod9_Fl17	MZ1	30	0.9	6	8	0	0	82	4	0	0	36
Clarkes	Mod9_Fl19	MZ1	31	0	2	0	8	0	76	14	0	1	107
Clarkes	Mod9_Fl20	MZ1	19.1	0.2	0	2	8	0	84	6	0	1	15
Clarkes	Mod9_Fl21	MZ1	28.2	5.7	10	2	0	0	82	6	0	0	0
Clarkes	Mod9_Fl22	MZ1	26	0.5	0	8	0	0	76	6	0	0	52
Clifford	Mod9_Fl18	MZ1	18.8	2.8	0	0	0	0	88	12	0	0	18
Clifford	Mod9_Fl23	MZ2	36.3	2	22	0	2	0	74	2	0	0	0
Clifford	Mod9_Fl24	MZ1	32.2	0.2	14	6	8	0	70	0	0	0	25
Clifford	Mod9_Fl25	MZ1	26.4	2.9	4	0	4	0	84	8	0	0	4
Dun Dun East	Stage2_Fl19	MZ1	17	0	16	0	2	0	74	8	0	0	88
Dun Dun East	Stage2_Fl20	MZ1	3	0	24	4	4	4	42	22	0	0	64
Dun Dun East	Stage2_Fl21	MZ1	13.2	3.4	2	2	0	0	66	30	0	2	163
Dun Dun East	Stage2_Fl22	MZ1	17	0	8	0	0	0	82	10	0	3	134
Dun Dun East	Stage2_Fl23	MZ1	15.3	6.7	18	4	2	0	64	12	0	6	142
Dun Dun East	Stage2_Fl24	MZ1	15	0.35	8	2	2	0	62	24	2	3	131
Dun Dun East	Stage2_Fl25	MZ1	18	1.5	2	0	4	0	90	4	0	0	95

BOA	Plot Number	MZ	Native Overstorey Species	Native Mid Storey Species	Native ground cover (Grasses)	Native Ground Cover (Shrubs)	Native Ground Cover (Other)	Exotic Ground Cover	Litter	Bare soil	Crypto	# Hollow Barring Trees	Logs (m)
Dun Dun East	Stage2_Fl26	MZ1	16	0	0	0	0	0	96	4	0	2	74
Dun Dun East	Stage2_Fl27	MZ1	16	0	2	0	2	0	86	10	0	0	4
Dun Dun East	Stage2_Fl28	MZ1	12.5	0	2	0	2	0	76	20	0	5	112
Dun Dun East	Stage2_Fl29	MZ1	12	0	8	0	0	0	76	16	0	9	70
Dun Dun East	Stage2_Fl30	MZ1	8.5	5	18	0	6	0	40	20	16	0	39
Dun Dun East	Stage2_Fl31	MZ2	0	0	26	0	0	8	40	26	0	0	0
Dun Dun East	Stage2_Fl32	MZ2	0	0	24	0	2	10	44	20	0	0	0
Dun Dun East	Stage2_Fl33	MZ2	0	0	40	0	0	16	26	18	0	0	0
Dun Dun East	Stage2_Fl34	MZ2	0	0	38	0	2	22	26	12	0	0	2
Dun Dun East	Stage2_Fl35	MZ2	0	0	26	0	4	10	22	38	0	0	16
Dun Dun East	Stage2_Fl36	MZ2	7.5	0.5	16	0	0	0	60	22	2	1	102
Dun Dun East	Stage2_Fl37	MZ2	0	0	24	0	0	16	38	22	0	0	2
Dun Dun East	Stage2_Fl38	MZ2	0	0	26	0	2	12	30	30	0	0	0
Dun Dun East	Stage2_Fl70	MZ2	0	0	38	0	4	30	22	6	0	0	0
Dun Dun East	Stage2_Fl71	MZ2	0	0	32	0	0	12	30	26	0	0	0
Dun Dun West	Stage2_Fl10	MZ1	24.7	0	6	2	0	0	72	24	0	2	95
Dun Dun West	Stage2_Fl11	MZ1	17.8	5.2	10	14	16	0	60	0	0	2	122
Dun Dun West	Stage2_Fl12	MZ1	35.5	0	0	0	0	0	96	4	0	2	107
Dun Dun West	Stage2_Fl13	MZ2	0	0	42	0	0	26	24	8	0	1	53
Dun Dun West	Stage2_Fl14	MZ2	5.5	0	48	0	4	0	16	32	0	0	54
Dun Dun West	Stage2_Fl15	MZ2	0	0	40	4	0	28	8	20	0	0	18
Dun Dun West	Stage2_Fl16	MZ2	0	4	20	6	2	10	36	26	0	0	38
Dun Dun West	Stage2_Fl17	MZ2	0	0	48	6	2	4	24	16	0	0	96
Dun Dun West	Stage2_Fl18	MZ2	0	0	10	0	2	72	6	10	0	0	106
Dun Dun West	Stage2_Fl7	MZ1	15	2	8	0	6	0	66	20	0	4	46
Dun Dun West	Stage2_Fl72	MZ2	0	0	64	0	2	2	12	20	0	0	47
Dun Dun West	Stage2_Fl73	MZ2	0	0	24	0	0	58	12	16	0	0	18

BOA	Plot Number	MZ	Native Overstorey Species	Native Mid Storey Species	Native ground cover (Grasses)	Native Ground Cover (Shrubs)	Native Ground Cover (Other)	Exotic Ground Cover	Litter	Bare soil	Crypto	# Hollow Barring Trees	Logs (m)
Dun Dun West	Stage2_Fl8	MZ1	16.5	0.5	46	0	6	8	30	10	0	0	66
Dun Dun West	Stage2_Fl9	MZ1	16.5	0.2	20	10	2	0	48	20	0	0	144
Elward	Mod9_Fl10	MZ1	31.5	5	0	0	0	0	86	14	0	1	124
Elward	Mod9_Fl11	MZ1	3.4	11	10	2	0	0	70	12	6	0	12
Elward	Mod9_Fl12	MZ1	17.5	2.7	18	4	0	0	74	4	0	2	62
Elward	Mod9_Fl13	MZ1	27	0	0	0	2	0	70	26	2	2	74
Elward	Mod9_Fl14	MZ2	1.9	6	14	0	0	0	42	36	8	0	0
Libertus	Stage2_Fl39	MZ1	11.5	4	0	0	2	0	88	8	2	3	20
Libertus	Stage2_Fl40	MZ1	19	0.5	0	2	0	0	96	2	0	0	15
Libertus	Stage2_Fl41	MZ2	0	0	30	0	2	8	44	12	4	0	0
Moolarmoo	Mod9_Fl32	MZ1	24.3	0	0	0	18	0	60	22	0	0	83
Moolarmoo	Mod9_Fl33	MZ1	12.7	9.4	2	0	10	0	36	52	0	0	68
Moolarmoo	Mod9_Fl34	MZ2	0	0	70	0	2	8	12	8	0	0	2
Moolarmoo	Mod9_Fl35	MZ2	0	0	6	0	0	4	82	8	0	0	0
Old Bobadeen	Stage2_Fl49	MZ1	16.7	0	6	0	0	0	72	22	0	0	14
Old Bobadeen	Stage2_Fl50	MZ2	0	0	22	0	0	0	48	30	0	0	0
Old Bobadeen	Stage2_Fl51	MZ2	0	0	18	0	0	4	60	18	0	0	1.4
Old Bobadeen	Stage2_Fl52	MZ2	0	0	28	0	2	2	28	6	0	0	0
Old Bobadeen	Stage2_Fl53	MZ2	0	0	0	0	0	36	48	16	0	0	0
Old Bobadeen	Stage2_Fl54	MZ2	0	0	26	0	0	8	46	20	0	0	0
Old Bobadeen	Stage2_Fl55	MZ2	0	0	6	0	0	28	56	10	0	0	0
Old Bobadeen	Stage2_Fl66	MZ2	0	0	12	0	0	0	24	64	0	0	0
Old Bobadeen	Stage2_Fl67	MZ2	0	0	12	0	0	12	40	36	0	0	0
Onsite Offset	Stage2_Fl58	MZ1	23.5	0	0	0	4	0	88	8	0	0	0
Onsite Offset	Stage2_Fl59	MZ1	27.5	0	2	0	0	0	96	2	0	2	51
Onsite Offset	Stage2_Fl60	MZ1	29.7	4.1	2	0	4	0	78	8	0	4	80
Onsite Offset	Stage2_Fl61	MZ2	0	0	18	0	14	0	52	12	2	0	12

BOA	Plot Number	MZ	Native Overstorey Species	Native Mid Storey Species	Native ground cover (Grasses)	Native Ground Cover (Shrubs)	Native Ground Cover (Other)	Exotic Ground Cover	Litter	Bare soil	Crypto	# Hollow Barring Trees	Logs (m)
Onsite Offset	Stage2_Fl62	MZ2	0	0.7	32	4	2	0	20	42	0	0	0
Onsite Offset	Stage2_Fl63	MZ2	0	14	14	6	2	4	46	26	2	0	0
Onsite Offset	Stage2_Fl64	MZ2	0	0	14	0	2	0	30	54	0	0	0
Onsite Offset	Stage2_Fl68	MZ2	0	0	8	0	2	0	42	46	2	0	0
Onsite Offset	Stage2_Fl69	MZ2	0	0	28	0	4	0	28	38	2	0	0
Property 24 & 25	Mod9_Fl29	MZ1	17.3	0.5	18	0	2	0	78	2	0	0	10
Property 24 & 25	Mod9_Fl30	MZ2	0	0	18	0	28	0	24	24	6	0	0
Property 24 & 25	Mod9_Fl31	MZ2	0	0	20	0	0	4	76	0	0	0	0
Property 5	Mod9_Fl26	MZ2	0	0	2	0	0	22	68	8	0	0	10
Property 5	Mod9_Fl27	MZ2	0	0	2	0	0	44	48	6	0	0	0
Property 5	Mod9_Fl28	MZ1	29.8	0.4	16	0	4	0	68	12	0	0	290
Ulan 18	Stage2_Fl43	MZ2	0	0.2	18	0	0	6	76	0	0	0	0
Ulan 18	Stage2_Fl44	MZ2	0	0	10	0	0	0	66	24	0	0	0
Ulan 18	Stage2_Fl45	MZ2	0	0	0	0	2	4	54	40	0	0	0
Ulan 18	Stage2_Fl47	MZ1	10.8	0.4	2	4	0	0	62	12	20	4	12
Ulan 18	Stage2_Fl48	MZ1	26.6	0	18	0	0	0	52	30	0	4	152
Ulan 18	Stage2_Fl65	MZ2	0	0	16	0	0	0	48	36	0	0	1

Appendix 3F. SURFACE WATER MONITORING DATA

Table 5: 2019 Surface water quality data

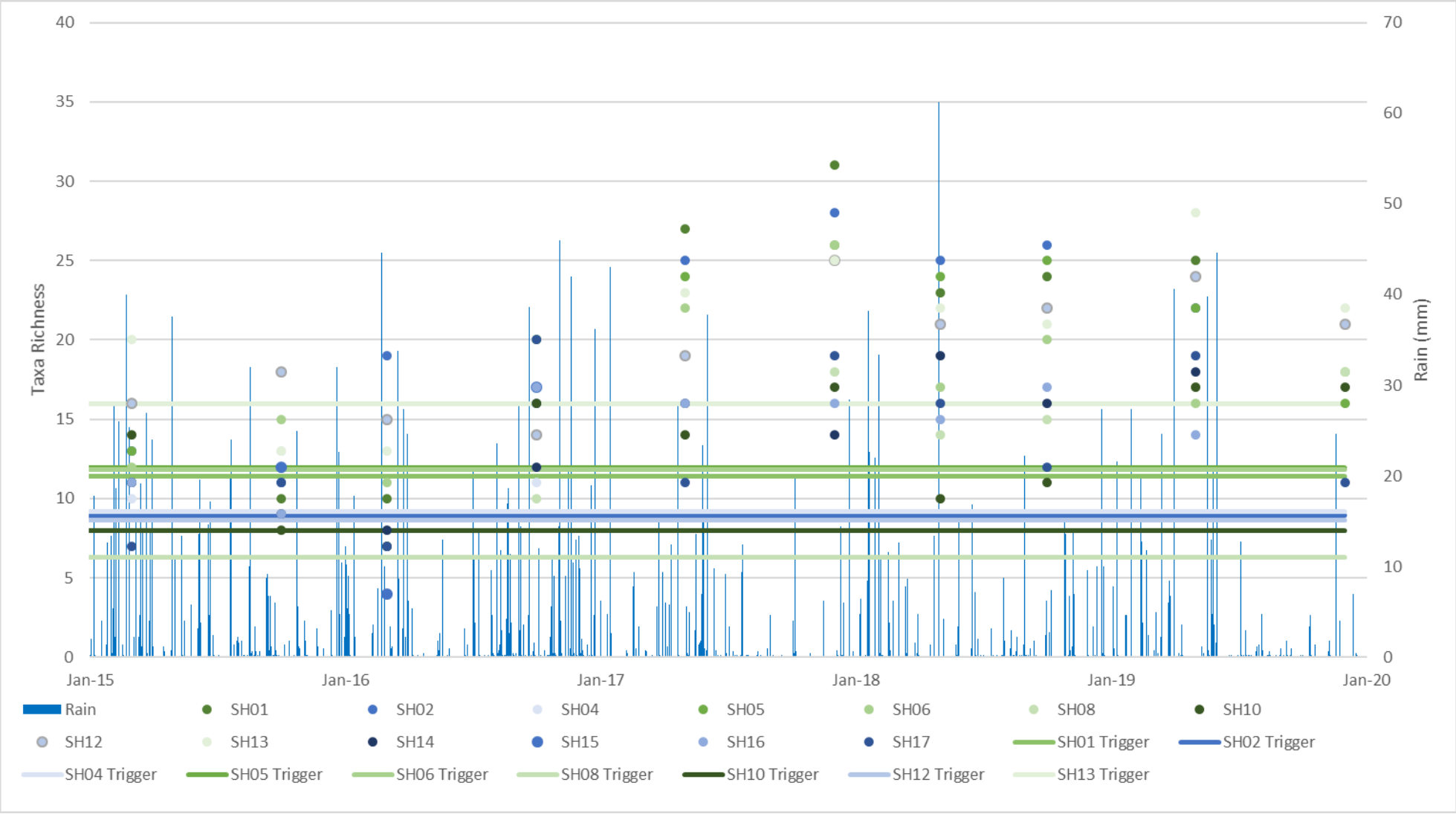
Sample Point	Sample Date	pH (Field) (Unit)	pH (Lab) (Unit)	EC (Lab) (µS/cm)	EC (Field) (µS/cm)	TSS (mg/L)	TDS (mg/L)	Temperature (°C)	Turbidity - Lab (NTU)	Cu - T (mg/L)	Pb - T (mg/L)	Zn - T (mg/L)	Ni - T (mg/L)	Fe - T (mg/L)	Mn - T (mg/L)	As - T (mg/L)	Se - T (mg/L)	Cd - T (mg/L)	Cr - T (mg/L)	Li (mg/L)	Ba - T (mg/L)	Sr (mg/L)	DO (mg/L)	P - T (mg/L)	N - Total (mg/L)
SW01	7/01/2019 10:05	6.19	7.52	786	795	5	508	31.6	0.3	0.001	0.001	0.005	0.006	0.14	0.021	0.001	0.01	0.0001	0.001	0.124	0.02	0.232	7.38	0.04	0.1
SW01	29/01/2019 9:45	7.54	7.65	761	801	5	528	30.8	0.5			0.007		0.14											
SW01	11/02/2019 10:05	7.46	7.47	784	830	11	508	27.8	5.6																
SW01	11/03/2019 10:25	7.19	7.87	779	823	7	442	28	0.4																
SW01	18/03/2019 10:10	7.54	7.96	763	727	5	508	24.9	0.6			0.005		0.09											
SW01	30/03/2019 10:15	7.71	7.65	584	580	14	413	21.6	21.2			0.005		0.54											
SW01	8/04/2019 9:00	6.88	7.48	731	782	5	466	21.8	0.4																
SW01	13/05/2019 10:10	7.24	7.68	779	767	5	490	17.7	0.2																
SW01	11/06/2019 9:55	7.41	8.02	794	*	5	432	10.6	0.3	0.001	0.001	0.005	0.004	0.05	0.004	0.001	0.01	0.0001	0.001	0.158	0.014	0.19	11.05	0.01	0.1
SW01	8/07/2019 10:00	7.34	7.96	778	757	5	452	14.3	0.2																
SW01	12/08/2019 9:45	7.17	7.37	738	749	5	472	15.1	0.4																
SW01	9/09/2019 10:00	7.58	8.02	796	745	5	510	14	0.5																
SW01	14/10/2019 10:25	7.7	8.09	819	798	5	469	25.6	0.3																
SW01	11/11/2019 9:15	6.97	7.95	862	878	5	454	20	0.4																
SW02	7/01/2019 10:25	6.09	7.73	807	794	6	524	35.3	0.6	0.001	0.001	0.006	0.011	2.01	0.231	0.001	0.01	0.0001	0.001	0.146	0.026	0.226	7.02	0.17	0.1
SW02	29/01/2019 10:00	7.52	7.61	768	795	5	522	29	0.6			0.005		0.69											
SW02	11/02/2019 10:30	7.48	7.7	783	819	5	564	26.6	2.8																
SW02	11/03/2019 10:50	7.38	7.74	780	842	7	484	27	0.2																
SW02	18/03/2019 10:35	7.57	7.83	776	727	5	454	25.5	0.3			0.005		0.05											
SW02	8/04/2019 9:30	6.99	7.64	719	790	5	444	20.7	0.3																

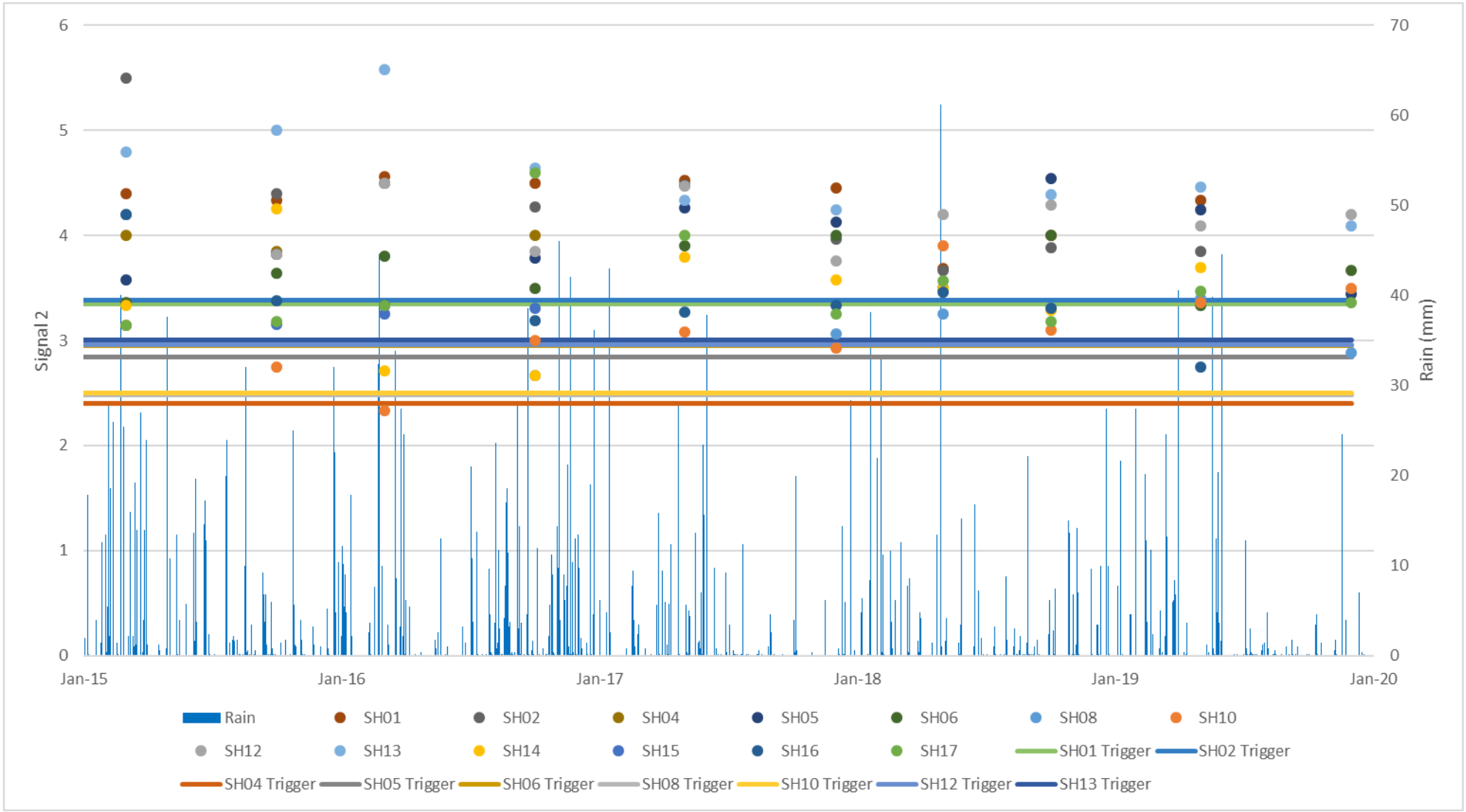
Sample Point	Sample Date	pH (Field) (Unit)	pH (Lab) (Unit)	EC (Lab) (µS/cm)	EC (Field) (µS/cm)	TSS (mg/L)	TDS (mg/L)	Temperature (°C)	Turbidity - Lab (NTU)	Cu - T (mg/L)	Pb - T (mg/L)	Zn - T (mg/L)	Ni - T (mg/L)	Fe - T (mg/L)	Mn - T (mg/L)	As - T (mg/L)	Se - T (mg/L)	Cd - T (mg/L)	Cr - T (mg/L)	Li (mg/L)	Ba - T (mg/L)	Sr (mg/L)	DO (mg/L)	P - T (mg/L)	N - Total (mg/L)
SW02	13/05/2019 10:30	7.42	7.82	806	788	5	492	17.5	0.2																
SW02	11/06/2019 10:05	7.52	8.17	812	*	5	420	10.8	0.4	0.001	0.001	0.005	0.004	0.05	0.005	0.001	0.01	0.0001	0.001	0.156	0.013	0.192	10.87	0.01	0.1
SW02	8/07/2019 10:20	7.47	7.95	831	793	5	485	14.1	0.2																
SW02	12/08/2019 10:10	7.28	7.86	746	776	5	470	14.8	0.3																
SW02	9/09/2019 10:25	7.64	8.01	814	755	5	501	14	0.2																
SW02	14/10/2019 10:50	7.76	7.96	847	898	5	466	26.1	0.2																
SW02	11/11/2019 9:30	7.27	7.96	880	871	10	458	18.3	1.3																
SW05	7/01/2019 11:30	6.69	7.14	641	639	5	418	34.9	2.5	0.001	0.001	0.005	0.002	0.85	0.891	0.001	0.01	0.0001	0.001	0.004	0.041	0.19	3.65	0.02	2.4
SW05	29/01/2019 12:15	7.16	7.02	504	529	24	335	28	30.5			0.005		1.66											
SW05	11/02/2019 12:15	6.89	6.92	543	587	7	382	21.8	6.7																
SW05	11/03/2019 10:55	6.84	6.53	626	682	28	386	23.5	5																
SW05	18/03/2019 9:20	6.39	7.08	632	598	5	412	19.7	12.5			0.005		1.51											
SW05	30/03/2019 13:00	6.92	6.76	554	547	26	420	19.8	41.3			0.008		2.75											
SW05	8/04/2019 11:10	7.05	6.58	570	584	12	407	20.6	26.8																
SW05	13/05/2019 10:50	7.46	6.7	661	647	5	474	12.7	35.3																
SW05	11/06/2019 11:30	6.97	6.59	677	*	15	398	12.3	34.2	0.001	0.001	0.007	0.003	3.46	0.349	0.001	0.01	0.0001	0.001	0.006	0.047	0.216	5.87	0.02	1.1
SW05	8/07/2019 11:20	7.17	6.8	718	649	7	436	12.4	33																
SW05	12/08/2019 11:00	7.32	7.29	659	676	5	418	8.6	20.5																
SW05	9/09/2019 10:45	7.46	7.46	783	712	6	432	10.8	5.7																
SW05	14/10/2019 10:50	7.02	7.51	888	985	5	506	17.1	2.6																
SW08	7/01/2019 10:30	6.11	7.02	4250	3890	8	2840	29.7	5.8	0.001	0.001	0.005	0.002	2.81	2.66	0.001	0.01	0.0001	0.001	0.013	0.16	0.883	1.73	0.18	1.3
SW08	29/01/2019 16:15	7.13	6.7	1240	1261	28	916	31.5	65			0.017		2.2											
SW08	11/06/2019 10:35	6.7	7.2	4980	*	7	2670	11.3	2.2	0.001	0.001	0.005	0.008	0.42	0.21	0.001	0.01	0.0001	0.001	0.016	0.124	0.758	8.21	0.02	1

Sample Point	Sample Date	pH (Field) (Unit)	pH (Lab) (Unit)	EC (Lab) (µS/cm)	EC (Field) (µS/cm)	TSS (mg/L)	TDS (mg/L)	Temperature (°C)	Turbidity - Lab (NTU)	Cu - T (mg/L)	Pb - T (mg/L)	Zn - T (mg/L)	Ni - T (mg/L)	Fe - T (mg/L)	Mn - T (mg/L)	As - T (mg/L)	Se - T (mg/L)	Cd - T (mg/L)	Cr - T (mg/L)	Li (mg/L)	Ba - T (mg/L)	Sr (mg/L)	DO (mg/L)	P - T (mg/L)	N - Total (mg/L)
SW09	7/01/2019 9:55	6.47	7.19	4540	4160	13	3070	30.3	5.4	0.001	0.001	0.005	0.002	2.1	1.79	0.001	0.01	0.0001	0.001	0.001	0.137	1.32	4.85	0.01	0.4
SW09	29/01/2019 15:55	6.79	7	2680	2400	9	1600	32.5	6.8			0.019		1.15											
SW09	11/02/2019 9:45	6.55	7.25	4740	4720	21	2840	22.4	62.9																
SW09	11/03/2019 9:10	6.77	7.19	4180	4210	8	2420	21.9	12																
SW09	18/03/2019 10:35	6.51	7.41	3990	3530	35	2190	20.5	52.1			0.005		3.75											
SW09	30/03/2019 13:50	6.39	7.14	4040	3660	12	2420	19.3	12.5			0.005		3.71											
SW09	8/04/2019 9:10	7.34	7.06	4560	4070	28	2470	20	30.3																
SW09	13/05/2019 9:45	6.43	7.22	4670	4390	7	2540	13.5	12.8																
SW09	11/06/2019 10:05	6.36	6.98	4780	*	15	2530	13.7	23.8	0.001	0.001	0.005	0.003	3.62	4.6	0.001	0.01	0.0001	0.001	0.001	0.154	1.04	2.13	0.08	0.3
SW09	8/07/2019 9:30	7.2	6.83	4470	4310	10	2240	13.5	28.6																
SW09	12/08/2019 9:45	6.55	7.43	4030	4030	11	2290	8.8	35.8																
SW09	9/09/2019 9:30	7.46	7.48	4160	3950	7	2440	9.9	10																
SW09	14/10/2019 9:40	6.62	6.93	4290	4320	8	2280	14.8	11.7																
SW11	29/01/2019 11:15	7.66	7.08	132	143	42	258	29.6	159			0.016		2.73											
SW11	30/03/2019 11:10	7.43	7.13	76	92	72	198	20.6	205			0.015		1.09											
SW12	29/01/2019 11:55	7.43	7.02	246	260	20	279	27.6	83.2			0.009		3.76											
SW12	11/02/2019 11:50	7.12	7.33	487	527	5	336	22.7	3																
SW12	12/08/2019 11:20	7.19	7.5	571	564	5	350	10.3	6.4																
SW12	14/10/2019 11:00	7.11	7.65	655	658	5	358	16.5	3.1																

Note: Sampling events where location was too low to sample have not been included. Underlined Dates are from Rainfall Events.
*Error in Field data

Figure 3-e Stream Health Trending data and rainfall


Taxa Richness
Rain (mm)
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50
60
70
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Rain
SH01
SH02
SH04
SH05
SH06
SH08
SH10
SH12
SH13
SH14
SH15
SH16
SH17
SH01 Trigger
SH02 Trigger
SH04 Trigger
SH05 Trigger
SH06 Trigger
SH08 Trigger
SH10 Trigger
SH12 Trigger
SH13 Trigger


Signal 2
Rain (mm)
0
1
2
3
4
5
6
0
10
20
30
40
50
60
70
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Rain
SH01
SH02
SH04
SH05
SH06
SH08
SH10
SH12
SH13
SH14
SH15
SH16
SH17
SH01 Trigger
SH02 Trigger
SH04 Trigger
SH05 Trigger
SH06 Trigger
SH08 Trigger
SH10 Trigger
SH12 Trigger
SH13 Trigger

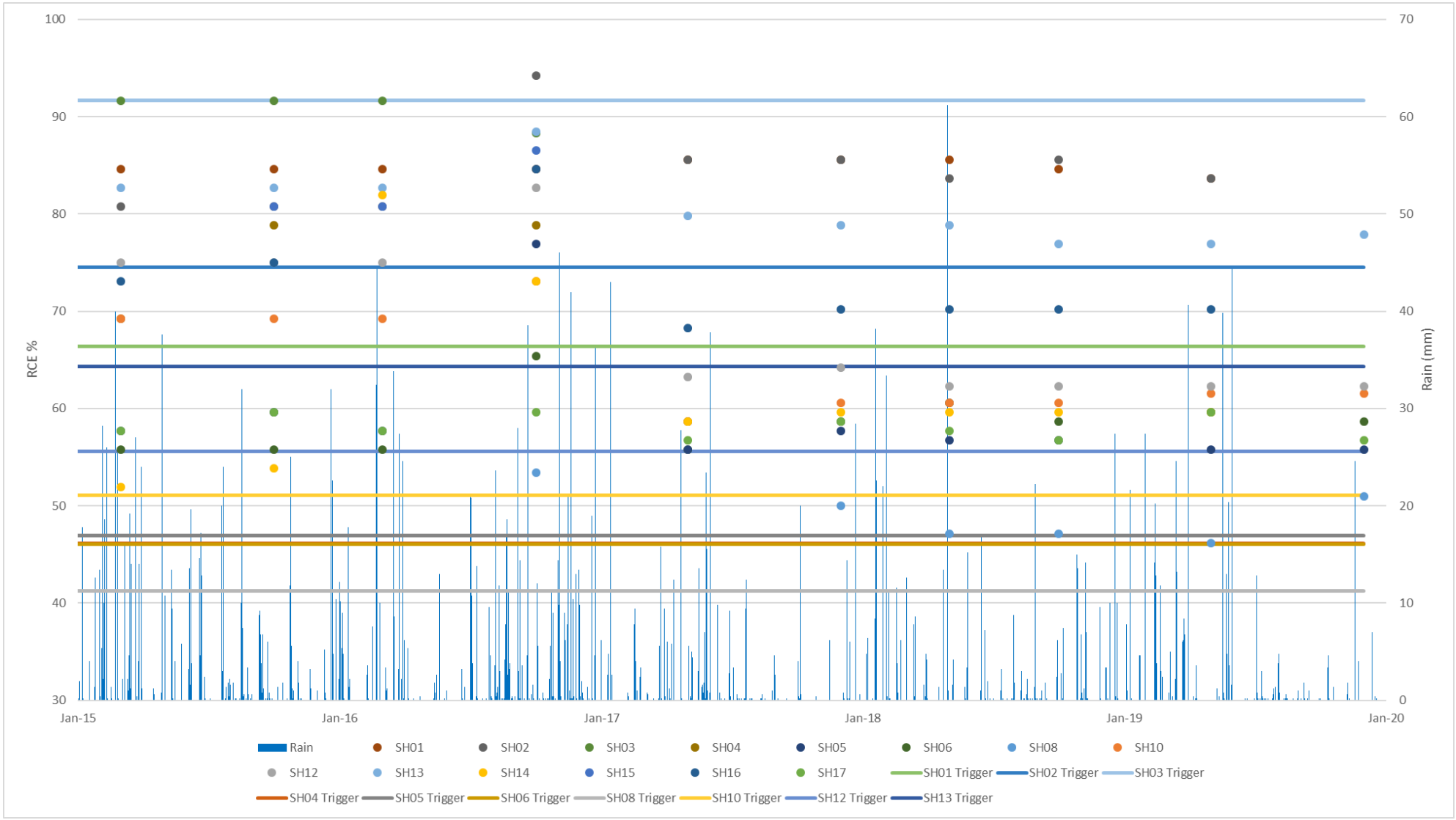
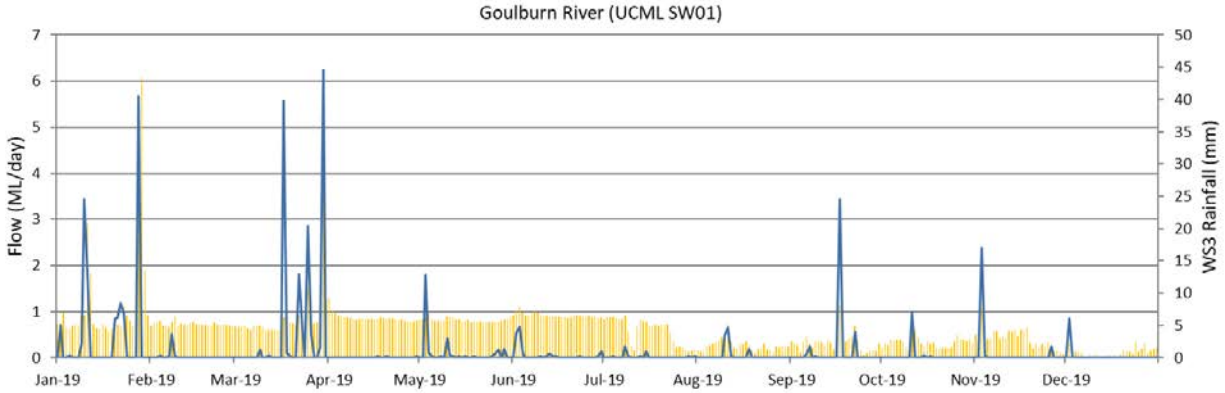

RCE %
Rain (mm)
100
90
80
70
60
50
40
30
70
60
50
40
30
20
10
0
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Rain
SH01
SH02
SH03
SH04
SH05
SH06
SH08
SH10
SH12
SH13
SH14
SH15
SH16
SH17
SH01 Trigger
SH02 Trigger
SH03 Trigger
SH04 Trigger
SH05 Trigger
SH06 Trigger
SH08 Trigger
SH10 Trigger
SH12 Trigger
SH13 Trigger

Table 6: Effluent Discharge Quality

Sample Location	Sample Date	Biological Oxygen Demand (mg/L)	Total Nitrogen (mg/L)	Oil & Grease (mg/L)	Total Phosphorus (mg/L)	pH	Total Suspended Solids (mg/L)
OC Effluent Tank	13/02/2019	6	17.4	<5	2.18	7.42	56
OC Effluent Tank	17/05/2019	10	7.8	<5	2.28	7	18
OC Effluent Tank	15/08/2019	<2	4.8	<5	2.1	6.85	16
OC Effluent Tank	13/11/2019	10	6.8	<5	3.94	7.34	62
Admin Effluent	13/02/2019	<2	29	<5	23	6.6	8
Admin Effluent	17/05/2019	<2	31	<5	25.3	6.67	5
Admin Effluent	15/08/2019	<2	118	<5	28.3	6.36	20
Admin Effluent	12/11/2019	39	219	8	30	7.41	73
CHPP Effluent	13/02/2019	75	5.7	<5	0.3	7.2	14
CHPP Effluent	17/05/2019	17	3.4	<5	0.13	7.03	33
CHPP Effluent	15/08/2019	4	3.5	<5	0.14	6.88	35
CHPP Effluent	12/11/2019	9	1.8	<5	0.11	7.84	35
UG Effluent Tank	13/02/2019	49	6.6	<5	1.18	7.35	24
UG Effluent Tank	17/05/2019	61	7.7	10	2.06	6.66	25
UG Effluent Tank	15/08/2019	53	7.5	12	1.36	6.92	31
UG Effluent Tank	12/11/2019	41	5.4	16	0.64	6.41	51

Figure 3-f 2019 Stream Flow and rainfall



No Flow was recorded in Murragamba Creek, Eastern Creek, and the upper reaches of Wilpinjong Creek.

APPENDIX 3G. GROUNDWATER MONITORING DATA

Sample Point	Date	Electrical Conductivity -Field (µS/cm)	Electrical Conductivity - Lab (µS/cm)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	pH (Field) (Unit)	pH Lab (Unit)	Calcium - Dissolved (mg/L)	Magnesium - Dissolved (mg/L)	Sodium - Dissolved (mg/L)	Alkalinity Carbonate (mg/L)	Alkalinity Bicarbonate (mg/L)	Chloride (mg/L)	Sulphate - Turbidimetric (mg/L)	Aluminium - Dissolved (mg/L)	Arsenic - Dissolved (mg/L)	Boron - Dissolved (mg/L)	Cobalt - Dissolved (mg/L)	Cadmium - Dissolved (mg/L)	Chromium - Dissolved (mg/L)	Copper - Dissolved (mg/L)	Iron - Dissolved (mg/L)	Lead - Dissolved (mg/L)	Manganese - Dissolved (mg/L)	Mercury - Dissolved (mg/L)	Nickel - Dissolved (mg/L)	Selenium - Dissolved (mg/L)	Silver - Dissolved (mg/L)	Zinc - Dissolved (mg/L)	Ammonia as N (mg/L)	Nitrate (mg/L)	Phosphorus - Total (mg/L)	Reactive Phosphorus - Total (mg/L)	Fluoride (mg/L)
PZ003	11/04/19	758	743	424	46	6.33	7.26	3	19	114	<1	89	176	28	0.1	<0.001	<0.05	0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	0.003	<0.0001	<0.001	<0.01	<0.001	0.015	0.03	0.2	0.15	<0.01	0.2
PZ003	15/10/19	844	848	422	20	5.89	6.23	4	21	117	<1	93	185	35	0.18	<0.001	<0.05	0.004	<0.0001	<0.001	0.001	0.05	<0.001	0.018	<0.0001	0.006	<0.01	<0.001	0.037	<0.01	0.45	0.07	<0.01	0.3
PZ039	9/04/19	531	520	480	21	6.30	6.60	25	13	45	<1	26	153	11	<0.01	<0.001	<0.05	0.002	<0.0001	<0.001	0.002	5.75	<0.001	0.173	<0.0001	0.002	<0.01	<0.001	0.029	0.21	0.16	0.03	<0.01	<0.1
PZ039	17/10/19	645	629	380	23	6.21	5.83	26	14	47	<1	32	166	12	<0.01	<0.001	<0.05	0.001	<0.0001	<0.001	<0.001	6.74	<0.001	0.165	<0.0001	0.003	<0.01	<0.001	0.022	0.23	0.21	0.01	<0.01	<0.1
PZ040B	9/04/19	677	698	498	18	5.31	6.02	6	14	102	<1	6	220	23	0.03	<0.001	<0.05	0.012	<0.0001	<0.001	<0.001	0.25	<0.001	0.097	<0.0001	0.01	<0.01	<0.001	0.089	0.12	0.05	<0.01	<0.01	0.1
PZ040B	17/10/19	831	833	434	42	5.44	5.27	8	16	108	<1	9	244	28	0.04	<0.001	<0.05	0.013	<0.0001	<0.001	<0.001	0.11	<0.001	0.132	<0.0001	0.012	<0.01	<0.001	0.055	0.19	0.13	0.22	<0.01	<0.1
PZ044	11/04/19	2730	2790	2330	34	6.86	7.56	396	74	98	<1	356	258	807	<0.01	<0.001	<0.05	<0.001	<0.0001	<0.001	<0.001	0.13	<0.001	0.083	<0.0001	0.002	<0.01	<0.001	0.019	0.45	0.57	0.11	<0.01	0.3
PZ044	15/10/19	2780	2880	2000	38	6.86	6.74	401	76	98	<1	379	268	716	<0.01	0.002	<0.05	<0.001	<0.0001	<0.001	<0.001	0.53	<0.001	0.311	<0.0001	0.002	<0.01	<0.001	0.033	0.02	0.5	0.04	<0.01	0.3
PZ055	10/04/19	2075	1800	1260	12	6.3	6.06	19	78	251	<1	38	355	490	0.02	<0.001	<0.05	0.318	<0.0001	<0.001	<0.001	11	<0.001	6.19	<0.0001	0.063	<0.01	<0.001	0.068	1	0.14	0.03	<0.01	<0.1
PZ055	16/10/19	2184	2240	1260	42	5.4	5.58	20	85	259	<1	40	433	412	0.01	<0.001	<0.05	0.322	<0.0001	<0.001	<0.001	0.2	<0.001	6.34	<0.0001	0.068	<0.01	<0.001	0.064	1.07	0.03	<0.01	<0.01	0.1
PZ058A	11/04/19	14540	15400	14500	2850	3.59	3.53	135	606	1960	<1	<1	3620	4480	323	0.024	<0.05	1.73	0.013	0.085	0.258	2.78	0.006	1.67	<0.0001	2.09	0.11	<0.001	11.9	0.02	<0.05	0.83	0.1	0.4
PZ058A	15/10/19	15350	15700	12000	1920	8.49	3.54	138	650	2040	<1	<1	3620	4300	332	0.024	<0.05	1.71	0.0128	0.085	0.733	6.42	0.007	1.78	0.0001	2.22	0.08	<0.001	11.3	0.01	<0.05	0.9	0.06	0.3
PZ101B	8/04/19	778	718	511	74	7.20	7.45	52	20	79	<1	304	53	<1	<0.01	0.007	<0.05	<0.001	<0.0001	<0.001	<0.001	1.77	<0.001	0.229	<0.0001	0.002	<0.01	<0.001	<0.005	0.6	0.1	0.34	0.03	1.1
PZ101B	15/10/19	816	834	450	86	6.85	7.55	55	22	81	<1	329	55	<1	<0.01	0.007	<0.05	<0.001	<0.0001	<0.001	0.002	1.97	<0.001	0.235	<0.0001	0.002	<0.01	<0.001	<0.005	0.59	0.02	0.29	<0.01	1.2
PZ101C	8/04/19	536	525	356	7	6.63	7.04	33	16	58	<1	195	60	<1	<0.01	0.002	<0.05	0.002	<0.0001	<0.001	0.002	0.92	<0.001	0.499	<0.0001	0.005	<0.01	<0.001	0.007	0.31	0.03	0.16	<0.01	0.5
PZ101C	15/10/19	637	639	336	74	7	6.97	33	17	63	<1	221	62	1	0.11	0.002	<0.05	0.002	<0.0001	<0.001	<0.001	1.53	<0.001	0.543	<0.0001	0.004	<0.01	<0.001	0.013	0.38	0.2	0.11	<0.01	0.5
PZ102A	8/04/19	1316	1250	794	<5	6.96	7.19	70	28	152	<1	252	201	137	<0.01	<0.001	<0.05	<0.001	<0.0001	<0.001	0.002	1.95	<0.001	0.074	<0.0001	<0.001	<0.01	<0.001	<0.005	0.52	0.02	0.02	<0.01	2
PZ102A	15/10/19	1417	1460	759	98	6.94	7.33	69	28	158	<1	287	206	128	0.03	<0.001	<0.05	0.025	<0.0001	<0.001	<0.001	0.54	<0.001	0.125	<0.0001	0.086	<0.01	<0.001	0.01	0.46	0.03	0.03	<0.01	2
PZ102B	8/04/19	2308	2330	1980	<5	6.55	6.92	183	78	228	<1	173	134	975	<0.01	<0.001	<0.05	<0.001	<0.0001	<0.001	0.004	<0.05	<0.001	0.004	<0.0001	0.007	<0.01	<0.001	0.183	<0.01	0.52	0.03	<0.01	1.2
PZ102B	15/10/19	2510	2510	1790	26	6.9	6.67	190	79	223	<1	190	142	782	0.02	<0.001	<0.05	<0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	0.009	<0.0001	0.009	<0.01	<0.001	0.184	0.04	0.67	<0.01	<0.01	1.2
PZ103A	12/04/19	610	526	364	36	6.1	6.84	43	19	39	<1	140	81	10	<0.01	0.002	<0.05	0.001	<0.0001	<0.001	0.001	4.25	<0.001	0.078	<0.0001	0.009	<0.01	<0.001	<0.005	0.19	0.01	0.05	<0.01	0.4
PZ103A	15/10/19	703	698	354	118	6.35	6.67	42	19	55	<1	180	81	18	<0.01	0.002	<0.05	0.001	<0.0001	<0.001	<0.001	3.75	<0.001	0.098	<0.0001	0.005	<0.01	<0.001	0.016	0.34	<0.01	0.01	<0.01	0.6
PZ103C	12/04/19	304	256	207	3550	5.28	5.58	5	8	33	<1	16	68	14	0.02	<0.001	<0.05	0.015	<0.0001	<0.001	0.002	0.44	<0.001	0.266	<0.0001	0.134	<0.01	<0.001	0.049	0.01	0.03	0.46	<0.01	<0.1
PZ103C	15/10/19	327	337	172	665	5.33	5.35	5	8	34	<1	23	68	19	0.01	<0.001	<0.05	0.013	<0.0001	<0.001	<0.001	0.48	<0.001	0.254	<0.0001	0.126	<0.01	<0.001	0.076	<0.01	0.02	0.11	<0.01	<0.1
PZ104	11/04/19	7790	7760	2000	299	12.73	12.4	710	<1	35	62	<1	23	<1	0.05	<0.001	<0.05	<0.001	<0.0001	0.082	0.002	<0.05	<0.001	<0.001	<0.0001	0.001	<0.01	<0.001	<0.005	0.2	0.03	0.13	<0.01	0.2
PZ104	17/10/19	5340	5120	1140	180	12.3	12.2	438	<1	37	60	<1	23	<1	0.13	<0.001	<0.05	<0.001	<0.0001	0.476	<0.001	<0.05	0.004	<0.001	<0.0001	<0.001	<0.01	<0.001	<0.005	0.22	0.04	0.06	<0.01	0.2
PZ105C	8/04/19	183	154	199	29	6.25	6.80	4	3	23	<1	34	44	<1	<0.01	0.001	<0.05	0.014	<0.0001	<0.001	0.001	3.02	<0.001	0.766	<0.0001	0.062	<0.01	<0.001	0.006	0.08	<0.01	0.07	<0.01	<0.1
PZ105C	15/10/19	211	219	120	22	6.25	5.93	4	3	24	<1	48	47	1	<0.01	<0.001	<0.05	0.013	<0.0001	0.002	<0.001	2.92	<0.001	0.742	<0.0001	0.05	<0.01	<0.001	0.007	0.09	0.04	0.05	<0.01	<0.1
PZ106A	9/04/19	675	654	378	22	8.85	8.19	21	2	101	<1	44	190	11	0.52	<0.001	<0.05	<0.001	<0.0001	<0.001	0.004	<0.05	<0.001	0.004	<0.0001	<0.001	<0.01	<0.001	<0.005	<0.01	0.92	<0.01	<0.01	0.1
PZ106A	17/10/19	766	787	418	48	8.64	9.01	23	2	100	1	52	198	14	0.49	<0.001	<0.05	<0.001	<0.0001	<0.001	0.002	<0.05	<0.001	0.002	<0.0001	<0.001	<0.01	<0.001	<0.005	<0.01	1.04	0.01	<0.01	0.1
PZ106B	9/04/19	1699	1790	1470	189	5.21	5.83	26	47	239	<1	13	576	46	0.03	<0.001	<0.05	0.04	0.0006	<0.001	0.002	0.18	<0.001	0.954	<0.0001	0.061	<0.01	<0.001	0.131	0.06	0.03	0.33	<0.01	<0.1
PZ106B	17/10/19	1531	1590	874	48	6.03	5.26	22	39	187	<1	24	469	45	0.03	<0.001	<0.05	0.024	0.0002	<0.001	<0.001	0.3	<0.001	0.715	<0.0001	0.039	<0.01	<0.001	0.106	0.02	0.02	0.02	<0.01	<0.1
PZ107	9/04/19	645	641	418	70	6.58	6.85	28	18	80	<1	137	92	49	<0.01	<0.001	<0.05	<0.001	<0.0001	<0.001	<0.001	3.13	<0.001	0.089	0.0001	<0.001	<0.01	<0.001	0.008	0.17	0.02	0.36	<0.01	0.2
PZ107	17/10/19	847	859	434	142	6.50	6.47	36	27	86	<1	175	122	49	<0.01	<0.001	<0.05	<0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	0.022	<0.0001	0.001	<0.01	<0.001	0.012	0.04	0.18	0.12	<0.01	0.2
PZ109	8/04/19	681	636	390	33	6.59	7.12	36	32	58	<1	198	81	14	<0.01	<0.001	<0.05	<0.001	<0.0001	0.001	<0.001	<0.05	<0.001	0.004	<0.0001	0.005	<0.01	<0.001	0.022	0.01	0.21	0.05	0.02	0.2
PZ109	14/10/19	735	740	366	31	7.49	6.74	36	32	57	<1	222	81	16	<0.01	<0.001	<0.05	<0.001	<0.0001	0.001	<0.001	<0.05	<0.001	0.003	<0.0001	0.003	<0.01	<0.001	0.019	<0.01	0.24	0.04	0.02	0.2

Sample Point	Date	Electrical Conductivity -Field (µS/cm)	Electrical Conductivity - Lab (µS/cm)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	pH (Field) (Unit)	pH Lab (Unit)	Calcium - Dissolved (mg/L)	Magnesium - Dissolved (mg/L)	Sodium - Dissolved (mg/L)	Alkalinity Carbonate (mg/L)	Alkalinity Bicarbonate (mg/L)	Chloride (mg/L)	Sulphate - Turbidimetric (mg/L)	Aluminium - Dissolved (mg/L)	Arsenic - Dissolved (mg/L)	Boron - Dissolved (mg/L)	Cobalt - Dissolved (mg/L)	Cadmium - Dissolved (mg/L)	Chromium - Dissolved (mg/L)	Copper - Dissolved (mg/L)	Iron - Dissolved (mg/L)	Lead - Dissolved (mg/L)	Manganese - Dissolved (mg/L)	Mercury - Dissolved (mg/L)	Nickel - Dissolved (mg/L)	Selenium - Dissolved (mg/L)	Silver - Dissolved (mg/L)	Zinc - Dissolved (mg/L)	Ammonia as N (mg/L)	Nitrate (mg/L)	Phosphorus - Total (mg/L)	Reactive Phosphorus - Total (mg/L)	Fluoride (mg/L)
PZ111	12/04/19	1000	927	850	1190	6.09	6.63	60	32	66	<1	110	253	13	<0.01	<0.001	<0.05	0.013	<0.0001	<0.001	0.001	1.59	<0.001	0.573	<0.0001	0.038	<0.01	<0.001	0.007	0.6	0.04	<0.01	<0.01	0.3
PZ111	17/10/19	1046	1040	614	629	7.83	6.47	58	32	59	<1	125	246	14	<0.01	<0.001	<0.05	0.013	<0.0001	<0.001	<0.001	0.54	<0.001	0.63	<0.0001	0.037	<0.01	<0.001	<0.005	0.12	0.04	0.02	<0.01	0.2
PZ112B	8/04/19	2470	2620	1880	6990	4.48	5.5	2	33	483	<1	6	661	343	0.2	<0.001	<0.05	0.032	0.0004	<0.001	0.004	<0.05	<0.001	0.083	<0.0001	0.084	<0.01	<0.001	0.134	0.01	2.42	0.64	<0.01	0.2
PZ112B	14/10/19	5250	3030	2640	3050	3.02	5.15	2	38	516	<1	5	708	308	0.19	<0.001	<0.05	0.038	0.0003	<0.001	0.001	<0.05	<0.001	0.109	<0.0001	0.091	<0.01	<0.001	0.146	0.08	2.16	0.55	<0.01	0.2
PZ137	9/04/19	1352	1360	1190	28	6.24	6.26	57	48	118	<1	65	396	81	<0.01	<0.001	<0.05	0.002	<0.0001	<0.001	0.001	7.8	<0.001	0.618	<0.0001	0.008	<0.01	<0.001	0.017	0.04	0.15	<0.01	<0.01	<0.1
PZ137	17/10/19	1466	1480	936	44	6.16	6.17	52	45	112	<1	60	384	79	<0.01	<0.001	<0.05	<0.001	<0.0001	<0.001	<0.001	0.89	<0.001	0.126	<0.0001	0.002	<0.01	<0.001	0.011	<0.01	0.18	<0.01	<0.01	0.1
PZ151	9/04/19	2170	2270	1850	226	6.15	6.30	186	89	175	<1	46	281	837	<0.01	0.004	<0.05	0.019	0.0002	<0.001	0.002	5.53	<0.001	0.364	<0.0001	0.049	<0.01	<0.001	0.22	0.2	0.02	0.08	<0.01	0.2
PZ151	14/10/19	2980	2980	2380	3120	5.87	5.66	270	130	213	<1	10	233	1260	<0.01	<0.001	0.08	0.04	0.001	<0.001	0.002	<0.05	<0.001	0.739	<0.0001	0.104	<0.01	<0.001	0.718	0.14	0.04	0.52	<0.01	0.2
PZ170	9/04/19	3480	3810	3720	38	6.36	6.59	211	144	268	<1	219	1140	2	<0.01	0.007	<0.05	0.004	<0.0001	<0.001	<0.001	10.8	<0.001	0.306	<0.0001	0.03	<0.01	<0.001	0.009	0.18	0.08	0.02	0.02	<0.1
PZ170	17/10/19	4040	3990	2560	32	6.35	6.37	212	148	268	<1	238	1120	<1	<0.01	0.005	<0.05	0.009	<0.0001	<0.001	<0.001	8.62	<0.001	0.324	<0.0001	0.06	<0.01	<0.001	0.04	0.26	0.2	0.02	<0.01	0.1
PZ174	9/04/19	10940	12400	12300	7	6.03	6.37	218	610	1270	<1	312	4080	358	<0.01	<0.001	<0.05	0.182	0.0001	<0.001	<0.001	0.31	<0.001	1.07	<0.0001	0.093	<0.01	<0.001	0.068	0.14	<0.01	<0.02	<0.01	0.6
PZ174	17/10/19	11510	11800	7680	44	5.94	6.04	216	580	1180	<1	322	3840	291	<0.01	<0.001	<0.05	0.198	<0.0001	<0.001	0.001	0.12	<0.001	1.18	<0.0001	0.101	<0.01	<0.001	0.076	0.2	0.02	<0.02	<0.01	0.4
PZ175	9/04/19	12310	14000	13800	622	6.36	6.81	163	755	1580	<1	442	4660	455	<0.01	<0.001	<0.05	0.036	0.0001	<0.001	0.002	<0.05	<0.001	0.305	<0.0001	0.012	<0.01	<0.001	0.006	0.05	0.02	0.22	<0.01	1.1
PZ175	17/10/19	12500	12300	8100	6060	6.24	6.26	141	650	1380	<1	394	4000	340	<0.01	<0.001	<0.05	0.033	0.0008	<0.001	<0.001	<0.05	<0.001	0.278	<0.0001	0.016	<0.01	<0.001	0.008	0.04	0.08	0.11	<0.01	0.8
PZ176	9/04/19	542	500	414	20	6.48	6.58	13	18	62	<1	38	154	1	<0.01	<0.001	<0.05	<0.001	<0.0001	<0.001	0.002	2.64	<0.001	0.164	<0.0001	0.002	<0.01	<0.001	0.008	0.06	0.18	0.03	<0.01	<0.1
PZ176	17/10/19	580	613	366	50	6.91	6.5	12	18	62	<1	43	171	2	<0.01	<0.001	<0.05	<0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	0.026	<0.0001	<0.001	<0.01	<0.001	0.009	0.04	0.16	0.01	<0.01	<0.1
PZ186	11/04/19	353	284	199	165	6.49	6.67	19	10	24	<1	70	53	2	<0.01	0.003	<0.05	<0.001	<0.0001	<0.001	<0.001	7.63	<0.001	0.184	<0.0001	0.002	<0.01	<0.001	0.006	0.07	0.02	1.6	<0.01	0.2
PZ186	17/10/19	379	371	217	56	6.01	6.42	19	11	23	<1	80	54	4	<0.01	0.004	<0.05	<0.001	<0.0001	0.001	<0.001	7.63	0.002	0.191	<0.0001	<0.001	<0.01	<0.001	0.006	0.08	0.02	0.21	<0.01	0.2
PZ187	11/04/19	912	866	499	206	6.08	6.3	2	11	159	<1	30	278	19	<0.01	<0.001	<0.05	<0.001	<0.0001	<0.001	0.004	0.25	<0.001	0.01	<0.0001	0.007	<0.01	<0.001	<0.005	0.02	0.79	0.21	<0.01	<0.1
PZ187	17/10/19	526	538	274	165	5.64	5.74	2	6	87	<1	16	143	10	<0.01	0.002	<0.05	<0.001	<0.0001	0.002	<0.001	1.85	0.003	0.021	<0.0001	0.005	<0.01	<0.001	<0.005	0.2	0.08	0.1	<0.01	<0.1
PZ188	11/04/19	134	107	108	37	5.98	5.63	1	2	22	<1	11	36	2	<0.01	<0.001	<0.05	0.003	<0.0001	<0.001	0.002	<0.05	<0.001	0.02	<0.0001	0.01	<0.01	<0.001	0.058	<0.01	0.14	0.03	<0.01	<0.1
PZ188	17/10/19	150	152	98	34	5.06	5.35	<1	2	22	<1	9	38	<1	<0.01	<0.001	<0.05	0.003	<0.0001	<0.001	0.001	<0.05	<0.001	0.016	<0.0001	0.008	<0.01	<0.001	0.01	0.08	0.12	0.14	<0.01	<0.1
PZ189	11/04/19	424	298	282	56	6.2	5.87	13	11	37	<1	27	81	3	0.01	<0.001	<0.05	0.003	<0.0001	<0.001	<0.001	19.3	<0.001	0.593	<0.0001	0.005	<0.01	<0.001	0.384	0.03	0.2	0.26	<0.01	0.2
PZ189	17/10/19	450	430	274	27	5.93	6.18	12	11	32	<1	56	82	3	0.01	<0.001	<0.05	<0.001	<0.0001	0.002	<0.001	22.4	0.002	0.523	<0.0001	<0.001	<0.01	<0.001	0.01	0.04	0.01	0.19	<0.02	0.2
PZ191	11/04/19	1518	1540	1130	83	3.42	3.02	33	24	128	<1	<1	458	4	0.04	<0.001	<0.05	0.008	<0.0001	<0.001	0.003	42.6	<0.001	1.15	<0.0001	0.009	<0.01	<0.001	0.023	0.39	0.05	0.17	<0.01	<0.1
PZ191	16/10/19	1262	1240	720	2730	6.8	6.62	31	15	186	<1	186	136	183	<0.01	<0.001	<0.05	<0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	0.08	<0.0001	<0.001	<0.01	<0.001	<0.005	0.59	0.07	2.58	<0.01	0.7
PZ202	9/04/19	76	70	96	2720	5.43	5.58	<1	2	12	<1	13	17	6	0.06	<0.001	<0.05	0.002	<0.0001	<0.001	<0.001	<0.05	<0.001	0.119	<0.0001	0.004	<0.01	<0.001	0.016	0.02	0.04	0.69	<0.01	<0.1
PZ203	9/04/19	301	269	208	16	5.5	5.71	3	5	48	<1	8	78	13	<0.01	<0.001	<0.05	0.044	<0.0001	<0.001	0.002	<0.05	<0.001	0.228	<0.0001	0.037	<0.01	<0.001	0.063	<0.01	0.09	0.02	<0.01	<0.1
PZ203	14/10/19	327	348	190	53	4.97	5.38	4	6	44	<1	12	78	17	0.02	<0.001	<0.05	0.052	<0.0001	<0.001	0.001	<0.05	<0.001	0.288	<0.0001	0.042	<0.01	<0.001	0.044	<0.01	0.08	0.04	<0.01	<0.1
PZ213	9/04/19	415	392	324	10	5.68	5.98	10	10	51	<1	15	122	12	<0.01	<0.001	<0.05	0.1	0.0001	<0.001	0.004	<0.05	<0.001	0.424	<0.0001	0.184	<0.01	<0.001	0.131	<0.01	0.22	<0.01	<0.01	<0.1
PZ213	17/10/19	703	729	398	36	5.36	5.36	9	13	100	<1	13	213	10	<0.01	<0.001	<0.05	0.028	0.0001	<0.001	0.002	<0.05	<0.001	0.173	<0.0001	0.088	<0.01	<0.001	0.106	0.03	0.47	0.14	<0.01	0.1
PZ214	9/04/19	154	128	105	9	6.12	6.18	5	5	19	<1	29	33	4	<0.01	<0.001	<0.05	0.001	<0.0001	<0.001	0.001	<0.05	<0.001	0.015	<0.0001	0.008	<0.01	<0.001	0.022	<0.01	1.17	0.01	<0.01	<0.1
PZ214	17/10/19	204	207	111	35	5.86	5.93	6	7	22	<1	34	36	3	<0.01	<0.001	<0.05	0.002	<0.0001	<0.001	<0.001	<0.05	<0.001	0.019	<0.0001	0.006	<0.01	<0.001	0.021	<0.01	1.89	<0.01	<0.01	0.1

BORE	PZ105A – 28m	PZ105A – 80m	PZ105A – 118m	PZ105A – 130m	PZ127 - 43m	PZ127 - 68m	PZ127 - 112m	PZ127 - 141m	PZ128 - 20m	PZ128 - 36m	PZ128 - 55m
Jan-19	372.62	366.41	355.16	347.54	449.10	441.90	383.60	374.10	388.80	374.90	370.70
Feb-19	373.14	366.22	355.80	347.95	449.00	441.50	383.30	373.60	388.70	374.80	370.70
Mar-19	373.41	366.15	356.05	348.07	449.13	441.16	382.84	373.11	388.77	374.78	370.53
Apr-19	373.77	366.12	356.10	348.30	448.38	436.62	380.89	371.89	388.82	374.73	370.46
May-19	373.91	366.11	356.17	348.30	449.13	432.94	381.46	372.05	388.91	374.70	370.39
Jun-19	374.02	366.57	356.15	347.89	449.13	433.78	381.29	369.94	388.86	374.68	370.29
Jul-19	374.03	367.51	355.97	347.74	449.30	434.28	381.46	368.49	388.86	374.65	370.18
Aug-19	374.00	367.97	355.73	346.35	449.13	435.27	381.63	367.43	388.86	374.61	370.18
Sep-19	373.96	368.45	355.47	347.24	449.13	435.68	381.58	366.59	388.79	374.56	370.11
Oct-19	373.95	369.56	355.16	347.54	449.19	435.80	381.52	365.53	388.77	374.51	370.01
Nov-19	373.84	369.61	354.75	347.74	449.13	435.80	381.52	364.86	388.75	374.46	369.98
Dec-19	373.77	366.55	354.41	347.77	449.19	435.51	381.46	364.03	388.75	374.44	369.92
min	*372.62*	*366.11*	*354.41*	*346.35*	*448.38*	*432.94*	*380.89*	*364.03*	*388.70*	*374.44*	*369.92*
max	*374.03*	*369.61*	*356.17*	*348.30*	*449.3*	*441.9*	*383.60*	*374.10*	*388.91*	*374.90*	*370.70*

BORE	PZ129 - 35m	PZ129 - 53m	PZ129 - 74m	PZ130 - 38.5m	PZ130 - 64m	PZ130 – 97m	PZ133 - 31.5m	PZ133 - 43m	PZ133 - 59m	PZ179 - 28m	PZ179 - 33m	PZ179 - 145m
Jan-19	390.20	384.30	374.40	496.60	472.50	449.80	419.80	413.60	387.80	414.20	412.10	336.90
Feb-19	390.20	384.40	373.80	496.60	472.50	449.80	419.40	413.00	387.80	414.20	412.10	336.00
Mar-19	390.07	384.43	373.59	496.59	472.58	449.78	419.26	413.15	387.83	414.35	414.91	334.92
Apr-19	390.05	384.13	372.38	496.57	472.62	449.78	419.33	412.74	387.83	414.68	415.83	334.75
May-19	390.05	384.05	367.73	496.54	472.67	449.75	418.89	411.04	387.85	415.13	416.35	334.40
Jun-19	390.05	384.17	365.19	496.54	472.62	449.75	418.67	411.44	387.83	415.53	416.57	334.00
Jul-19	390.03	383.93	363.69	496.52	472.69	449.75	418.42	410.71	387.83	415.90	416.76	333.14
Aug-19	390.02	383.74	363.06	496.50	472.69	449.71	*	*	*	416.16	416.84	332.79
Sep-19	390.05	383.53	362.59	496.45	472.69	449.70	*	*	*	416.34	416.94	332.48
Oct-19	390.02	383.41	362.83	496.45	472.53	449.71	*	*	*	416.56	417.01	332.31
Nov-19	390.03	383.57	363.71	496.42	472.51	449.68	*	*	*	416.70	417.04	331.91
Dec-19	390.00	383.39	364.06	496.40	472.58	449.66	*	*	*	416.82	417.06	331.68
min	*390.00*	*383.39*	*362.59*	*496.40*	*472.50*	*449.66*	*418.42*	*410.71*	*387.80*	*414.20*	*412.10*	*331.68*
max	*390.20*	*384.43*	*374.40*	*496.60*	*472.69*	*449.80*	*419.80*	*413.60*	*387.85*	*416.82*	*417.06*	*336.90*

BORE	PZ192-68m	PZ192-166m	PZ192-178m	PZ193 - 80m	PZ193 - 162m	PZ193 - 184m
Jan-19	403.40	356.20	351.70	418.10	360.20	350.80
Feb-19	403.40	356.00	351.60	418.10	360.18	350.70
Mar-19	403.24	355.86	351.41	418.04	360.17	350.51
Apr-19	403.21	355.56	351.15	418.05	360.25	350.27
May-19	403.16	355.42	351.06	417.99	360.24	350.17
Jun-19	403.13	354.82	350.31	417.99	359.97	349.59
Jul-19	402.98	353.76	349.40	417.91	359.23	348.45
Aug-19	402.91	353.14	348.60	417.87	358.87	347.83
Sep-19	402.79	352.57	348.03	417.85	358.64	347.26
Oct-19	402.42	352.32	347.65	417.80	358.49	346.85
Nov-19	402.25	351.79	347.10	417.72	358.22	346.37
Dec-19	402.23	351.31	346.90	417.69	358.15	345.96
min	*402.23*	*351.31*	*346.90*	*417.69*	*358.15*	*345.96*
max	*403.40*	*356.20*	*351.70*	*418.10*	*360.25*	*350.80*

*Bore Mined out by OC4

BORE	PZ003	PZ39	PZ40B	PZ44	PZ55	PZ58A	PZ101C	PZ101B	PZ102B	PZ102A	PZ103C	PZ103B	PZ103A	PZ104	PZ105C	PZ106B	PZ106A	PZ107
Jan-19	469.30	413.10	415.30	479.10	423.10	467.20	380.50	366.80	358.80	358.50	400.10		357.00	375.10	374.20	426.30	494.70	434.40
Feb-19	469.20	413.10	415.10	479.10	423.10	467.20	380.50	366.80	358.70	358.20	400.10		356.80	375.20	374.30	426.40	494.50	434.60
Mar-19	468.80	413.00	415.00	479.10	423.10	467.30	380.40	366.80	358.40	357.80	400.00		356.60	374.80	374.20	426.40	495.30	434.70
Apr-19	468.50	413.00	414.90	479.10	423.10	467.20	380.50	366.80	358.80	359.00	399.90		356.40	374.50	374.20	426.40	494.20	434.70
May-19	469.20	412.80	414.70	478.90	423.10	467.00	380.40	366.40	358.00	357.60	399.90		356.10	374.20	374.20	425.70	494.20	434.80
Jun-19	467.90	412.80	414.30	479.00	423.10	467.10	380.30	366.50	357.70	357.40	399.90		355.50	374.00	374.10	425.80	494.00	435.30
Jul-19	467.70	412.80	414.30	479.10	423.00	467.10	380.40	366.40	357.20	356.80	400.00		354.60	373.80	374.10	425.80	494.00	435.40
Aug-19	467.30	412.50	414.20	479.10	422.90	466.90	380.30	366.10	356.50	356.00	399.80		353.90		374.00	425.90	494.00	436.10
Sep-19	467.20	412.40	413.80	478.90	422.90	467.00	380.30	366.00	356.10	355.70	399.80		353.60	374.50	374.00	426.00	494.00	436.30
Oct-19	467.30	412.40	413.80	478.90	422.90	466.90	380.30	365.80	355.80	355.30	399.90		353.30	374.50	373.80	426.00	494.00	436.50
Nov-19	467.30	412.40	413.60	478.80	422.80	466.80	380.20	365.60	355.00	354.70	399.90		352.60	373.10	373.90	425.30	494.00	436.30
Dec-19	467.30	412.30	413.50	478.80	422.80	467.40	380.20	365.40	355.10	354.60	399.90		352.50		373.80	425.40	494.50	436.20
min	*467.20*	*412.30*	*413.50*	*478.80*	*422.80*	*466.80*	*380.20*	365.40	355.00	*354.60*	399.80		352.50	*373.10*	*373.80*	*425.30*	*494.00*	*434.40*
max	*469.30*	*413.10*	*415.30*	*479.10*	*423.10*	*467.40*	*380.50*	366.80	358.80	*359.00*	400.10		357.00	*375.20*	*374.30*	*426.40*	*495.30*	*436.50*
BORE	**PZ109**	**PZ111**	**PZ112B**	**PZ137**	**PZ149**	**PZ151**	**PZ152**	**PZ170**	**PZ174**	**PZ175**	**PZ176**	**PZ177**	**PZ184**	**PZ186**	**PZ187**	**PZ188**	**PZ189**	**PZ191**
Jan-19	382.30	368.20	479.20	460.70	468.30	374.30	440.70	420.00	413.40	415.80	414.50			384.50	414.40	414.30	401.40	365.00
Feb-19	382.40	368.30	479.30	460.80	468.20	374.40	440.90	420.00	413.40	415.70	414.60	414.60	410.10	384.20	414.40	414.30	401.30	365.00
Mar-19	382.30	368.00	479.20	460.70		374.30		420.00	413.40	415.50	414.40			383.80	414.30	414.20	401.20	364.70
Apr-19	382.30	367.70	479.10	460.70	468.10	374.30	441.00	419.90	413.30	415.50	414.40	414.50		383.70	414.10	414.10	401.10	364.50
May-19	382.30	367.40	479.00	460.70	468.00	374.00	440.50	419.90	413.20	415.40	414.20	414.60		383.40	414.10	414.00	401.20	362.90
Jun-19	382.20	369.80	479.00	460.70		373.90	440.80	419.90	413.20	415.30	414.20	414.60	410.10	383.80	414.10	414.00	401.10	354.90
Jul-19	382.20	369.90	478.90	460.70		373.90	441.90	420.20	413.30	415.10	414.20			383.40	414.00	413.90	401.10	349.70
Aug-19	382.30	369.90	478.80	460.60	468.00	373.50	440.80	419.70	413.00	415.00	414.00	414.50	410.10	383.50	413.80	413.80	400.00	349.10
Sep-19	382.30	369.40	478.80	460.60	467.90	373.60	440.60	419.70	412.80	414.80	413.90	414.50	410.10	383.40	413.60	413.70	399.80	
Oct-19	382.30	369.30	478.70	460.70		373.70		419.60	412.80	414.70	413.90	414.50	410.10	381.10	413.60	413.60	399.70	349.00
Nov-19	381.60	368.80	478.60	460.60	467.90	373.40	440.30	419.60	412.80	414.60	413.70	414.50	410.10	380.60	413.60	413.50	399.70	348.90
Dec-19	381.50	368.60	478.50	460.60	468.00	373.50	440.30	419.50	412.70	414.50	413.70	414.50	410.10			413.50	399.60	357.00
min	*381.50*	*367.40*	*478.50*	*460.60*	*467.90*	*373.40*	*440.30*	*419.50*	*412.70*	*414.50*	*413.70*	*414.50*	*410.10*	*380.60*	*413.60*	*413.50*	*399.60*	348.90
max	*382.40*	*369.90*	*479.30*	*460.80*	*468.30*	*374.40*	*441.90*	*420.20*	*413.40*	*415.80*	*414.60*	*414.60*	*410.10*	*384.50*	*414.40*	*414.30*	*401.40*	365.00

BORE	PZ201	PZ202	PZ203	PZ211	PZ213	PZ214
Jan-19		408.40	402.70		413.70	413.80
Feb-19		408.40	402.60		413.60	413.70
Mar-19			402.50		413.50	413.60
Apr-19		408.30	402.60		413.50	413.60
May-19	408.00	408.50	402.50		413.40	413.50
Jun-19		408.50	402.50		413.30	413.40
Jul-19		408.50	402.40		413.20	413.30
Aug-19	408.10	409.50	402.30		413.10	413.20
Sep-19			402.30		413.10	413.20
Oct-19			402.30		412.90	413.00
Nov-19			402.30		412.90	413.00
Dec-19			402.20		412.80	412.90
min	*408.00*	*408.30*	*402.20*		*412.80*	*412.90*
max	*408.10*	*409.50*	*402.70*		*413.70*	*413.80*

Gaps in data indicate that no result is available

GROUNDWATER LEVEL GRAPHS

Figure 3-g: Ulan Granite Composite Hydrograph

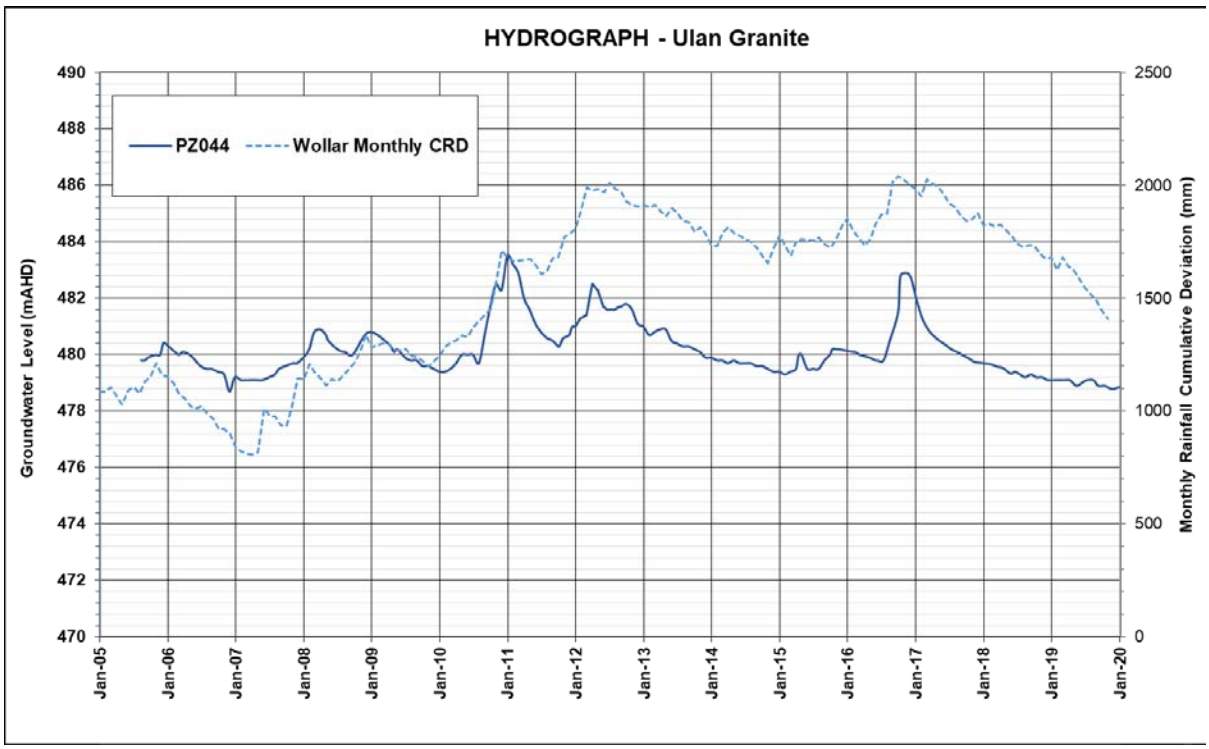


Figure 3-h: Marrangaroo and Ulan Seam Composite Hydrograph

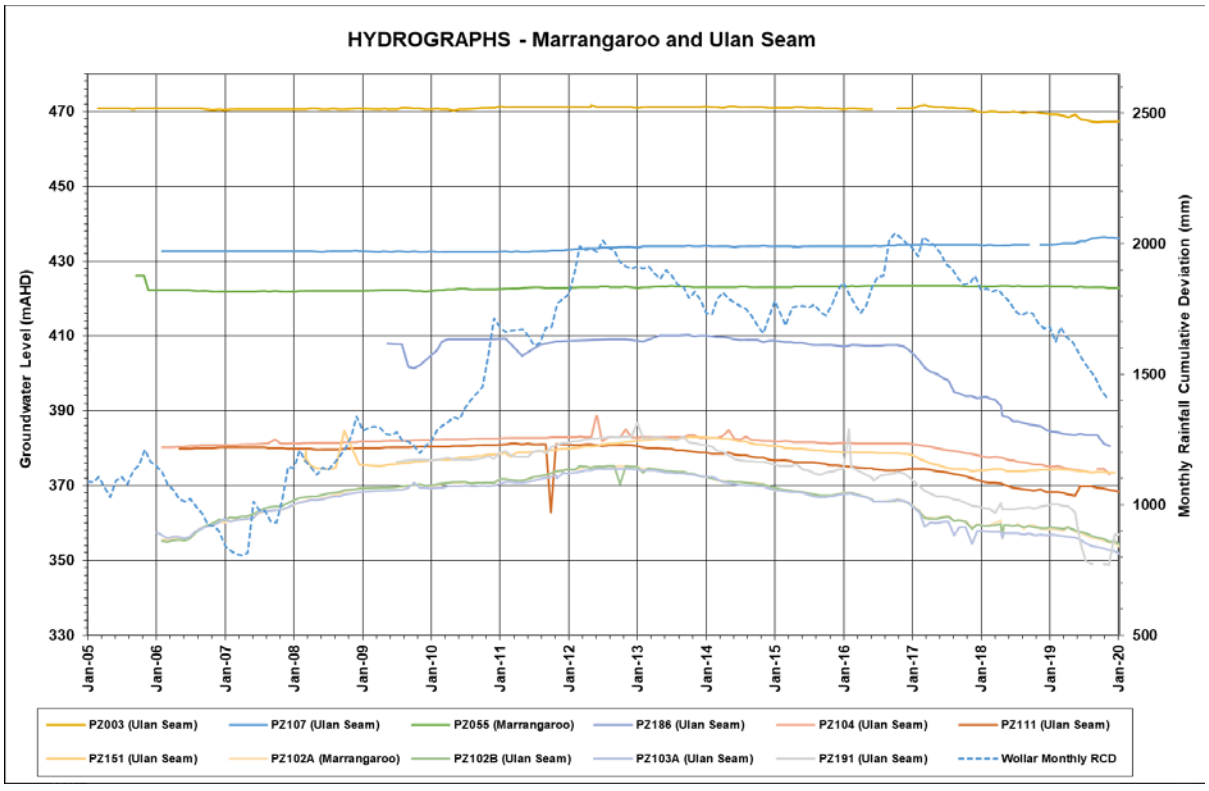


Figure 3-i: Permian Overburden Composite Hydrograph

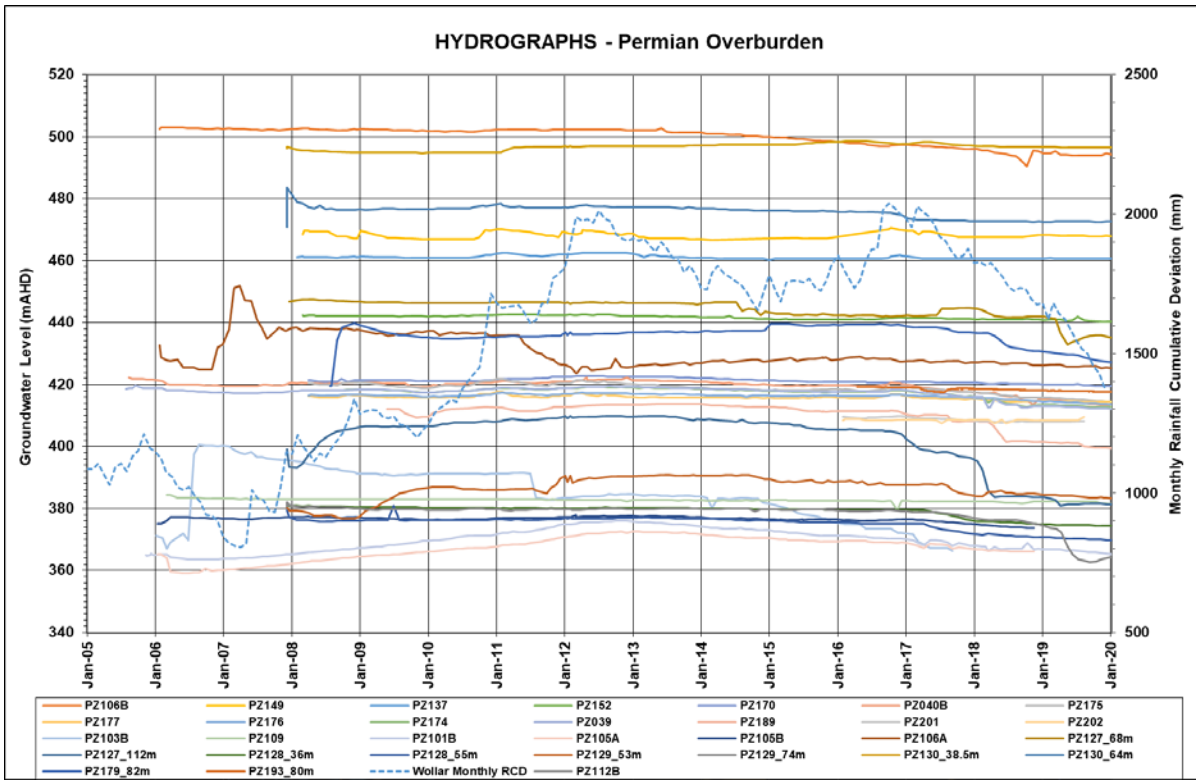


Figure 3-j: Triassic Composite Hydrograph

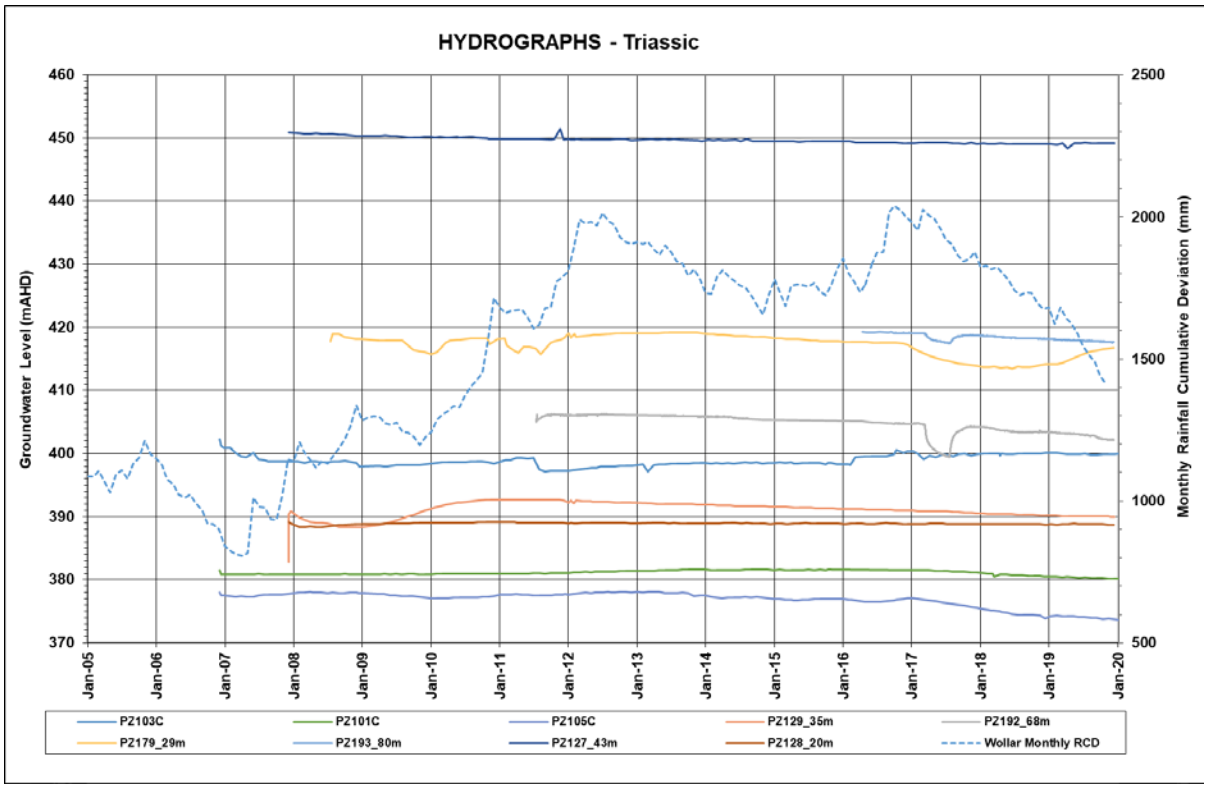
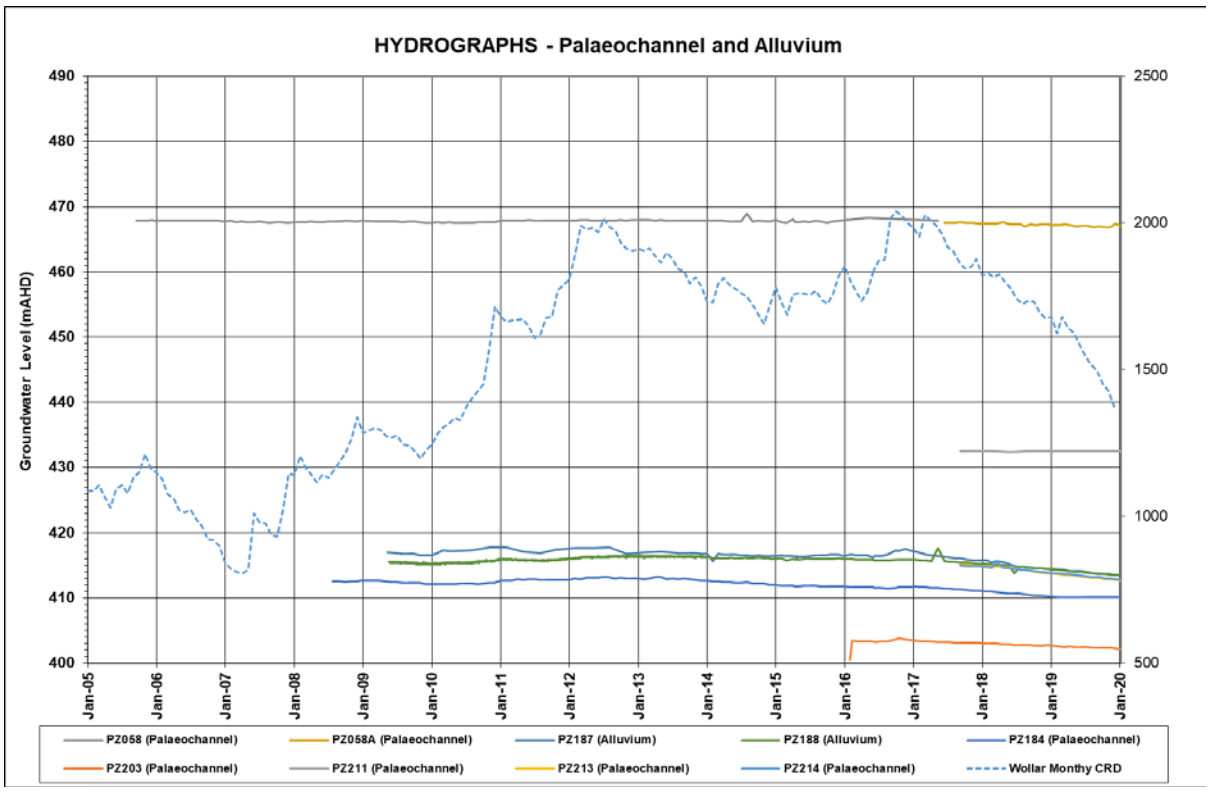


Figure 3-k Alluvium Composite Hydrograph



APPENDIX 4. COMMUNITY COMPLAINTS SUMMARY 2019

Date	Type	Location	Complaint Description
31/01/2019	Ridge Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. No actions required. Complainant not contacted upon their request.
10/02/2019	Ridge Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. No actions required. Complainant was unable to be contacted.
17/02/2019	Ridge Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. No actions required. The Complainant was Contacted on 18/02/2019, a message was left.
17/02/2019	Ridge Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. No actions required. Complainant advised of investigation, results and actions.
25/02/2019	Ridge Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. No actions required. Complainant not contacted upon their request.
25/02/2019	Ridge Road	Blasting (V/O)	Investigation revealed a blast was fired at MCO with overpressure and vibration results within compliance limits. Complainant was contacted and advised of results.
26/02/2019	Ridge Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. Operational changes were made. Complainant was attempted to be contacted.
18/04/2019	Ridge Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. No actions required. Complainant not contacted upon their request.
23/04/2019	Ridge Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. No actions required. Complainant not contacted upon their request.
4/05/2019	Saddlers Creek Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. No actions required. Complainant advised of investigation, results and actions.
5/05/2019	Ridge Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. Operational changes were made. Complainant not contacted upon their request.
8/05/2019	Ridge Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. No actions required. Complainant not contacted upon their request.
14/05/2019	Ridge Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. No actions required. The Complainant was Contacted on 14/05/2019, a message was left.
15/05/2019	Ridge Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. No actions required. Complainant advised of investigation, results and actions.
19/05/2019	Ridge Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. Operational changes were made. Complainant was advised of investigation, results and actions.
1/06/2019	Ridge Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. No actions required. Complainant not contacted upon their request.
2/06/2019	Ridge Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. No actions required. Complainant not contacted upon their request.
4/06/2019	Ridge Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. No actions required. Complainant not contacted upon their request.
16/06/2019	Ridge Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. Operational changes were made. Complainant not contacted upon their request.

Date	Type	Location	Complaint Description
16/06/2019	Ridge Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. Operational changes were made. Complainant was unable to be contacted.
25/06/2019	Ridge Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. Operational changes were made. The Complainant was Contacted on 25/06/2019, a message was left.
25/06/2019	Winchester Crescent	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. Operational changes were made. Complainant advised of investigation, results and actions.
25/06/2019	Ridge Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. Operational changes were made. The Complainant was Contacted on 25/06/2019, a message was left.
27/06/2019	Ulan Road	Air (Dust)	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Dust levels. Operational changes were made. Complainant advised of investigation, results and actions.
1/07/2019	Ridge Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. No actions required. Complainant not contacted upon their request.
1/07/2019	Ridge Road	Air (Dust)	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Dust levels. Operational changes were made. Complainant advised of investigation, results and actions.
6/07/2019	Ridge Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. No actions required. Complainant not contacted upon their request.
13/07/2019	Ulan Road	Air (Dust)	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Dust levels. No actions required. Complainant advised of investigation, results and actions.
16/07/2019	Saddlers Creek Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. Operational changes were made. Complainant not contacted upon their request.
17/07/2019	Ridge Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. No actions required. Complainant was unable to be contacted.
20/07/2019	Ridge Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. Operational changes were made. Complainant was Contacted on 21/07/2019, a message was left.
2/08/2019	Ridge Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. No actions required. Complainant was advised of investigation, results and actions.
25/08/2019	Spring Creek Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. No actions required. Complainant was advised of investigation, results and actions.
23/09/2019	Spring Creek Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring was not undertaken due to the timing description. No actions required. Complainant was advised of investigation, results and actions.
29/09/2019	Spring Creek Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. No actions required. Complainant was advised of investigation, results and actions.
20/10/2019	Ridge Road	Air (Odour)	Investigation revealed no unusual mining operations were occurring at the time. Observations were undertaken and indicated acceptable odour levels. Complainant was advised of investigation, results and actions.
26/12/2019	Spring Creek Road	Other	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. No actions required. Complainant not contacted upon their request.
28/12/2019	Spring Creek Road	Noise	Investigation revealed no unusual mining operations were occurring at the time. Monitoring results indicated acceptable Noise levels. No actions required. Complainant not contacted upon their request.

APPENDIX 5. COMMUNITY CONTRIBUTIONS

Community Support Program

Beneficiary	Project/Event
Mudgee High School	Charity Golf Day
Central West WIMNet	Women in Mining Event
Gulgong Men's Bowling Club	October Long Weekend Bowling Tournament
Mudgee Valley Writers	Mudgee Writers Festival 2019
Arts Council of Gulgong	Henry Lawson Festival Scarecrow Stroll
Mudgee Mens Bowling Club	Men's Bowling Tournament
Rotary Club of Mudgee	Mathematical Minds Competition
Turill Community Centre	Turill Community Centre Kitchen Upgrade
Balloon Aloft	New Balloon aloft event for Mudgee
Coolah District Development Group	Rocking the Racecourse
Mudgee Amateur Softball Association	Softball rebuild in Mudgee
Mudgee Women's Rugby League	Training equipment and consumables
Mudgee Triathlon Club	Mudgee Running Festival 2019
Lions Club Mudgee	Christmas Twilight Markets
Rylstone Street Feast Inc	Rylstone Street Feast 2019
Dunedoo Sports Club	Tunes on the Turf Event - November 2019
Mudgee Reader's Festival	Mudgee Reader's Festival 2019
Mudgee Show Society	Mudgee Show & Rodeo
Mudgee Wolves Football Club	Masters Football Competition
Mudgee Chamber of Commerce	Facebook Foundations for Business Course
Cudgegong Cruisers	CAN Cruise Event 2019
Watershed Landcare	Landcare Green Day 2019
Mudgee Senior Rugby League	Mudgee Mines 9s tournament 2020
Rotary Club of Mudgee	Christmas Carols 2019
Rylstone Kandos Show Society	Rylstone Kandos Show
Sculptures in the Garden	Moolarben Sculpture Acquisition Prize
The Business Concierge	Survivor Lifeskills Program
Rylstone Show / Rodeo Society	2019 Bullarama

Additional Donations

Beneficiary	Project/Event
Clontarf Foundation	Clontarf Academy Rewards for students
Lifeskills Plus	Mudgee Running Festival Coal Mines Cup
Mudgee Ambulance Service	Ambulance Cleaning Equipment
Police Citizens Youth Club(PCYC)	Time 4 Kids fundraiser
Cooks Gap Rural Fire Brigade	Additional PPE during the 2019 Fire Season
Moolarben Celebrity Golf Classic	Golf Tournament 2019
University of Wollongong	Mudgee Regional Community Scholarship