BENGALLA MINE
ANNUAL REVIEW 2019

BENGALLA

Prepared by:
BENGALLA MINING COMPANY PTY LIMITED
LOCKED BAG 5
MUSWELLBROOK NSW 2333

MARCH 2020

Annual Review Title Block

Name of operation	Bengalla Mine
Name of operator	Bengalla Mining Company Pty Limited
Development consent	SSD-5170 (as modified)
Name of holder of development consent	Bengalla Mining Company Pty Limited
Mining Leases	See **Table 6**
Name of holder of mining leases	Bengalla Mining Company Pty Limited
Water licences	See **Table 6**
Name of holder of water licences	Bengalla Mining Company Pty Limited and the Bengalla Joint Venture
MOP start date	8 November 2017 (Approval date)
MOP end date	31 December 2021
Annual Review start date	1 January 2019
Annual Review end date	31 December 2019

I, Cam Halfpenny, certify that this audit report is a true and accurate record of the compliance status of Bengalla Mining Company Pty Limited for the period 1 January 2019 to 31 December 2019 and that I am authorised to make this statement on behalf of Bengalla Mining Company Pty Limited.

Note:

a) The Annual Review is an 'environmental audit' for the purposes of section 122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows 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	Cam Halfpenny
Title of authorised reporting officer	General Manager
Date	23rd July 2020
Signature of authorised reporting officer	Cam Halfpenny

Note: Bengalla Mine Annual Review 2019 amended following Department of Planning, Industry and Environment request for additional information 27 May 2020.

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ACRONYMS

ACHMP	Aboriginal Cultural Heritage Management Plan
AEISG	Australasian Explosive Industry Safety Group
AGE	Australasian Groundwater and Environmental Consultants Pty Limited
ANZECC	Australian and New Zealand Environment Conservation Council
AQMP	Air Quality Management Plan
ARD	Acid Rock Drainage
AS/NZS	Australian/New Zealand Standard
bcm	Bank Cubic Meter
BDMP	Biodiversity Management Plan
Bengalla	Bengalla Mine
BJV	Bengalla Joint Venture
BMC	Bengalla Mining Company Pty Limited
BMP	Blast Management Plan
BOMP	Biodiversity Offset Management Plan
BTOC	Below Top of Casing
CCC	Bengalla Community Consultative Committee
CDF	Community Development Fund
CER	Clean Energy Regulator
CHPP	Coal Handling Preparation Plant
CO2-e	Carbon Dioxide Equivalent
CST	Community Support Team
CW1	Clean Water Dam 1
DoEE	Department of Environment and Energy
DoI - Water	NSW Department of Primary Industries – Lands and Water
DPIE	NSW Department of Planning, Industry and Environment
DPIE-RR	NSW Department of Planning, Industry and Environment Resources Regulator
EC	Electrical Conductivity
ED1	Staged Discharge Dam (Approved 2018)
EIS	Environmental impact statement titled *Continuation of Bengalla Mine, Environmental Impact Statement* (6 volumes), dated September 2013, as modified by the *Response to Submissions* dated March 2014
EMS	Environment Management Strategy
EPA	NSW Environment Protection Authority
EPBC	Environment Protection Biodiversity Conservation Approval
EPL 6538	Environment Protection Licence 6538
ERM	Environment Management Resource Pty Limited
ERT	Emergency Response Team
FY	Financial Year (1 July - 30 June)
GDP	Ground Disturbance Permit
GHG	Greenhouse Gas
GIS	Geographical Information System
GJ	Gigajoule

Ha	Hectare
HHMP	Historic Heritage Management Plan
HRSTS	Hunter River Salinity Trading Scheme
HVAS	High Volume Air Sampler
IEA	Independent Environmental Audit
INP	Industrial Noise Policy (EPA,2000)
LLS	NSW Local Land Services
MAC	Mt Arthur Coal
MACH Energy	MACH Energy Australia Pty Limited
Mbcm	Million Bank Cubic Meters
ML	Mining Lease (Followed by Number)
ML	Mega Litres (Preceded by Number)
MOD4	SSD-5170 Modification 4
MOP	Bengalla Mine Mining Operations Plan 2017 - 2021
MSC	Muswellbrook Shire Council
Mt	Mega Tonnes
NGER	National Greenhouse and Energy Reporting
NGER Act	National Greenhouse and Energy Reporting Act 2007
NMP	Noise Management Plan
NPfI	Noise Policy for Industry (EPA, 2017)
NPI	National Pollutant Inventory
NPWS	National Parks and Wildlife Services
NSW	New South Wales
OEA	Overburden Emplacement Area
OEH	NSW Office of Environment and Heritage
Orica	Orica Australia Pty Limited
PE	Pacific Environment Pty Limited
PIN	Penalty Infringement Notice
PIRMP	Pollution Incident Response Management Plan
PM_{10}	Particulate Matter less than 10 micrograms
$PM_{2.5}$	Particulate Matter less than 2.5 micrograms
POEO Act	Protection of Environment Operations Act 1997
PPV	Peak Particle Velocity
RAP	Registered Aboriginal Party
Reporting Period	1 January 2019 - 31 December 2019
RFS	Rural Fire Service
RL	Relative Level
RMP	Rehabilitation Management Plan
RMS	NSW Roads and Maritime Services
ROM	Run of Mine
RTEMS	Real Time Environment Management System
SDD	Stage Discharge Dam (Existing)

SEE (MOD1)	Statement of Environmental Effects titled 'Bengalla Mine Development Consent Modification Statement of Environmental Effects' dated August 2015 and prepared by Hansen Bailey, including the Response to Submissions document dated October 2015
SEE (MOD2)	Statement of Environmental Effects titled 'Bengalla Mine Development Consent Modification Statement of Environmental Effects' dated April 2016 and prepared by Hansen Bailey, including the Response to Submissions document dated June 2016
SEE (MOD3)	Statement of Environmental Effects titled 'Bengalla Mine Development Consent Modification 3 Statement of Environmental Effects' dated September 2016 and prepared by Hansen Bailey, including the Response to Submissions document dated November 2016
SEE (MOD4)	Statement of Environmental Effects titled 'Bengalla Mine Development Consent Modification 4 Statement of Environmental Effects' dated December 2017 and prepared by Hansen Bailey, including the Response to Submissions document dated May 2018 and additional information dated July 2018 and November 2018
SSD-5170	State Significant Development 5170
SWL	Standing Water Level
t	Tonnes
TDS	Total Dissolved Solids
TEOM	Tapered Element Oscillating Microbalance
TSP	Total Suspended Particulates
TSS	Total Suspended Solids
VIMP	Visual Impact Mitigation Plan
WAL	Water Access Licence
WMP	Water Management Plan

1 STATEMENT OF COMPLIANCE

This Annual Review has been prepared to provide a summary of the performance of Bengalla Mine (Bengalla) over the period 1 January – 31 December 2019 (Reporting Period). The compliance status of Bengalla against relevant approvals is summarised in **Table 1**.

Any non-compliances recorded during the Reporting Period were ranked according to the risk matrix included in **Table 2** and a brief description of each is provided in **Table 3**.

Table 1
Statement of Compliance

Were all the conditions of the relevant approvals complied with?	Yes/No
Development Consent SSD-5170 (as modified)	Yes
Environmental Protection Licence (EPL) 6538	Yes
Mining Lease (ML) 1397	Yes
ML 1469	Yes
ML 1450	Yes
ML 1711	Yes
ML 1728	Yes
ML 1729	Yes

Table 2
Non-Compliance Risk Matrix

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

Source: NSW Government (2015)

Table 3
Non- Compliances in the Reporting Period

Approval	Cond. #	Condition Description (Summary)	Non-compliance Status*	Comment	Section described in this Annual Review
There have been no non-compliances during the Reporting Period (Note: see below).					

Note: Non-compliance status as defined in the 'Annual Review Guideline, Post-Approval requirements for State significant mining developments' (NSW Government, 2015).

Notices:

The following regulatory notices were received by Bengalla Mining Company Pty Limited (BMC):

Environment Protection Authority

One notice under Section 191 of the *Protection of Environment Operations Act 1997* was received from the Environmental Protection Authority dated 9 January 2019. This notice required BMC to provide information and records relating to the servicing, maintenance and calibration of Bengalla air quality monitors.

BMC provided a response to EPA on this notice dated 22 February 2019.

Department of Planning, Industry & Environment – Resources Regulator

Three notices under Section 240 of the *Mining Act 1992* were received from the Department of Planning, Industry and Environment – Resources Regulator dated 1 November 2019. These notices require that BMC:

- Undertake an audit of topsoil management at Bengalla (Notice NTCE0003914);
- Complete a risk assessment for rehabilitation at Bengalla (Notice NTCE0003917); and
- Undertake an assessment of progressive rehabilitation planning and implementation at Bengalla (Notice NTCE 0003919).

  BMC are currently preparing responses to these notices.

Department of Planning, Industry & Environment

Section 9.22: Two notices under Section 9.22 of the *Environmental Planning and Assessment Act 1979* were received from the Department of Planning, Industry and Environment on 11 and 26 February 2020, respectively.

These notices require that BMC:

- Provide information and records regarding the management of air quality impacts at Bengalla during the 2018 calendar year; and

- Provide information and records regarding the management of air quality impacts at Bengalla during the 2019 calendar year.

BMC are currently preparing responses to these notices.

Independent Review: The DPIE required BMC to undertake an independent air quality review on 10 Racecourse Road and 7 Sheppard Avenue, Muswellbrook.

BMC are currently responding to the DPIE request.

2 INTRODUCTION

This section provides an overview of Bengalla, outlines the purpose of this Annual Review and provides contact details for relevant Bengalla personnel.

2.1 BACKGROUND

BMC operates Bengalla in the Upper Hunter Valley of New South Wales (NSW), approximately 130 km north-west of Newcastle and 4 km west of the township of Muswellbrook, as illustrated in **Figure 1**.

On 7 August 1995, BMC was granted Development Consent DA 211/93 for the construction and operation of a surface coal mine, coal preparation plant, rail loop, loading facilities and other associated infrastructure. DA 211/93 was surrendered to DPIE in December 2016.

On 3 March 2015, the Secretary of the DPIE, as delegate for the Minister for Planning, granted approval SSD-5170 for the continuation of Bengalla to 2039 at up to 15 Mtpa Run of Mine (ROM) coal production. Bengalla commenced operations under SSD-5170 on 1 October 2015. Since 2015, four Modifications to this consent have been approved.

The approved Bengalla layout is shown on **Figure 2**, with an overview of the Bengalla environmental monitoring network shown on **Figure 3**.

2.2 DOCUMENT PURPOSE

This Annual Review summarises the environmental performance of Bengalla for the Reporting Period. The requirements of Bengalla approvals relevant to the preparation of this Annual Review and where they have been addressed in the document are included in **Table 4**.

The structure and content of this Annual Review was prepared in accordance with the requirements of the '*Annual Review Guideline, Post-Approval requirements for State significant mining developments'* (NSW Government, 2015).

Table 4
Development Consent and Mining Lease requirements for Annual Review

Document	Where Addressed
SSD-5170 Condition (Schedule 5, Condition 4)	
4. By the end of March each year (or as otherwise agreed by the Secretary), the Applicant shall review the environmental performance of the development for the previous calendar year to the satisfaction of the Secretary. This review must:	This document
a) describe the development (including any rehabilitation) that was carried out in the past calendar year, and the development that is proposed to be carried out over the current calendar year;	**Section 2, 4**, **8** and **11**
b) include a comprehensive review of the monitoring results and complaints records of the development over the past year, which includes a comparison of these results against: • relevant statutory requirements, limits or performance measures/criteria; • monitoring results of previous years;	**Sections 6** to **9**

Document	Where Addressed
• relevant predictions of the EIS;	
c) identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;	**Sections 1** and **11**
d) identify any trends in the monitoring data over the life of the development;	**Sections 6** to **8**
e) identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and	**Sections 6** to **8**
f) describe what measures will be implemented over the next year to improve the environmental performance of the development.	**Section 12**
ML1450 and ML1469 Condition (Condition 3)	
1. Within 12 months of the commencement of mining operations and thereafter annually or at such other times as may be allowed by the Director-General, the lease holder must lodge an Annual Environmental Management Report (AEMR) (now referred to Annual Review) with the Director-General.	This document
2. The AEMR must be prepared in accordance with the Director-General's guidelines current at the time of reporting and contain a review and forecast of performance for the proceeding and ensuing twelve months in terms of: a) the accepted Mining Operations Plan; b) development consent requirements and conditions; c) Environmental Protection Authority and Department of Land and Water Conservation licences and approvals; d) any other statutory environmental requirements; e) details of any variations to environmental approvals applicable to the lease area; and f) where relevant, progress towards final rehabilitation objectives.	This document **Sections 3**, **4** and **8**
3. After considering an AEMR the Director-General may, by notice in writing, direct the leaseholder to undertake operations, remedial actions or supplementary studies in the manner and within the period specified in the notice to ensure that operations on the lease area are conducted in accordance with sound mining and environmental practice.	**-**
4. The leaseholder shall, as and when directed by the Minister, cooperate with the Director-General to conduct and facilitate review of the AEMR involving other government agencies.	**-**
ML1711, 1728 and 1729 Condition (Condition 3f)	
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 date (or at such other times as agreed by the Minister); and iii. be prepared in accordance with any relevant annual reporting guidelines published on the Department's website at www.resources.nsw.gov.au/environment. *Note: The Rehabilitation Report replaces the Annual Environmental Management Report.*	**Section 8**
ML1397 Condition (Condition 3f)	
The lease holder must prepare a Rehabilitation Report to the satisfaction of the Minister. The report must: iv. provide a detailed review of the progress of rehabilitation against the performance measures and criteria established in the approved MOP;	**Section 8**

Document	Where Addressed
v. be submitted annually on the grant anniversary date (or at such other times as agreed by the Minister); and vi. be prepared in accordance with any relevant annual reporting guidelines published on the Department's website at www.resourcesandenergy.nsw.gov.au/miners-andexplorers/rules-and-forms/pgf/environmental-guidelines	

2.3 BENGALLA CONTACTS

The relevant contacts for environmental management at Bengalla are outlined in **Table 5**.

Table 5
Bengalla Contacts

Contact	Contact Details
Cam Halfpenny General Manager	Phone: 02 6542 9500 Email: cam.halfpenny@bengalla.com.au
Craig White Environment Superintendent	Phone: 02 6542 9500 Email: craig.white@bengalla.com.au
BMC Website (Copies of public notices, environmental management documents, monitoring results and other information relating to Bengalla's operations)	http://www.bengalla.com.au/
Phone	Bengalla General Enquiries 02 6542 9500; or Community Complaints Hotline 1800 178 984.

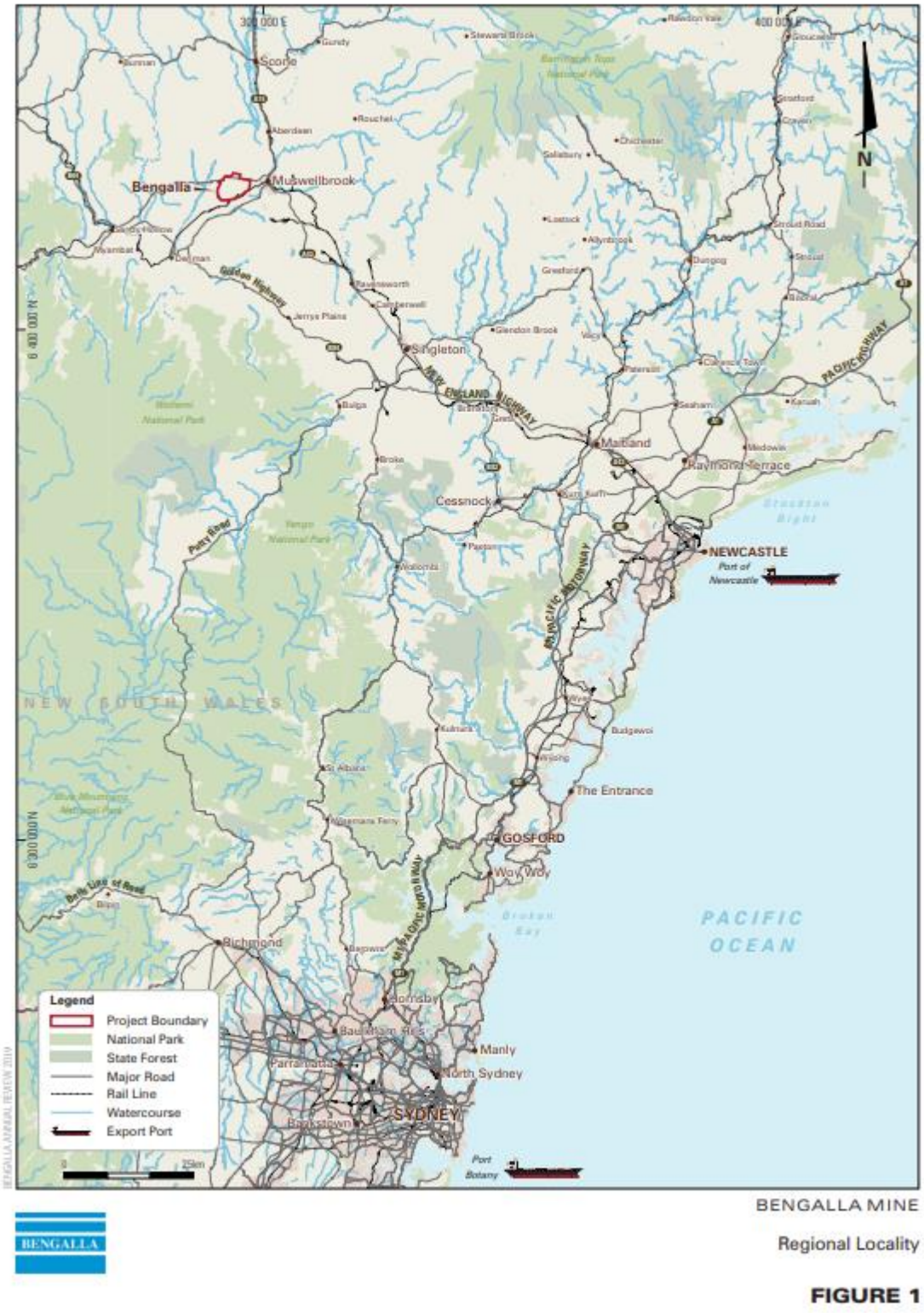


Figure 1
Regional Locality

Figure 2
Approved Site Layout

Figure 3
Environmental Monitoring Network

3 APPROVALS

This section provides a summary of leases, licences and approvals that regulate operations at Bengalla.

3.1 OVERVIEW

A summary of the key mining leases, licences and approvals for activities at Bengalla during the Reporting Period is provided in **Table 6**. Copies of the Bengalla approvals and supporting documentation are available on the BMC website: http://www.bengalla.com.au/.

Table 6
Bengalla Approvals Summary

Document	Approval Period(s)	Authority
Development Consent SSD-5170 (as modified)	03/03/2015 – 28/02/2039	DPIE
Development Consent SSD-5170 MOD 1 – approved December 2015	03/03/2015 – 28/02/2039	DPIE
Development Consent SSD-5170 MOD 2 – approved 1 July 2016	03/03/2015 – 28/02/2039	DPIE
Development Consent SSD-5170 MOD 3 – approved 23 December 2016	03/03/2015 – 28/02/2039	DPIE
Development Consent SSD-5170 MOD 4 – approved 19 December 2018	03/03/2015 – 28/02/2039	DPIE
DA 273/2006 – Explosives Facility	06/09/2006 – Perpetuity	MSC
Environment Protection and Biodiversity Conservation (EPBC) Act 1999 Approval 2012/6378	27/05/2015 – 31/12/2050	DoEE
ML 1397	27/06/1996 – 27/06/2038	DPIE-RR
ML 1450	10/06/1999 – 09/06/2020	DPIE-RR
ML 1469	05/06/2000 – 04/06/2021	DPIE-RR
ML 1711	29/09/2015 – 17/12/2031	DPIE-RR
ML 1728	10/02/2016 – 10/02/2037	DPIE-RR
ML 1729	10/02/2016 – 10/02/2037	DPIE-RR
EPL 6538	Anniversary Date 11 September	EPA
Mining Operations Plan (MOP) 2017 – 2021 Amendment A	08/11/2017 – 31/12/2021	DPIE-RR
WAL 001106	Expiry date: 18/03/2028	DoI - Water
WAL 41547 (formerly 20BL169798)*	Tenure Continuing	DoI - Water
20PE001354 (Hunter Pump River Permit)	01/05/1997 – Annual Renewal	DoI - Water
XSTR100151 (Licence to Store Explosives)	Expiry date: 10/01/2023	SafeWork NSW
5061036 (Radiation Management Licence)	Expiry date: 08/08/2020	EPA

**Bengalla's primary groundwater licence authorising extraction of water from the pit. Bengalla also holds various other groundwater licences under Part 5 of the Water Act 1912.*

3.2 PENDING APPLICATIONS

During this Reporting Period, modifications were made to the Air Quality Management Plan and Environmental Management Strategy. The two updated documents are awaiting approval.

3.3 STATUS OF MANAGEMENT PLANS

Table 7 outlines the environmental management plans and the approval status of each at the end of the Reporting Period.

Table 7
Status of BMC Management Plans

Management Strategy / Plan	Approval DPIE
Environmental Management Strategy	5 September 2017
Air Quality Management Plan ^	18 August 2017
Noise Management Plan	27 May 2019
Water Management Plan	1 February 2019
Blast Management Plan	18 August 2017
Biodiversity Management Plan	18 August 2017
Biodiversity Offset Management Plan	18 August 2017
MOP 2017-2021 Amendment A	11 April 2019 (DPIE-RR)
Aboriginal Cultural Heritage Management Plan	18 August 2017
Historic Heritage Management Plan	18 August 2017

^ - *Currently under review by DPIE*

4 OPERATIONS SUMMARY

This section provides a summary of exploration, mining and other activities undertaken at Bengalla during the Reporting Period. It also includes a summary of operations proposed for 2020.

4.1 MINING OPERATIONS

During 2019 mining operations at Bengalla progressed west.

Table 8 provides a comparison of the production quantities in 2019 to those recorded in 2018 and outlines the quantities proposed for 2020. ROM coal production of 12.5 Million tonnes (Mt) in 2019 was below the approved yearly limit of 15 Mt ROM coal.

Table 8
Production & Waste Summary

Material	Unit	Approved Limit	Previous Reporting Period (2018 Actual)	This Reporting Period (2019 Actual)	Next Reporting Period (2020 Plan)
Waste Rock / Overburden	Mbcm	-	48.4	55.1	49.5
ROM Coal	Mt	15	11.3	12.5	11.8
Reject Material	Mt	-	2.2	2.6	2.8
Saleable Product	Mt	-	9.0	10.0	9.5

Note: Forecast data sourced from AOP (2020)

4.2 OTHER OPERATIONS

Other operations at Bengalla during the reporting included:

- ***Exploration***: Bengalla drilled a total of 107 boreholes in 2019. Nine boreholes were fully cored (5 were tested for coal quality, 3 were tested for fugitive gas emissions and 1 was cored for geotechnical investigations), with the remaining boreholes open hole chipped. All were drilled within ML1397, ML1450 and ML1729.

  The majority of the boreholes were drilled to the base of the Edderton Coal seam with 10 holes drilled to the base of the Edinglassie Coal seam. The current pre-production drilling program will continue in 2020, with initial planning targeting 9 core holes and 83 chip holes in ML1397 and ML1729.

- ***Coal Transport***: Product coal is transported via rail to the port of Newcastle. During the Reporting Period, 9,985,611t of product coal was transported by rail to the Port of Newcastle.

  SSD-5170 Modification 4 (MOD4) restricts train movements from Bengalla to a maximum of 16 laden trains per day. The total number of train movements during the Reporting Period was 1,130 with a maximum of seven train movements in a day.

- ***Infrastructure, Construction and Management***: The following projects were commenced, progressed or completed during the Reporting Period:

- New dam precinct west of Bengalla Link Road;
- Dry Creek East Dam construction; and
- New magazine.

4.3 NEXT REPORTING PERIOD

Forecast projects for the next Reporting Period include:

- Relocation of various infrastructure to facilitate the progression of mining;
- Decommissioning of the existing Stage Discharge Dam;
- Orica reload facility;
- Dragline shutdown pad;
- New maintenance and tyre bay pad; and
- Pre-production drilling program will continue.

A summary of key environmental approval and management activities proposed for 2020 is provided in **Section 12**.

5 ACTION REQUIRED FROM PREVIOUS ANNUAL REVIEW

BMC received correspondence from the DPIE on 20 June 2019, stating that the Bengalla Annual Review 2018 is considered to satisfy the requirements of the Project Approval and the DPIE *Annual Review Guideline* (October 2015).

6 ENVIRONMENTAL MANAGEMENT & PERFORMANCE

This section describes BMC's environmental monitoring, management and performance during the Reporting Period. Environmental management actions planned to be implemented in 2020 are also described, as required.

Surface water and groundwater environmental management and performance are discussed in ***Section 7.2*** *and* ***Section 7.3****, respectively.*

6.1 METEOROLOGY

6.1.1 Environmental Management

BMC operates a meteorological station and inversion tower in accordance with the requirements of MOD4 and EPL 6538 (see **Figure 3**).

On 26 August 2019, BMC replaced the existing wind speed, wind direction and temperature sensors on the inversion tower. No further upgrades were required within the Reporting Period to the meteorological station and inversion tower.

6.1.2 Environmental Performance

Wind speed, wind direction, air temperature, relative humidity, solar radiation, rainfall and evapotranspiration are recorded at the meteorological station. A summary of the 2019 meteorological data is included as **Appendix A**.

During the Reporting Period, BMC failed to continuously monitor 15-minute average data at the Meteorological Station and 1-hour average data at the Meteorological Station and Inversion Tower on three occasions. On the 9/1/2019, 18/1/2019 and 27/9/2019 data capture was lost due to power failures resulting in loss of communications. Each of these instances were resolved and communications re-established.

Overall data capture rates at the meteorological station and inversion tower exceeded 98%. The sampling method (AM-4) specified in EPL 6538 Condition M4.1 identifies a 90% data capture rate as the requirement for regulatory modelling applications.

6.1.3 Further Actions

There are no additional actions planned for 2020 regarding meteorological monitoring.

6.2 NOISE

6.2.1 Environmental Management

BMC manage noise in accordance with the approved Noise Management Plan (NMP), which describes measures for monitoring and managing noise from Bengalla.

Three methods of noise monitoring are utilised at Bengalla, including:

- Compliance attended noise monitoring;
- Onsite managed supplementary attended monitoring; and
- Onsite managed unattended (Real-time) Monitoring.

BMC focuses its assessment of noise during the night period (i.e. 9pm to 7am).

6.2.2 Environmental Performance

Compliance Attended Noise Monitoring

During the Reporting Period, compliance attended monitoring was undertaken by an appropriately qualified acoustic consultant nominally once per calendar month (but at least two weeks apart) during the night period (10 pm to 7 am) at three locations representative of the nearest private residences (see **Figure 4**).

The NMP outlines the applicable criterion for the three monitoring locations. Operational noise (Bengalla alone and cumulatively with other sources) were measured at each monitoring location and assessed against the applicable criterion (see **Appendix B**).

Supplementary Attended Monitoring

Supplementary attended monitoring continued to be undertaken for night periods. Measurements are recorded by trained BMC personnel at the same locations for compliance attended monitoring.

Note: Results from the supplementary attended monitoring are not used to determine compliance.

Unattended (Real-time) Monitoring

BMC operates two continuous, unattended real-time noise monitoring units as a management tool. The locations of the two real-time noise monitoring units are shown on **Figure 4**.

Note: The noise levels recorded at the real-time monitors are not used to determine compliance.

Noise Monitoring Results

Compliance with Bengalla noise criteria were assessed via the compliance attended noise monitoring program. No exceedances of the noise monitoring criteria were identified during the Reporting Period (Bridges Acoustics, 2019). A summary of the 2019 compliance criteria and compliance attended noise monitoring results is provided in **Appendix B**.

The compliance monitoring measurements for 2017 and 2018 have not been included in this Annual Review (already publicly available). A review of attended noise monitoring measurements over the period 2017 – 2019 indicates that results were generally consistent.

Six complaints relating to noise were received during the Reporting Period (see **Section 9.3**).

Comparison to Assessment Predictions

The acoustic impact assessments supporting SSD-5170 predicted that the approved operations would not produce an exceedance of the Bengalla specific noise criteria at any surrounding privately-owned residence that was not identified as being subject to land acquisition upon request (either to BMC or the operator(s) of surrounding mines).

Noise monitoring results recorded during the Reporting Period were consistent with the predictions in the Bengalla EIS and MOD1 – MOD 4.

Private Residence Mitigation

In accordance with MOD4, BMC is required to implement additional reasonable and feasible noise mitigation measures upon receiving written request by the landholder of the privately-owned residences listed in SSD-5170.

During the previous Reporting Period, BMC received one request for additional noise mitigation. Following consultation with the landowner the mitigation was implemented in two phases, in February and June 2019.

6.2.3 Further Actions

BMC will continue to review the NMP in accordance with MOD4. Should amendments to the NMP be required, BMC will then lodge the revised NMP with relevant regulatory agencies for comment.

Figure 4
Noise Monitoring Locations

6.3 BLASTING

6.3.1 Environmental Management

BMC has developed and implemented a Blast Management Plan (BMP), which sets out procedures for blast monitoring and management at Bengalla. Fume generation is managed per the Post Blast Fume Generation Mitigation and Management Plan.

6.3.2 Environmental Performance

Blast Monitoring Program

MOD4 Schedule 3, Condition 10 allows a maximum of 6 blasts per week, averaged over a calendar year. A total of 199 individual blasts from 188 blasts events occurred during the Reporting Period averaging 3.6 blast events per week. Blast overpressure and vibration criteria are presented in **Table 9**, with monitoring locations shown on **Figure 5**.

Blast monitoring is undertaken at 11 real time blast monitors that record the following data for each blast event:

- Time and date;
- Peak vector sum (mm/s);
- Air overpressure peak (dB Linear Peak); and
- Waveform trace, where applicable.

Assessment of compliance with blast criteria for privately owned residences and public infrastructure is undertaken at three blast monitors located on non-mine owned land (see **Table 9**).

Blast Monitoring Results

A summary of blast performance for the Reporting Period is provided in **Table 10**, with monitoring results for locations representative of private receivers included in **Appendix C**. During the Reporting Period, results from the blast monitors on non-mine owned land did not exceed relevant criteria for overpressure or ground vibration.

The blast monitoring results for private receivers in 2017 and 2018 have not been included in this Annual Review (already publicly available). A review of blast monitoring measurements over the period 2017 – 2019 indicates that results were generally consistent.

Five fume events occurred at Bengalla during the Reporting Period. One complaint was received regarding a fume event. This blast was classified as a localised event and was not a reportable incident.

6.3.3 Further Actions

BMC will continue to review the BMP in 2020 in accordance with MOD4. Should any amendments to the BMP be required, BMC will lodge the revised BMP with relevant regulatory agencies for comment.

Table 9
Blast Monitoring Locations and Criteria

Location	Blast Monitoring ID	Criteria	
		Vibration	Overpressure
Private Receivers			
Moore	MRE	10 mm/s and 5% ≥ 5mm/s	120 dB (linear Peak) and 5% ≥ 115dB (linear Peak)
St James School	SCH		
Blake	BLK		
Historic Heritage Site Monitoring Locations			
Edinglassie Homestead	EGL	10 mm/s	120 dB (linear Peak) and 5% ≥ 115 dB (linear Peak)
Bengalla Homestead	BHS		
ARTC Infrastructure			
Wantana	WAN	100 mm/s	-

Mine owned locations used as an internal management tool.

Table 10
Blast Performance Summary 2019

Blast Summary	Number of Blasts	% of Blasts
Total blast events	199 Individual Blasts, 188 Blast Events	-
Blasts >5mm/s at private residence	1	<1
Average number of blasts per week	3.6	-
Days with more than 2 blast events	4	2
Number of road closures – Wybong Road	45	24
Number of road closures – Bengalla Road	0	0
Number of rail loop closures	0	0
Number of blast events within SDD Notification Area	74	39
Number of blast events within CW1 Notification Area	67	36
Exceedances of applicable vibration and overpressure criteria	-	-
• Private Receivers Monitoring Locations Vibration (10 mm/sec)	0	0
• Private Receivers Monitoring Locations Vibration (5 % ≥5mm/sec))	1	<0.5
• Private Receivers Monitoring Locations Overpressure (120dB)	0	0
• Private Receivers Monitoring Locations Overpressure (5% ≥115dB)	0	0
• Historic Heritage Site Monitoring Locations Vibration (10 mm/sec)	0	0
• Historic Heritage Site Monitoring Locations Vibration (5% ≥5 mm/sec))	0	0
• Historic Heritage Site Monitoring Locations Overpressure (120 dB)	0	0

Blast Summary	Number of Blasts	% of Blasts
• Historic Heritage Site Monitoring Locations Overpressure (5% ≥115dB)	3	1
• ARTC Infrastructure (100 mm/sec)	0	0
Blast result capture rate, all non-mine owned monitors	199	100
Fume events (≥ Rating 3)	1	<0.5

6.4 AIR QUALITY

6.4.1 Environmental Management

BMC has developed and implemented an Air Quality Management Plan (AQMP), which sets out procedures for the management of odour, fume, dust and greenhouse gas emissions at Bengalla.

6.4.2 Environmental Performance

Air Quality Monitoring Program

MOD4 and EPL 6538 provide criteria and monitoring methods required to determine air quality concentrations including particulate matter less than 10 microns (PM_{10}), 2.5 microns ($PM_{2.5}$), total suspended particulates (TSP) and deposited dust. Compliance with these criteria is assessed via BMC's air quality monitoring network.

Bengalla's air quality monitoring network is shown in **Figure 6** and comprises:

- One meteorological station and an inversion tower;
- Eight real-time air quality monitors (four E-Bam monitors and four DustTrak monitors), six of which are linked to the RTEMS;
- Nine High Volume Air Samplers (HVAS) with five measuring TSP and four measuring PM_{10}; and
- 27 Depositional Dust Gauges of which 14 are compliance gauges.

Meteorological monitoring is undertaken to predict adverse weather conditions on a daily basis.

BMC utilises six of the eight real-time air quality monitors to provide monitoring data beyond that required by regulatory requirements.

BMC are required to monitor PM10 continuously at intervals of 10 minutes at EPA22, EPA23 and EPA24 in accordance with EPL 6538. During 2019 data recovery rates at these monitors were: EPA22 (98.7%), EPA23 (98.6%) and EPA24 (97.8%). All monitors were operated in accordance with the sampling method specified in EPL 6538. The absent sample values were considered to be a result of monitor servicing and maintenance and negative concentrations, which are a symptom of zero drift.

Theft of all batteries and solar panels from EPA24 on 29th December resulted in a loss of two days data.

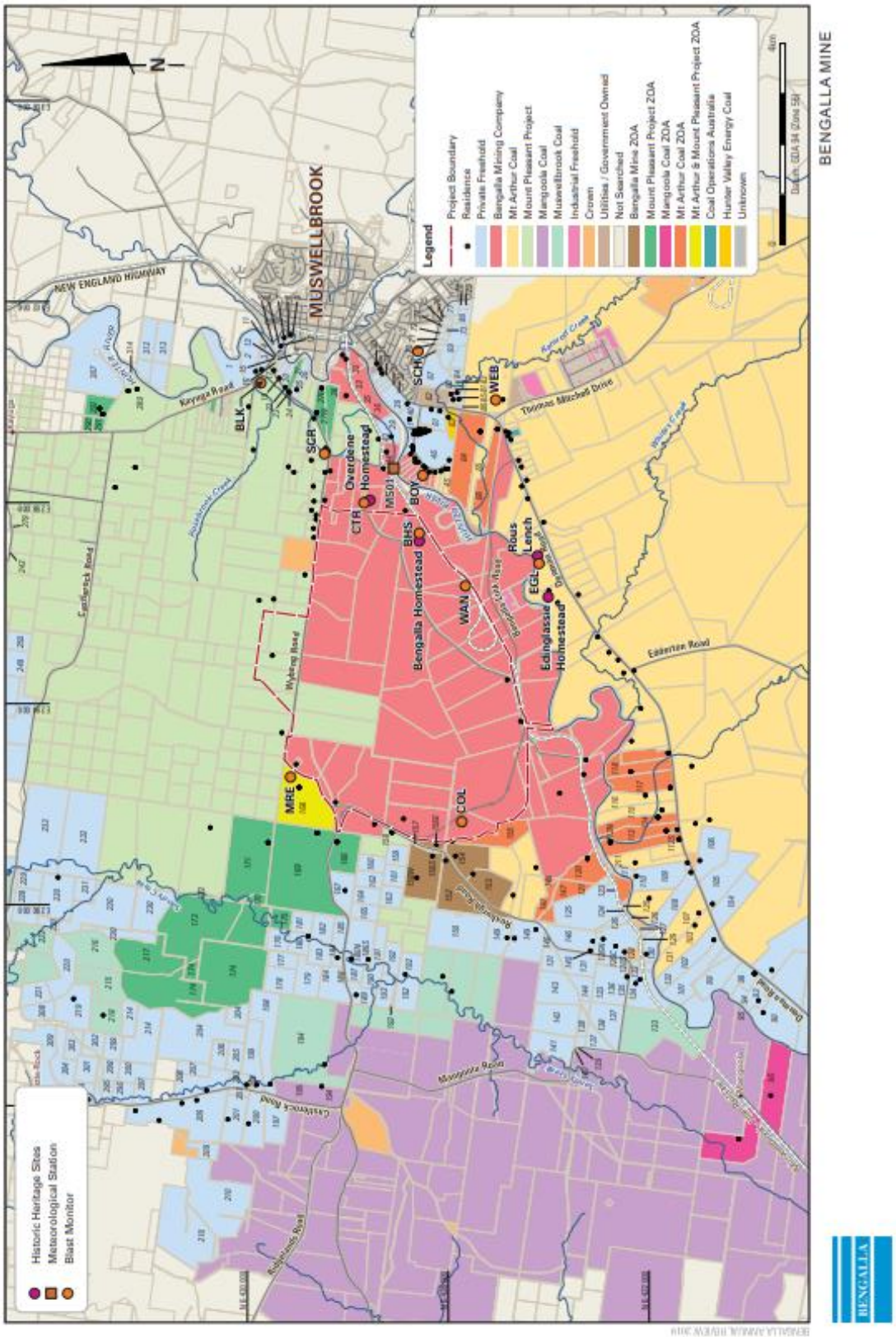


Figure 5
Blast Monitoring Locations

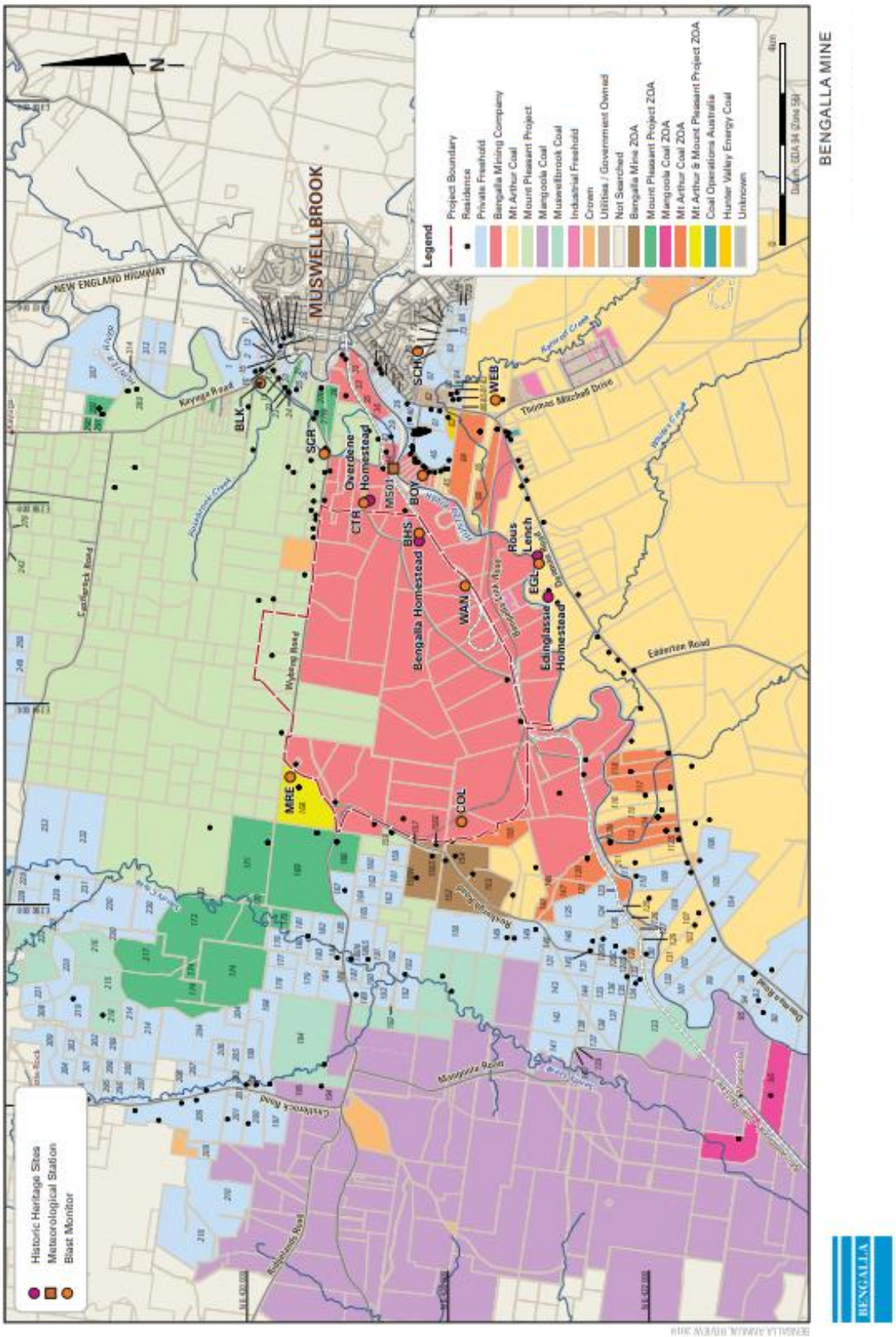


Figure 6
Air Quality Monitoring Locations

BMC operates nine HVAS, one of which (PM_{10}-3) is located on land owned by Hunter Valley Energy Coal Pty Limited the operator of Mt Arthur Coal (MAC). Monitoring of TSP and PM_{10} via the HVAS is a measure of compliance against MOD4. Measurements are sampled every six days for a continuous 24-hour period in accordance with the '*Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – Total suspended particulate matter (TSP) - High volume sampler gravimetric method*' (AS/NZS 3580.9.3:2015) and '*Methods for sampling and analysis of ambient air - Determination of suspended particulate matter - PM_{10} high volume sampler with size-selective inlet - Gravimetric method*' (AS/NZS 3580.9.6:2015).

Of the 27 dust deposition gauges monitored by BMC, 14 are situated on land representative of the closest private residences and are used to measure compliance against MOD4 criteria. Sampling of dust gauges is undertaken monthly in accordance with the "*Methods for Sampling and Analysis of Ambient Air – Determination of Particulate Matter – Deposited Matter – Gravimetric Method*" (AS/NZS 3580.10.1:2003).

Air Quality Monitoring Results

BMC engaged an independent air quality specialist to analyse monitoring data to determine Bengalla's compliance with MOD4 monitoring criteria.

Deposited Dust

Table 11 details deposited dust results for the Reporting Period for the 14 dust deposition gauges representative of the closest private residences. At the end of the Reporting Period, D20 had exceeded the MOD4 criterion for annual average total deposited dust (4g/m^2/month), however was compliant with the maximum allowable annual increase in deposited dust levels (2g/m^2/month). The independent air quality assessment reviewed site D20 and concluded that Bengalla did not contribute more than 1.5g/m^2/month to the annual average deposited dust level at that location.

Total Suspended Particulates

Table 12 details annual average TSP monitoring results for the Reporting Period.

The independent air quality assessment of TSP reviewed both BMC and independent DPIE monitoring data and concluded that annual TSP levels at these monitors excluding extraordinary events comply with the 90µg/m^3 criteria of MOD4.

The review also noted that the:

- HV1 monitor has no private receiver in the vicinity; and
- HV6 monitor is impacted by highly localised dust from a dirt vehicular track which surrounds the HVAS monitor, within 2m of the instrument, which reflects local activity in monthly data.

Table 11
Summary of Deposited Dust Monitoring Results

Site	Annual Average Deposited Dust Criteria (g/m²)	2019 Annual Average Deposited Dust (g/m²)	2018 Annual Average Deposited Dust (g/m²)	2017 Annual Average Deposited Dust (g/m²)
D01	4.0	1.6	1.3	1.0
D02	4.0	1.9	1.9	1.2
D04A	4.0	2.7	2.9	2.5
D05	4.0	2.6	2.2	1.5
D06	4.0	3.8	2.8	1.7
D07A	4.0	2.2	2.2	1.4
D08	4.0	2.1	2.0	1.8
D09	4.0	3.7	2.6	1.8
D10	4.0	3.8	3.0	2.0
D20	4.0	<1.5*	4.6	3.9
D23B	4.0	2.0	1.8	2.2
D25	4.0	1.5*	3.2	2.3
D26	4.0	2.5	2.5	2.1
DA	4.0	2.5	2.7	2.3

** Bengalla's estimated maximum potential contribution to the annual average deposited dust as determined by Todoroski Air Sciences (2020)*

Table 12
Summary of Annual Average TSP Monitoring Results

Site	Period	Annual Average TSP Criteria (µg/m³)	2019 Annual Average TSP (µg/m³)	2018 Annual Average TSP (µg/m³)	2017 Annual Average TSP (µg/m³)
HV1	All Run days	90	124	94.3	58.9
	Estimated Bengalla maximum contribution excluding extraordinary events		20.3		
HV2	All Run days	90	112.5	91.4	60.0
	Estimated Bengalla maximum contribution excluding extraordinary events		11.2		
HV3	All Run days	90	85.2	69.7	43.9
	Estimated Bengalla maximum contribution excluding extraordinary events		5.9		
HV4	All Run days	90	95.1	71.5	49.6

Site	Period	Annual Average TSP Criteria (µg/m^3)	2019 Annual Average TSP (µg/m^3)	2018 Annual Average TSP (µg/m^3)	2017 Annual Average TSP (µg/m^3)
	Estimated Bengalla maximum contribution excluding extraordinary events		6.9		
HV6	All Run days	90	143	112	96.4
	Estimated Bengalla maximum contribution excluding extraordinary events		33.9		

** Extraordinary events as detailed in Todoroski Air Sciences (2020) Bengalla – Annual average deposited dust, TSP HVAS and PM10 HVAS levels for 2019 includes smoke associated with 2019/2020 bushfires, drought conditions and increased frequency of dust storms*

Particulate Matter <10 Microns (PM_{10}) and <2.5 Microns ($PM_{2.5}$)

Table 13 details PM_{10} monitoring results for the Reporting Period. The independent air quality assessment of PM_{10} reviewed both BMC and independent DPIE monitoring data and concluded that the Bengalla increment was below the criteria.

The 2019 detailed air quality monitoring results are included in **Appendix D**.

Details of elevated PM_{10} results and Bengalla's response and correspondence with DPIE during 2019 in included in **Appendix I**. As detailed in the approved AQMP BMC currently relies upon the Upper Hunter Air Quality Monitoring Network managed by the EPA to record and monitor Particulate Matter less than 2.5 microns ($PM_{2.5}$) levels. The primary EPA monitoring utilised by BMC is the *Muswellbrook* monitor, approximately 5 km east of Bengalla.

Trend and Comparison to Assessment Predictions

A review of the air quality monitoring results against the criteria over the 2017 – 2019 period indicates that the cumulative measurements have increased. The cumulative increases over the period are primarily due to elevated background levels influenced by drought over the period and by bushfires in 2019. Bengalla was not the primary influence on dust levels in the vicinity of the mine in 2019.

The results from the Bengalla air quality monitoring network was found to be generally consistent with the predictions made in the Bengalla EIS and MOD1 – MOD4 air quality assessment. Elevated readings at the Bengalla monitors are likely due to elevated background concentrations in 2019.

Private Residence Mitigation

During the Reporting Period, there were no written requests for the installation of additional air quality mitigation received from any owner of privately-owned residence within the mitigation area. One property outside the mitigation zone was fitted with two air conditioners.

Table 13
Summary of PM_{10} Monitoring Results

Site	Period	Annual Average PM_{10} Criteria ($\mu g/m^3$)	2019 Annual Average PM_{10} ($\mu g/m^3$)	2018 Annual Average PM_{10} ($\mu g/m^3$)	2017 Annual Average PM_{10} ($\mu g/m^3$)
PM_{10}-1	All Run days	25	49.3	33.3	23.1
	Estimated Bengalla maximum contribution excl extraordinary events		4.6		
PM_{10}-2	All Run days	25	37.9	27.1	19.2
	Estimated Bengalla maximum contribution excl extraordinary events		2.7		
PM_{10}-3	All Run days	25	38.7	27.5	20.9
	Estimated Bengalla maximum contribution excl extraordinary events		1.8		
PM_{10}-4	All Run days	25	48.9	38.2	28.0
	Estimated Bengalla maximum contribution excl extraordinary events		8.0		

** Extraordinary events as detailed in Todoroski Air Sciences (2020) Bengalla – Annual average deposited dust, TSP HVAS and PM10 HVAS levels for 2019 includes smoke associated with 2019/2020 bushfires, drought conditions and increased frequency of dust storms*

6.4.3 Further Actions

BMC reviewed the current AQMP on four occasions during 2019 with each review submitted to DPIE for review with a further review required during 2020. Should further amendments to the new approved AQMP be required, BMC will lodge the revised AQMP with relevant regulatory agencies for comment.

6.5 SPONTANEOUS COMBUSTION

Occurrences of spontaneous combustion are infrequent at Bengalla due to the inert nature of the strata and proactive stockpile management.

6.5.1 Environmental Management

Affected areas in the pit are capped with inert material as soon as practical to minimise smoke or odour generation. To minimise the possibility of spontaneous combustion at Bengalla, reject and carbonaceous material is emplaced below the final landform surface.

6.5.2 Environmental Performance

No reportable spontaneous combustion incidents were recorded at Bengalla during the Reporting Period.

6.5.3 Further Actions

There are no additional actions planned for 2020 regarding the management of spontaneous combustion.

6.6 GREENHOUSE GAS

6.6.1 Environmental Management

MOD4 requires BMC to implement reasonable and feasible measures to minimise the release of greenhouse gas (GHG) emissions from Bengalla.

BMC contributes to research and development initiatives that investigate GHG minimisation (see **Table 14**).

Table 14
Greenhouse Gas Emission Reduction Research and Development Initiatives

Program	Outcomes
COAL21	Australian black coal producers contribute a voluntary levy to the Coal21 Fund to support the development of low emission coal technology in Australia.
Australian Coal Association Research Programme (ACARP)	Australian black coal producers contribute five cents per tonne of product coal to fund research and the development of technologies that lead to the safe, sustainable production and utilisation of coal. ACARP is currently coordinating work to develop improved methods for estimating fugitive emissions from underground coal mining. There is also considerable research activity on the reduction of dust emissions from coal during transport to and storage at the major export terminals in Australia and to understand opportunities to reduce fugitive greenhouse gas emissions from mines.

6.6.2 Environmental Performance

At the end of each Financial Year (FY) BMC reports on the emissions of certain substances to the NPI. GHG emissions, energy consumption and production data are also reported under the National Greenhouse and Energy Reporting (NGER) Scheme requirements.

National Pollutant Inventory

In the 2019 FY BMC's NPI report included 31 substances.

In 2019 FY BMC triggered the emissions and transfers reporting requirements for 28 of the 31 reportable substances.

National Greenhouse and Energy Reporting

During 2019 FY Bengalla emitted 525,123 t CO_2-e (Scope 1 and Scope 2) consistent with production.

A comparison of the 2019 FY NGER results with the results for previous FYs are presented in **Table 15** and **Table 16**.

Table 15
Energy Consumed and Produced FY 2017 to 2019

Energy	2019	2018	2017
Consumed (GJ)	2,652,682	2,504,231	2,197,415
Produced (GJ)	246,485,436	248,063,567	232,020,274

Table 16
Greenhouse Gas Emissions 2017 to 2019

Greenhouse Gas Emissions	2019	2018	2017
Scope 1 (tCO_2-e)	465,015	425,713	429,011
Scope 2 (tCO_2-e)	60,108	61,274	59,046
Total (tCO_2-e)	**525,123**	**486,987**	**488,057**

6.6.3 Further Actions

There are no additional actions planned for 2020 regarding the management of greenhouse gases.

6.7 NON-MINERAL WASTE

Environmental Management

Waste generated from Bengalla Mine (Bengalla) during 2019 was 3,333 tonnes in 2019. The total increase in 2019 was 12% higher than 2018, with 44% total waste being recycled in 2019. Table 17 details waste management in 2019.

Table 17
Waste Management 2019

	2018	2019
Total (T)	2,948	3,333
Recycled (T)	1,295	1,458

6.7.1 Environmental Performance

The total volume of material disposed of externally in 2019 was 1,875 t. The major waste streams recycled at Bengalla in 2019 were scrap metal, waste oil and co-mingled recycling. During the Reporting Period, approximately 1,458t of waste was recycled. This volume represents approximately 78% of the offsite non-mineral waste generated at Bengalla during 2019.

There were no non-compliances with regulatory requirements in relation to non-mineral waste management in 2019.

6.7.2 Further Actions

There are no additional actions planned for 2020 regarding the management of non-mineral waste.

6.8 MINERAL WASTE

6.8.1 Environmental Management

Management of mineral waste at Bengalla in 2019 was undertaken in accordance with the *'BMC Acid Rock Drainage' (ARD) and Mineral Waste Management Plan'*.

6.8.2 Environmental Performance

In accordance with the ARD and Mineral Waste Management Plan, BMC maintains a mineral waste inventory of the volumes of inert and potentially acid forming waste disposed on site and disposal locations.

The volumes of total mineral waste generated and stored at Bengalla in 2019 are summarised in **Table 8**.

6.8.3 Further Actions

There are no additional actions planned for 2020 regarding the management of mineral waste.

6.9 CONTAMINATED LAND

6.9.1 Environmental Management

Land contamination may occur as a result of hydrocarbon or other chemical spills. Bengalla implements controls for hydrocarbon and chemical management.

6.9.2 Environmental Performance

During the Reporting Period, there were no non-compliances relating to the management of hazardous materials and contaminated land.

A summary of incidents for 2019 is presented in **Section 11.2**.

6.9.3 Further Actions

There are no additional actions planned for 2020 regarding the management of contaminated land.

6.10 ABORIGINAL ARCHAEOLOGY & CULTURAL HERITAGE

6.10.1 Environmental Management

The management of Aboriginal archaeology and cultural heritage at Bengalla is undertaken in accordance with the ACHMP.

6.10.2 Environmental Performance

All known Aboriginal heritage artefacts within the Bengalla Disturbance Boundary were salvaged in 2016.

Areas disturbed during Bengalla's activities in 2019 were assessed for potential impacts to Aboriginal archaeology as part of Bengalla's GDP process.

Within the Reporting Period, no artefacts were found on Bengalla site and no unapproved impacts to Aboriginal heritage items occurred.

6.10.3 Further Actions

Should any amendments to the ACHMP be required, BMC will lodge the revised plan with the relevant regulatory agencies and stakeholders for comment.

6.11 NON-ABORIGINAL HERITAGE

6.11.1 Environmental Management

Two European heritage sites are located in the vicinity of Bengalla (Bengalla Homestead c1877 and the Overdene Homestead c1860).

BMC has developed and implemented a HHMP, which describes the requirements for the ongoing management and conservation of the Bengalla and Overdene Homesteads. Images from Bengalla's Non-Aboriginal Heritage sites are displayed in Appendix J.

6.11.2 Environmental Performance

Annual dilapidation surveys for Bengalla Homestead and Overdene Homestead were conducted September 2019.

Bengalla Homestead

The 2019 inspection of Bengalla Homestead and associated buildings concluded that there appeared to be no further major degradation since the 2018 inspection.

Externally the condition of the homestead and service wing remained stable and the building was generally, in good repair. However, there was some minor cracking of the brickwork mortar joints under the western windows of the service wing that had developed since our 2018 inspection and should be monitored. Full renovation of the interior of the book keepers cottage was still required and externally the building was generally in a good state of repair.

The renovated cottage service building and garden shed were in a good state of repair. The condition of the other remaining structures are consistent with the 2018 inspection including the hayshed, tool shed, steel water tower and stable.

All buildings and their repair work should continue to be monitored for any signs of cracks caused by foundation movement or mine workings nearby. Additionally, the termite bait stations should be maintained and regular inspections carried out to ensure there is no termite activity in the vicinity of the buildings.

Overdene Homestead

The 2019 inspection of Overdene Homestead concluded that there appeared to be no further major degradation since the 2018 inspection.

The replacement of the roof sheeting and diversion of stormwater away from the building appeared to be successful and the previous restoration of the sandstone and brickwork appeared to be stable.

The remaining outstanding items for the external part of the building included the replacement of missing pipe props from the tie rod ends to assist in continually stabilising the structure. Internally, the condition of the cottage appeared to be stable. Installation of a new floor system, restoration of windows, doors and internal walls was still outstanding.

Keys Family Private Cemetery

An annual inspection was undertaken on the Keys Family Private cemetery in December 2019. The cemetery was in good condition with the area mowed and headstones remain in good condition with no evidence of vandalism.

No other historic heritage sites were impacted during the period. Appendix J contains comparative photos from 2018 and 2019 for the remaining sites.

A summary of the 2019 maintenance and preservation works completed by BMC at the Homesteads is presented in Table 188.

6.11.3 Further Actions

Should any amendments to the Historic Heritage Management Plan (HHMP) be required, BMC will lodge the revised HHMP with relevant regulatory agencies for comment.

BMC will continue to implement the program of maintenance and preservation works as identified by the HHMP in the next Reporting Period.

Table 18
Short Term Maintenance of the Bengalla and Overdene Homesteads 2019

Reference	Maintenance	Response	Status
BENGALLA HOMESTEAD			
Whole Complex			
HHMP Appendix C, Section 7.3	3 monthly termite inspections	Termite inspections and bait stations were installed throughout 2019. (30/1/2019, 1/3/2019, 14/6/2019, 24/9/2019).	On-going
Building 1 – Homestead and Service Wing			
HHMP Appendix C, Section 7.3	Quarterly testing of fire management system	The Bengalla Homestead has been fitted with a mains smoke detection alarming system, which notifies Dispatch of any potential incidents allowing for response to be initiated from BMC. These systems get checked monthly.	Complete
Building 3 – Underground Cistern			
HHMP Appendix C, Section 7.3	Maintain to prevent further deterioration.	No maintenance works were undertaken during 2019.	On-going
Building 5 – Toilet/Shower			
HHMP Appendix C, Section 7.3	Undertake minimal maintenance to ensure stability of building	No maintenance was undertaken in 2019.	On-going
Building 6 - Gazebo			
HHMP Appendix C, Section 7.3	Quarterly inspection to ensure guttering is functioning and draining adequately	New downpipes and gutters have been installed.	On-going
Building 7 - Laundry			
HHMP Appendix C, Section 7.3	Retain any salvageable materials, including the laundry sink and bricks, for reuse elsewhere on site or for reconstruction. Materials to be stored in a suitable location with protection from the elements.	Laundry reconstructed using salvageable materials. New roof installed.	Complete
Building 8 – Book-keeper's Cottage			

Reference	Maintenance	Response	Status
HHMP Appendix C, Section 7.3	Stabilise footing defects.	Works completed in previous period.	Complete
Building 9 – Tennis Court			
HHMP Appendix C, Section 7.3	Maintain in current condition.	Lawn and grounds maintenance undertaken as required. New fencing has been installed near the main entry to the homestead and between the homestead and cottage.	On-going
Building 12 – Modern Water-Tower			
HHMP Appendix C, Section 7.3	Maintain to prevent further deterioration	Tank Stand painted and new timber tank platform installed	On-going
Building 13 – Stockyards			
HHMP Appendix C, Section 7.3	Maintain in current condition.	No maintenance works undertaken in 2019.	On-going
OVERDENE HOMESTEAD			
External			
HHMP Appendix D, Section 6.4	Treat termites and/or other pests appropriately.	Termite inspections and bait stations were installed throughout 2019. (30/1/2019, 1/3/2019, 14/6/2019, 24/9/2019).	On-going
HHMP Appendix D, Section 6.4	Repair damage caused by termites, where integral to structural integrity.	Internal foundation walls have been repointed and repaired ready for the installation of a new timber flooring system.	On-going
HHMP Appendix D, Section 6.4	Check and repair/replace, if necessary, the roof, all downpipes, guttering and drainage gullies for leaks and to ensure free-flowing drainage.	Pipe props have been replaced from the tie rod ends to assist in continually stabilising the structure. Some roof sheeting has been replaced	On-going
HHMP Appendix D, Section 6.4	Repair mortar where necessary, internally and externally.	Internal mortar continued to be monitored throughout 2019.	On-going
Internal			
HHMP Appendix D, Section 6.4	Undertake a detailed inspection of the foundations and rectify/repair, including hall archway and fireplace in Room 3.	No maintenance works undertaken during 2019.	On-going

6.12 FLORA & FAUNA

6.12.1 Environmental Management

MOD4 and EPBC Approval 2012/6378 require BMC to manage biodiversity at Bengalla and offsite lands.

6.12.2 Environmental Performance

Onsite Biodiversity Management & Mitigation

Biodiversity management at Bengalla is described in the Biodiversity Management Plan (BDMP).

Appendix E includes summary of commitments from the BDMP against activities undertaken during the Reporting Period and an annual Compliance Report against the conditions of EPBC Approval 2012/6378.

The management, monitoring and performance of Bengalla rehabilitation during the Reporting Period is described in **Section 8**.

Offsite Biodiversity Management & Mitigation

BMC manages approximately 6,215 ha of offsite land under the Biodiversity Offset Management Plan (BOMP). The location of the offset properties in relation to Bengalla is illustrated on **Figure 7**.

During the Reporting Period, BMC undertook several management programs on the offset properties, including but not limited to:

- Weed inspections and weed spraying program;
- Dog baiting and trapping programs;
- Fire trail maintenance across Kenalea, Echo, Kenalput and Black Mountain offsets; and
- Summer and Winter ecological surveys.

BMC attended various meetings with relevant stakeholders including adjoining private neighbours, National Parks and Wildlife Services, Local Land Services, various Wild Dog Associations and the Rural Fire Service.

The EPBC Compliance Report (**Appendix E**) did not identify any non-compliances with the conditions of EPBC 2012/6378.

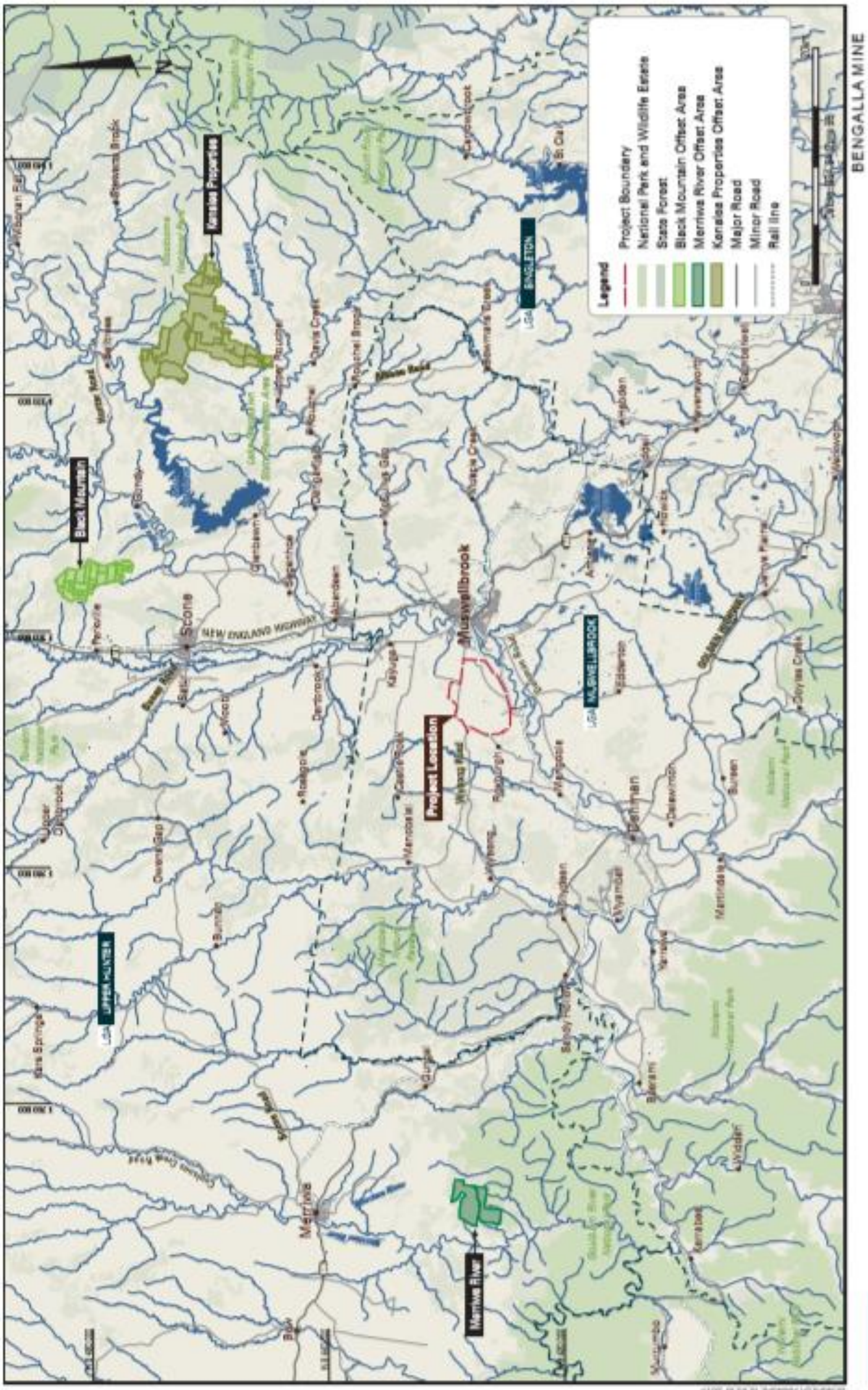


Figure 7 Biodiversity Offset Areas

Offset Ecological Surveys

The ecological monitoring program of the Biodiversity Offset Areas established for the Project commenced in 2016. A total of 28 permanent flora monitoring sites were established and surveyed. A suite of surveys was undertaken in 2019, including bird census, terrestrial IR camera surveys for the Spotted-tailed Quoll and feral animals, arboreal IR camera surveys for the Squirrel Glider, ultrasonic bat detection and opportunistic observations.

The data collected for the 2019 report represents the third year of annual monitoring. Given that the monitoring program is still in its early stages, few measurable changes in survey results were detected in year three annual monitoring surveys. This is expected to change over time due to a combination of the implementation of management activities and natural regeneration. Table 19 details the 2019 assessment results against the performance criteria.

Table 19
Assessment Against Performance Criteria

KPI / Measurable Indicators	Year 5 Performance Criteria	Results of Year 3 (2019) Monitoring
Vegetation Management Zones		
Zone 1 - Existing Forest and Woodland (Maintain condition of vegetation within benchmark)		
Total native species richness (NPS)	Maintenance or increase in native species richness	Ten of 19 monitoring sites recorded an equal or greater native plant species richness compared to baseline. Of the nine sites where native species richness was below baseline numbers, only one is below benchmark values.
% Native over-store cover (NOS)	Maintenance of current cover	Zero of 19 monitoring sites recorded an equal or greater native over storey cover compared to baseline. Of the 19 sites where native over storey was below baseline numbers, only 6 are also below benchmark values.
% Native mid-storey cover (NMS)	Maintenance of current cover	Fourteen of 19 monitoring sites recorded an equal or greater native mid-storey cover compared to baseline. Of the five sites where native mid-storey cover was below baseline numbers, four are also below benchmark values.
% Native ground cover (grasses) (NGCG)	Maintenance of cover above lower benchmark	One of 19 monitoring sites recorded an equal or greater native ground cover (grasses) compared to baseline However, 18 of the 19 monitoring sites are above lower benchmark for native ground cover (grasses).
% Native ground cover (shrubs) (NGCS)	Maintenance of current cover	Four of 19 monitoring sites recorded an equal or greater native ground cover (shrubs) compared to baseline. Of the 15 sites where native ground cover (shrubs) was below baseline numbers, nine are also below benchmark values.
% Native ground cover (other natives) (NGCO)	Maintenance of current cover above	Sixteen of 19 monitoring sites recorded an equal or greater native ground cover (other natives) compared to baseline. Seventeen of 19 monitoring sites are

KPI / Measurable Indicators	Year 5 Performance Criteria	Results of Year 3 (2019) Monitoring
	lower benchmark	above lower benchmark for native ground cover (other natives).
% Exotic plant cover	Weed cover not increased above baseline	Twelve of 19 monitoring sites recorded an equal or lower exotic plant cover compared to baseline.
% overstorey regeneration (OR)	100%	Nine of 19 monitoring sites have 100% regeneration of all canopy species present.
Number of trees with hollows (NTH)	Maintenance of number of trees with hollows	Fifteen of 19 monitoring sites recorded an equal or greater number of trees with hollows compared to baseline.
Total length (m) of fallen logs (FL)	Maintenance of length (m) of fallen logs	Fourteen of 19 monitoring sites recorded an equal or greater length of fallen logs compared to baseline. Of the five sites where length of fallen logs was below baseline numbers, all are also below benchmark values.
Zone 2 - Derived Native Grasslands (Maintain and improve through assisted natural regeneration. Aim to increase to benchmark condition)		
Total native species richness (NPS)	Increase to at least 50% of lower benchmark.	All six monitoring sites recorded native species richness at least 50% of lower benchmark.
% Native over-storey cover (NOS)	No change expected in 5 years	Native over-storey cover absent from monitoring sites. Changes expected over a longer timeframe.
% Native mid-storey cover (NMS)	Increase to at least 50% of lower benchmark.	Native mid-storey cover absent from monitoring sites. Changes expected over a longer timeframe.
% Native ground cover (grasses) (NGCG)	Maintenance of cover within benchmark range.	Five of six monitoring sites within benchmark range for native ground cover (grasses), two of which exceed the upper benchmark.
% Native ground cover (shrubs) (NGCS)	Increase to at least 50% of lower benchmark.	Zero of six monitoring sites with native ground cover (shrubs) at least 50% of lower benchmark. Changes expected over a longer timeframe.
% Native ground cover (other natives) (NGCO)	Increase to at least 50% of lower benchmark.	Five of six monitoring sites with native ground cover (other natives) at least 50% of lower benchmark. Changes expected over a longer timeframe.
% Exotic plant cover	Weed cover not increased above baseline	Four of six monitoring sites recorded equal or decreased weed cover compared to baseline, which may be the result of dry conditions preceding surveys.
% overstorey regeneration (OR)	No change expected in 5 years	No significant change observed. Changes expected over a longer timeframe.
Number of trees with hollows (NTH)	No change expected in 5 years. Maintenance of trees with hollows.	No significant change observed. Changes expected over a longer timeframe.

KPI / Measurable Indicators	Year 5 Performance Criteria	Results of Year 3 (2019) Monitoring
Total length (m) of fallen logs (FL)	No change expected in 5 years	Six of six monitoring sites recorded a greater or equal length of fallen logs compared to baseline.
Zone 3 – Riparian (Rebuild/improve riparian corridors; protect waterways. Aim to increase to benchmark condition)		
Total native species richness (NPS)	Increase to at least 50% of lower benchmark.	All monitoring sites at least 50% of lower benchmark for native species richness.
% Native over-storey cover (NOS)	No change expected in 5 years	Two of three monitoring sites within benchmark range for native overstorey cover.
% Native mid-storey cover (NMS)	Increase to at least 50% of lower benchmark.	One of three monitoring sites at least 50% of lower benchmark for native mid-storey cover. Changes expected over a longer timeframe.
% Native ground cover (grasses) (NGCG)	Increase to at least 50% of lower benchmark.	All monitoring sites at least 50% of lower benchmark for native ground cover (grasses).
% Native ground cover (shrubs) (NGCS)	Increase to at least 50% of lower benchmark.	One monitoring sites at least 50% of lower benchmark for native ground cover (shrubs).
% Native ground cover (other natives) (NGCO)	Increase to at least 50% of lower benchmark.	All monitoring sites at least 50% of lower benchmark for native ground cover (other natives).
% Exotic plant cover	Weed cover not increased above baseline	Observed decrease in weed cover, which may be the result of dry conditions preceding surveys.
% overstorey regeneration (OR)	No change expected in 5 years	No significant change observed. Changes expected over a longer timeframe.
Number of trees with hollows (NTH)	No change expected in 5 years. Maintenance of trees with hollows,	No significant change observed. Changes expected over a longer timeframe.
Total length (m) of fallen logs (FL)	No change expected in 5 years	No significant change observed. Changes expected over a longer timeframe.
Box Gum Woodland and Derived Native Grassland		
Box Gum Woodland		
Increase in site condition value	No change predicted.	No significant change observed. Changes expected over a longer timeframe.
Increase in site context value	No change predicted.	No significant change observed. Changes expected over a longer timeframe.
Derived Native Grassland		
Increase in site condition value	Native species richness to increase to at least 50% of lower benchmark.	All monitoring sites with native species richness at least 50% of lower benchmark.

KPI / Measurable Indicators	Year 5 Performance Criteria	Results of Year 3 (2019) Monitoring
	Native ground cover (shrubs) to increase to at least 50% of lower benchmark.	No monitoring sites with native ground cover (shrubs) at least 50% of lower benchmark. Changes expected over a longer timeframe.
	Native ground cover (other natives) to increase to at least 50% of lower benchmark.	All monitoring sites with native ground cover (other natives) at least 50% of lower benchmark. Changes expected over a longer timeframe.
Increase in site context value	No change predicted.	No significant change observed. Changes expected over a longer timeframe.
Threatened Species		
Tiger Orchid : - Maintenance of resident species populations and existing habitat for species. - Increase in suitable habitat and increase in species populations and area of occupancy.	Increase in the extent and condition of habitat	Species not detected during surveys. No obvious increase in area and condition. Changes expected over a longer timeframe.
Squirrel Glider : - Maintenance of resident species populations and existing habitat for species. - Increase in suitable habitat and increase in species populations and area of occupancy.	- Increase in the extent and condition of habitat - Continued detection of the species	Species not detected during surveys. No obvious increase in area and condition. Changes expected over a longer timeframe.
Spotted-tailed Quoll : - Maintenance of resident species populations and existing habitat for species. - Increase in suitable habitat and increase in species populations and area of occupancy.	- Increase in the extent and condition of habitat - Continued detection of the species	Species recorded at three locations within the Kenalea Properties. No obvious increase in area and condition. Changes expected over a longer timeframe.
Threatened Microbats - Maintenance of resident species populations and existing habitat for species. - Increase in suitable habitat and increase in species populations and area of occupancy.	- Increase in the extent and condition of habitat - Continued detection of the species	Several species recorded at several locations within the Biodiversity Offset Areas. No obvious increase in area and condition. Changes expected over a longer timeframe.

KPI / Measurable Indicators	Year 5 Performance Criteria	Results of Year 3 (2019) Monitoring
Woodland Birds : - Maintenance of resident species populations and existing habitat for species. - Increase in suitable habitat and increase in species populations and area of occupancy.	- Increase in the extent and condition of habitat - Continued detection of the species	Five threatened woodland birds recorded within Kenalea and Merriwa River. No obvious increase in area and condition. Changes expected over a longer timeframe.
Regent Honeyeater and Swift Parrot : - Maintenance of resident species populations and existing habitat for species. - Increase in suitable habitat and increase in species populations and area of occupancy.	Increase in the extent and condition of habitat	Species not detected during surveys. No obvious increase in area and condition. Changes expected over a longer timeframe.
Weeds		
Weed density and distribution	Weed cover not increased above baseline	Changes to exotic species richness variable across the Biodiversity Offset Areas. Observed decrease in weed cover, which may be the result of dry conditions preceding surveys.
Weed diversity	Weed diversity not increased above baseline	No significant changes to weed species diversity observed.
Significant target weed infestations	Significant target weed infestations not increased above baseline	Significant weed infestations not mapped as part of annual monitoring. Some changes in occurrences of target species at monitoring sites observed.
Feral Animals		
Feral animal abundance	No increase from the baseline feral animal abundances	Changes in species occurrences observed, including detections of some previously recorded species and absence of previously recorded species at specific sites. Changes expected over a longer timeframe. However, impacts likely to persist as animals move from adjoining areas into the Biodiversity Offset Areas.
Habitat disturbance by feral animals	No increase from the baseline feral animal disturbance levels	No significant disturbance observed at the monitoring sites.

There were no proposed measures recommended in the 2019 report to improve the performance of rehabilitation and restoration activities with the Biodiversity offset Areas.

Bushfire Hazard Reduction Burns

Due to ongoing drought and low fuel loads, no additional hazard reduction burns occurred in 2019.

6.12.3 Further Actions

Should any amendments to the BDMP or BOMP be required, BMC will review and submit a revised version of the BDMP or BOMP to the relevant regulatory agencies and stakeholders for comment.

6.13 WEEDS & PEST MANAGEMENT

6.13.1 Environmental Management

Weed and pest management at Bengalla and its offset properties is undertaken in accordance with Bengalla's BDMP and BOMP, respectively.

Periodic inspections are undertaken for weeds and pests, as required. Weed and pest control at Bengalla and on the BMC offset properties is undertaken through respective chemical and baiting applications.

6.13.2 Environmental Performance

6.13.2.1 Weed Management

Weeding is undertaken using boom spray, spot spraying or stem application dependent upon the weed and the terrain.

Bengalla

During 2019, approximately 9 ha was treated for the management of weeds (see Error! Reference source not found.**11**). Target weed species included African boxthorn, galenia, prickly pear and other weeds. Priority areas for treatment included the rehabilitation areas, topsoil stockpiles and GDP areas (prior to topsoil stripping).

Observations during the weed treatment program and follow up inspections indicate that treatment methods used during the Reporting Period have generally been effective in reducing the presence of weeds in target areas.

Offset Properties

Weed management across the biodiversity offset areas involves quarterly inspections and weed control programs.

Quarterly inspections are undertaken to determine weed control required for each quarter in each of the offset areas. Following identification, weed control commences and daily work records of site attendance are submitted which detail the sites treated, area (ha) treated, techniques and chemicals utilised and rates of application. **Figure 8-10** show locations of weed control in the Offset areas.

Weeds present dictate chemicals to be utilised based on their effectiveness. Chemical used during 2019 include Grazon Extra, MCPA 750 and Garlon 600.

Weeds controlled include Prickly Pear, Patersons curse and African boxthorn across each offset with Tiger Pear being controlled in Merriwa Offset. Riparian zone weeds were also treated in Kenalea and Echo including noogoora burr and thorn apple.

Application was primarily via vehicle mounted spray rigs however backpacks were also used in some areas.

Drought conditions prevailed throughout 2019 resulted in some weed species remaining dormant and not being evident in 2019 (eg St Johns Wort).

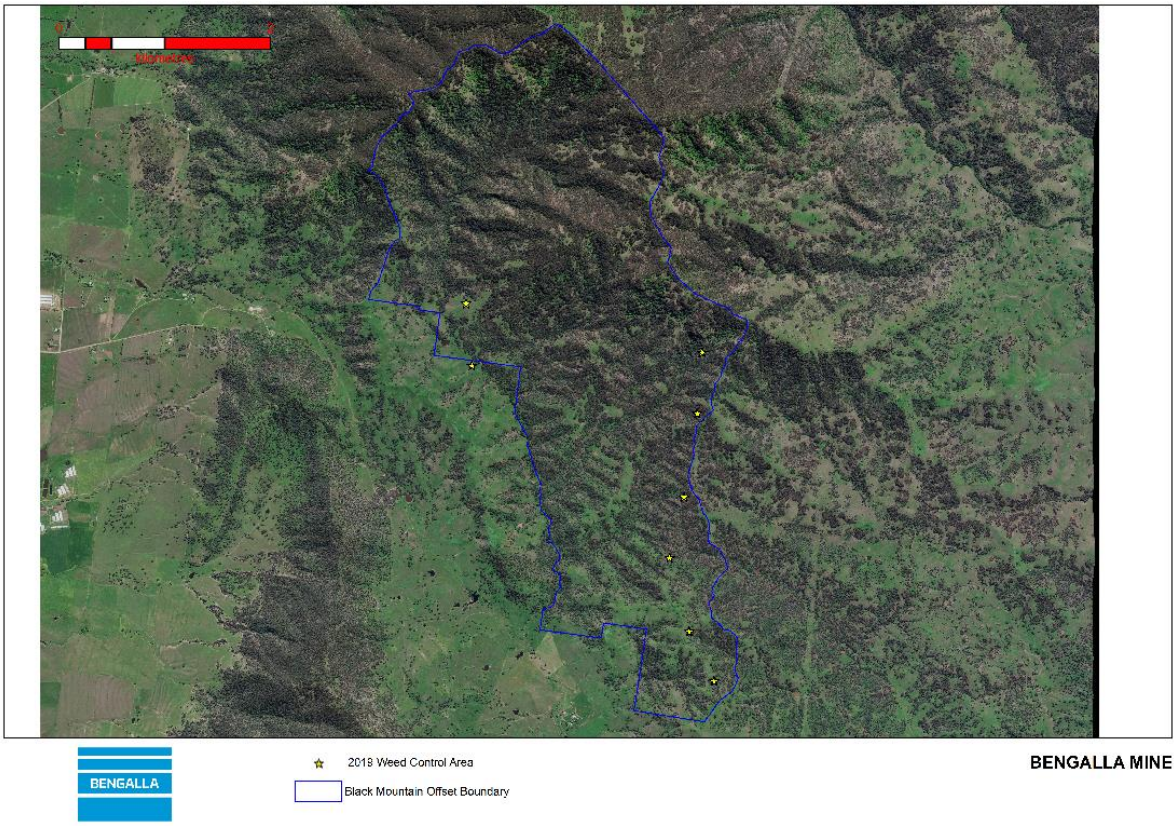


Figure 8 Black Mountain Weed Management Locations 2019

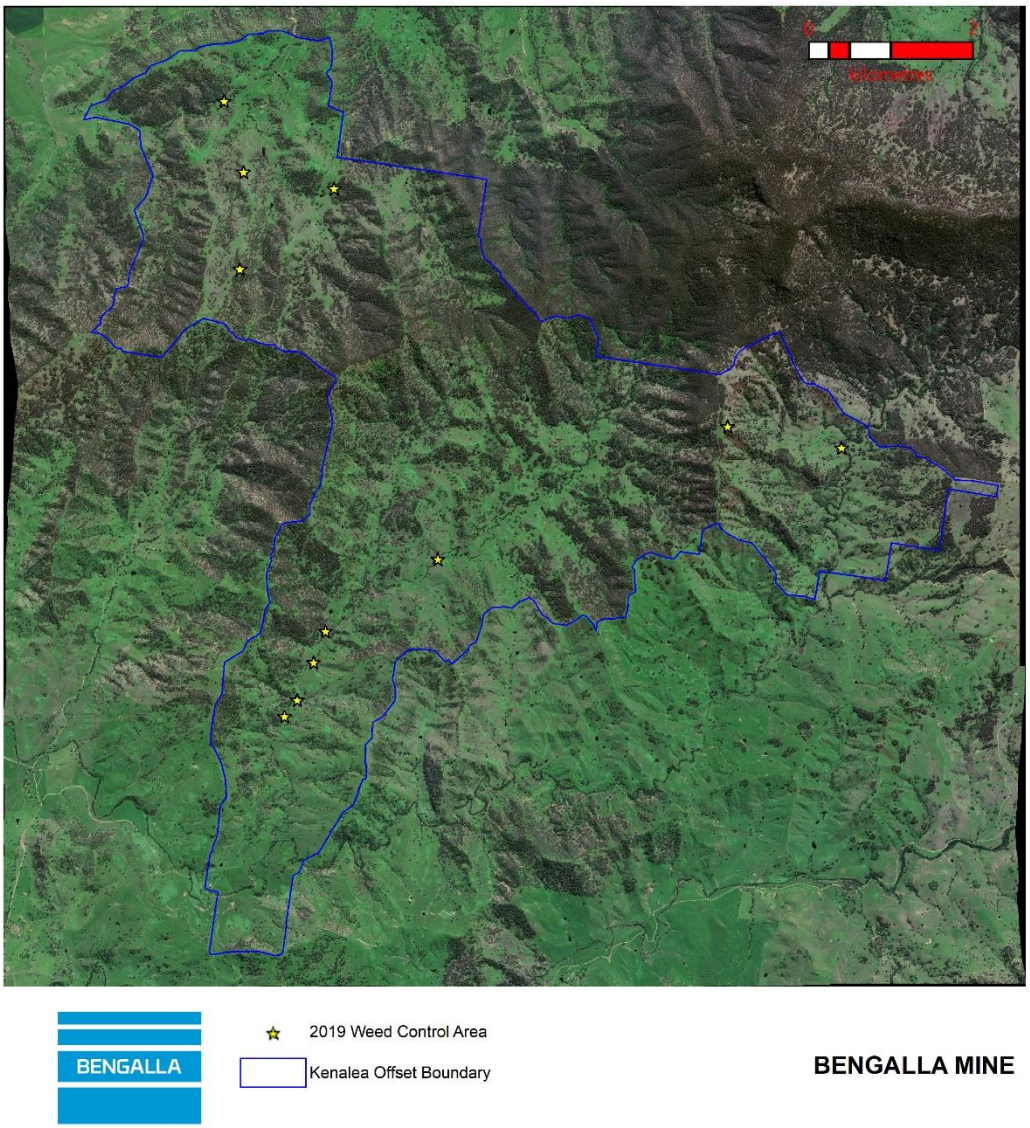


Figure 9 Kenalea Weed Management Locations 2019

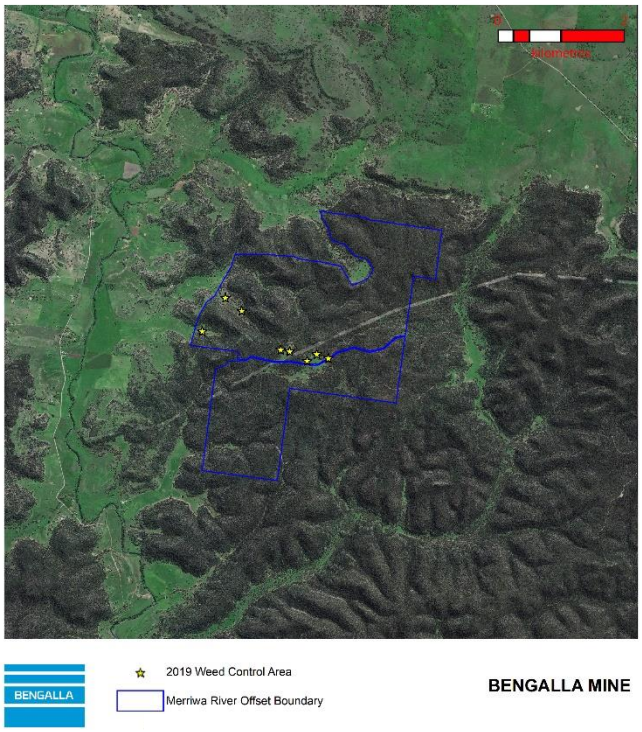


Figure 10 Merriwa River Weed Management Locations 2019

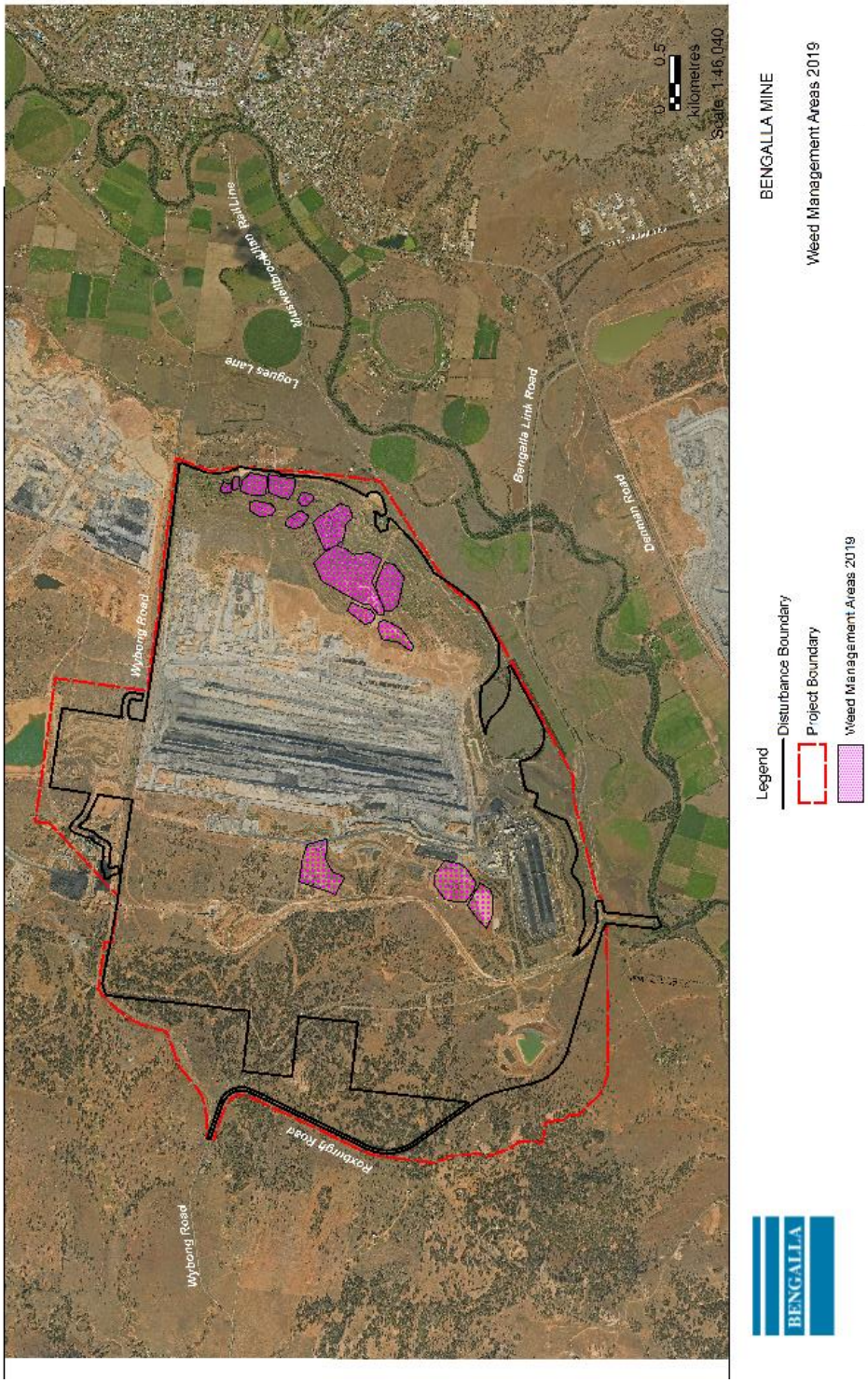


Figure 11 Weed Management Areas

6.13.2.2 Pest Management

Bengalla

Pigs were observed around the train loadout in late 2019. A culling program was developed and then implemented in Q1 2020. Details of the results will be included in the 2020 Annual Review.

Offset Properties

BMC undertook a 5-week dog ground baiting program across all offset properties; including aerial dog baiting in autumn and spring. A total of 86 bait stations were established with 1080 baits targeting foxes and wild dogs. Results indicated that 57% of baits were taken and these equated to 55% being foxes and 45% being wild dogs. Long term results indicate wild dog takes have increased over the past 4 years. Two dog trapping programs were undertaken in 2019 in conjunction with the Local Land Services.

BMC also undertook a pig trapping program that included a total of 12 traps fitted with HogEye cameras on Kenalea and Echo. The pig trapping program was undertaken in August 2019 with an equivalent of 120 trapping days completed. 52 pigs were trapped during the program.

6.13.3 Further Actions

Ongoing management of weeds and feral animals at Bengalla and offset properties will continue during 2020.

6.14 VISUAL AMENITY & LIGHTING

6.14.1 Environmental Management

BMC is required to implement reasonable and feasible measures to mitigate the visual and offsite lighting impacts of the development in accordance with MOD4.

6.14.2 Environmental Performance

6.14.2.1 Tree Screening Along Public Roads

MOD4 (Schedule 3, Condition 40), requires BMC to plant trees along sections of Denman Road, Roxburgh Road and Wybong Road that will have direct views of Bengalla. The screening must be planted in consultation with the MSC and, where required, the NSW Roads and Maritime Services (RMS).

During the Reporting Period, BMC consulted with key stakeholders (MSC, DPIE and MAC representatives) regarding the development and implementation of tree screens along identified public roads.

Tree screen planting was completed along sections of Roxburgh Road with views to Bengalla. A total of 328 native trees were planted in 2019. Ongoing maintenance work on the trees has consisted of replacement of failed plantings, watering and replacement of guards.

The Wybong Road tree screen area commenced in 2019 with hydro mulching of the visual bund adjacent to the road.

6.14.3 Further Actions

Plantings in road reserves or adjacent areas that will have views of Bengalla will be progressed where reasonable and feasible.

6.15 EMERGENCY RESPONSE PREPAREDNESS

BMC has an Emergency Response Team (ERT) which is trained to respond to emergencies and conducts simulated emergency exercises.

The BMC Environment Department conducted a pollution incident response test exercise on the 16 December 2019. The simulated scenario was a blast that had slept for 7 days. The location of the blast was in pit adjacent to the northern end wall. The blast was scheduled to fire in low risk wind speed conditions. The window of low risk wind conditions was projected to be from 7:00am to 8:00am. The wind was from the south east. Any particulates or fume from the blast is likely to exit Bengalla premises area towards the Mt Pleasant Mine infrastructure area where Mt Pleasant Mine employees and contractors may be located. The wind is increasing to medium, wind speed conditions at the time of the blast.

The exercise allowed BMC to confirm that the response procedures included in the Pollution Incident Response Management Plan are up to date and that the BMC and Mt Pleasant Operations Statutory Boundary Management Plan is capable of being implemented in a workable and effective manner.

7 WATER MANAGEMENT

This section describes the Bengalla water management objectives and performance during the Reporting Period.

7.1 WATER BALANCE

Bengalla water take during the Reporting Period is summarised in **Table 20** with an overview of the site water balance included in **Table 21** Site Water Balance 2019.

A discussion of surface water and groundwater monitoring and management during the Reporting Period is provided in **Section 7.2** and **Section 7.3**, respectively.

Table 20 Site Water Take 2019

Water Licence	Water Sharing Plan, Source & Management Zone	Entitlement	Passive Take / Inflows (ML)	Active Pumping (ML)	Total (ML)
WAL001106	Hunter Regulated River Water Source Water Sharing Plan	3098 units[1]	-	1,705	1,705
20BL169798	Hunter Unregulated and Alluvial Water Source – Hunter Regulated River Alluvial Water Source	125 ML[2]	113	-	113

Hunter Unregulated and Alluvial Water Source	Muswellbrook Water Source	109 ML[3]	0	-	0
Total					**1,818**

[1] The Hunter River Regulated Water year commences 1 July and concludes 30 June. Calendar year entitlement is therefore equal to two times the share component plus allocation assignments however in practice this is spread over two calendar years. In June 2019, BMC secured an allocation assignment of 200 ML to the BMC high security WAL increasing the entitlements for the 2018/19 year from 1,449 ML to 1,649 ML.

[2] Application lodged with NSW Office of Water on 22/12/2015 to increase entitlement to 325 ML.

[3] Harvestable rights entitlement calculation (Bengalla EIS).

Table 21 Site Water Balance 2019

Aspect	Volume (ML)
Water Inputs	
Raw water sourced from Hunter River (ML/yr)	1,705
Rainfall and catchment runoff (ML/yr)	555
Groundwater inflow to open cut pits (ML/yr)	113
Water entrained in ROM coal processed (ML/yr)	1,120
Total Inputs	***3,493***
Outputs	
Water entrained in product coal	1,878
Other CHPP plant losses	209
Dust suppression (stockpiles and haul roads)	709
Vehicle wash-down losses	123
Hunter River Salinity Trading Scheme (HRSTS) discharge	0
Other offsite discharges from mine water management system	0
Evaporation from dams	596
Total outputs	3,514
Water Balance for 2019	**-21**

Source: Bengalla Annual Water Balance 2019

7.2 SURFACE WATER

7.2.1 Environmental Management

BMC has a Water management Plan (WMP) which describes the surface water management infrastructure and procedures in place at Bengalla.

7.2.2 Environmental Performance

Surface Water Use

During the Reporting Period Bengalla pumped 1,705 ML from the Hunter River. The Bengalla water balance for 2019 is provided in **Section 7.1**.

Surface Water Monitoring Program

Bengalla's surface water monitoring is undertaken in accordance with the WMP. Surface water monitoring locations are shown on

Surface Water Monitoring Results

A comparison of the 2019 receiving surface water monitoring results with the results for previous years are presented in **Table 22**.

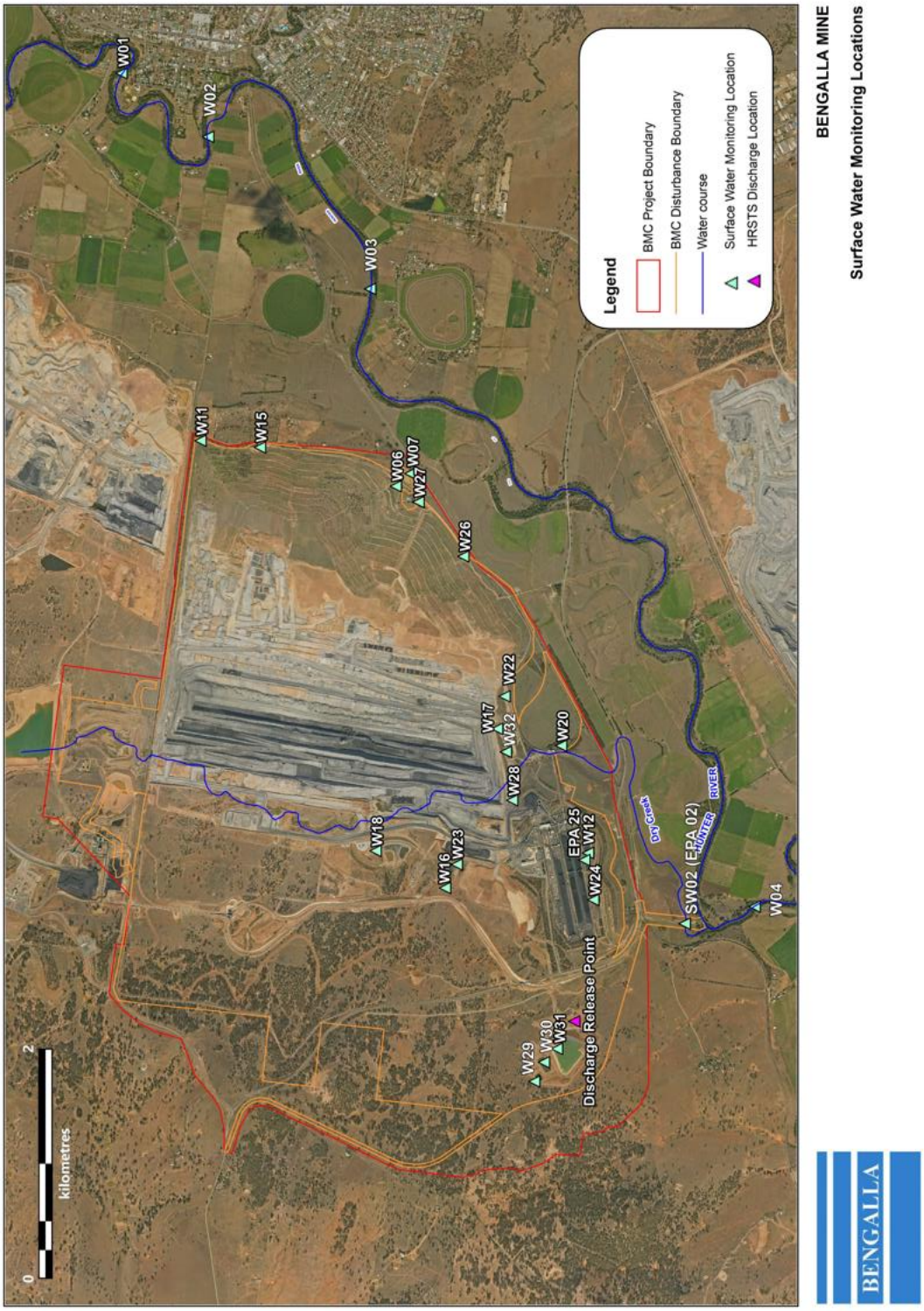


Figure 12 Surface Water Monitoring Locations

Table 22
Summary of surface water monitoring results (2017 – 2019)

Year	Site W01 Average			Site W02 Average			Site W03 Average			Site W04 Average		
	pH	TSS	EC	pH	TSS	EC	pH	TSS	EC	pH	TSS	EC
2017	7.9	8	458	7.9	17	459	7.9	14	487	7.9	10	535
2018	8.1	10	371	8.0	11	384	8.0	11	390	7.9	13	411
2019	7.9	46*	403	7.9	28*	398	8.0	11.5	395	8.0	13	425

**Rain event in March resulted in elevated results, elevating the average on those locations directly affected.*

Trends Over the Life of the Project

The Hunter River water quality trigger values in the WMP are used for the investigation of potential surface water impacts from Bengalla operations. Trigger values for the surface water parameters monitored monthly are:

- pH: 6.5 – 8.1;
- Total Suspended Solids (TSS): 40 mg/L; and
- Electrical Conductivity (EC): 650 µS/cm.

Discrepancies between predicted and actual water quality levels during the Reporting Period were related to individual monthly elevated results which were above the trigger values for Hunter River water quality assessment (see **Appendix F**).

The review of these elevated monthly results by BMC did not identify significant impacts or a trend of increased surface water impacts resulting from Bengalla (i.e. no discharge to the Hunter River occurred during the Reporting Period).

Comparison to Assessment Predictions

The Bengalla EIS predicted that downstream impacts on surface water quality would be negligible provided that discharge from Bengalla would be conducted according to the Hunter River Salinity Trading Scheme. No discharge occurred during the Reporting Period.

Surface water monitoring of pH, TSS and EC at the four Hunter River monitoring sites in 2019 confirms that water quality remains generally within the relevant WMP impact criteria for each parameter. TSS however peaked in April 2019 as a result of a significant rainfall event which was unrelated to mining operations.

An overview of the Bengalla site water balance for 2019 is provided in **Section 7.1**. In comparing the 2019 water balance results to the Bengalla EIS, Year 4 was selected as the most appropriate scenario. It should be noted that the Year 4 water balance also assumed a production rate of up to 15 Million tonnes per annum of product coal.

In 2019, the greatest variations from predictions in the surface water balance were related to the dry conditions prevailing throughout the year, with increased volumes from evaporation and in water demand for dust suppression.

7.2.3 Further Actions

Should any amendments to the WMP be required, BMC will lodge the revised plan with relevant regulatory agencies for comment.

7.3 GROUNDWATER

7.3.1 Environmental Management

BMC has a WMP which describes the groundwater management measures in place at Bengalla.

Groundwater Monitoring

Bengalla has a groundwater monitoring network in place targeting two aquifer systems: an alluvial aquifer associated with the Hunter River floodplain and a Permian aquifer system. The current groundwater monitoring network consists of a total of 42 bores which are shown in Error! Reference source not found..

The alluvium, shallow bedrock and deep bedrock bores are all sampled for Standing Water Level (SWL), pH, EC, and Total Dissolved Solids (TDS) at various frequencies. A chemical analysis including sulphate and metals is also undertaken on several bores annually.

Monitoring Results for Groundwater Levels and Quality

Appendix G discusses the 2019 groundwater monitoring results, trends and comparison with Bengalla EIS predictions including a summary of any key findings and comparison to the Bengalla EIS predictions.

7.3.2 Further Actions

BMC will consider the groundwater monitoring and management recommendations identified in **Appendix G**.

Should any amendments to the WMP be required, BMC will lodge the revised plan with relevant regulatory agencies for comment.

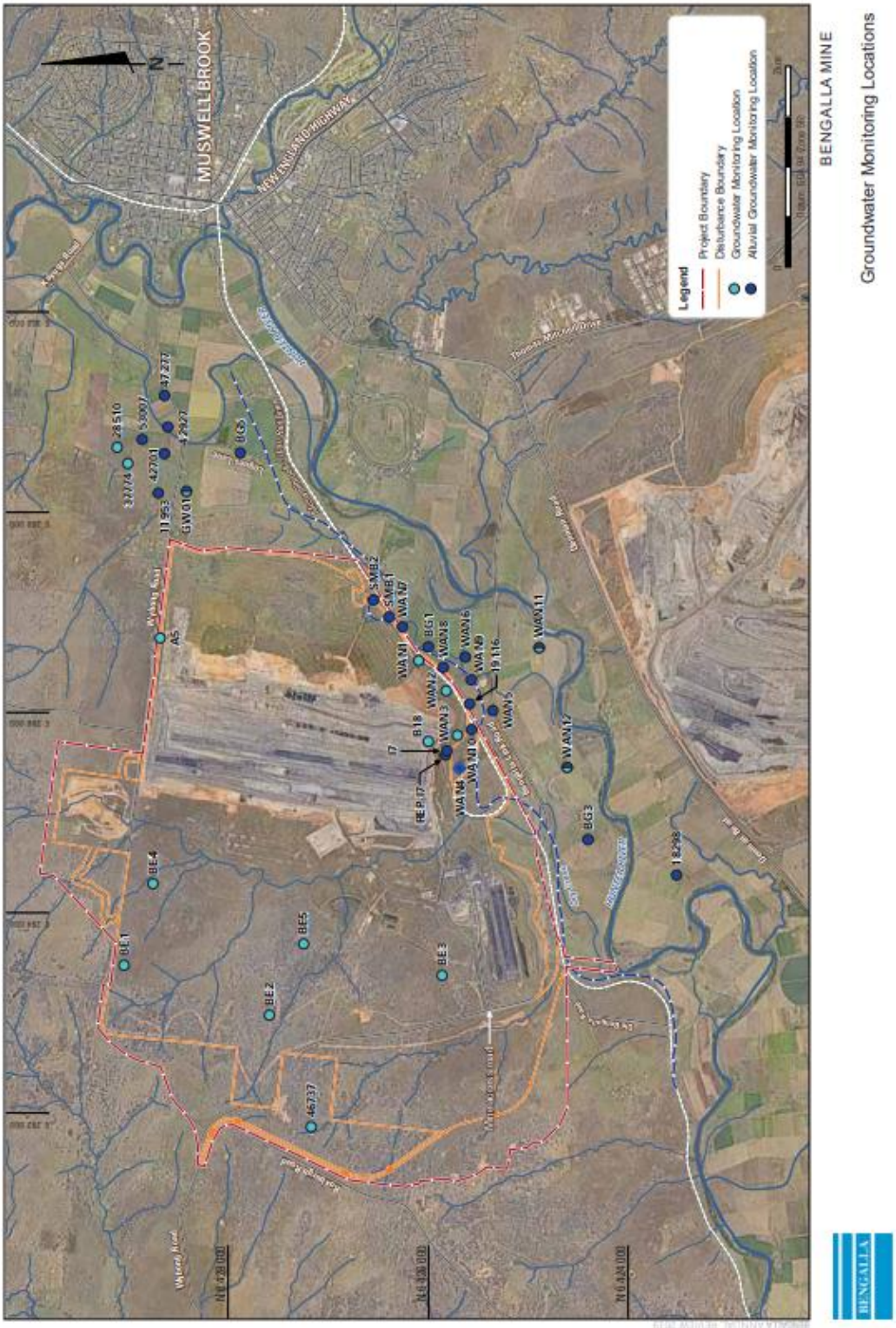


Figure 13 Groundwater Monitoring Locations

8 REHABILITATION

This section describes the Bengalla rehabilitation objectives and performance during 2019. Rehabilitation activities planned for the next Reporting Period are also discussed.

8.1 REHABILITATION OBJECTIVES AND FINAL LAND USE

The rehabilitation objectives for Bengalla as described in Schedule 3 Condition 44 of MOD4 and the status of each is provided in **Table 23**.

8.2 REHABILITATION MANAGEMENT

Rehabilitation at Bengalla is undertaken in accordance with MOD4 as described in the current Mining Operations Plan 2017-2021 Amendment A (MOP), subject to operational progress.

MOD4 Schedule 3 Condition 44 states that the final landform design must incorporate natural micro-relief and natural drainage lines.

The current MOP proposed to undertake 23 ha of rehabilitation in 2019, focusing on the southern face of the OEA and the southern visual relief area.

Rehabilitation completed in 2018, and part of the existing 2017 rehabilitation, was reshaped to incorporate the installation of micro-relief and natural drainage lines.

During the Reporting Period 13.5 ha on the southern face of the OEA was rehabilitated as new rehabilitation and 12.8 ha was dehabilitated for the installation of micro-relief. An interim cover crop of Millet was spread. When the conditions are suitable the woody species mix will be sown.

The planned remedial works to the northern (Wybong) face did not commence in 2019.

The rehabilitation completed up to and including 2019 and the planned program for 2020 is shown on **2**.

The rehabilitation completed in the last two Reporting Periods and the predicted rehabilitation activities for 2019 is summarised in **Table 24**.

Table 23
Bengalla Rehabilitation Objectives (from MOD4)

Feature	Objective	Status
Mine site (as a whole)	• Safe, stable and non-polluting	• Ongoing. See **Section 6.8.1** for a description of Bengalla mineral waste management during 2019.
	• Final landforms designed to incorporate natural micro-relief and natural drainage lines, which, where reasonable and feasible, further avoid straight run drainage drop structures, to integrate with surrounding landforms	• Overburden emplacement and rehabilitation activities are undertaken with the objective of achieving the concept final landform approved under MOD4.
Overburden Emplacement Area – exposed to Muswellbrook and Denman	• Rehabilitate the entire face with high density woody vegetation as soon as practicable following the completion of mining operations	• Ongoing. A strategy is being developed and implemented for establishment of high-density woody vegetation over existing rehabilitation areas.
Final void	• Designed as a long-term groundwater sink and to maximise groundwater flows across back-filled pits to the final void • Minimise the greatest extent practicable: o the size and depth of the final void; o the drainage catchment of the final void; o any high wall instability risk; and o risk of flood interaction (flows in and out of the void) • Maximise to the greatest extent practicable the final void landform to be in keeping with the natural terrain features of the surrounding landscape	• Final void designs approved under MOD4 to be reviewed at least five years from closure of Bengalla.
Agricultural land	• Restore or maintain land capability generally as described in the [Bengalla] EIS and shown conceptually in Appendix 9 [of SSD-5170]	• Ongoing. Rehabilitation activities are undertaken with the objective of achieving the land capability commitments approved under MOD4.
Revegetation areas	• Restore a minimum 10% treed coverage at the mine site • Higher density planting along the riparian zone of the Dry Creek reinstatement, and around the final void	• This activity is being investigated for redevelopment of the existing rehabilitation however the rehabilitation of riparian areas within dry creek and final void are not within the current MOP period.

Feature	Objective	Status
Dry Creek reinstatement	• No net loss of creek length; • Restore, maintain and/or improve hydrological and ecological function, quality and geomorphic stability; • Incorporate erosion control measures based on vegetation and engineering revetments; and • Revegetate with suitable native species	• Dry Creek reinstatement planned to commence from 2030 (Year 15) under MOD4.
Surface infrastructure	• To be decommissioned and removed, unless DPIE-RR agrees otherwise	• No decommissioning undertaken outside of active mining areas in 2019.
Community	• Ensure public safety; and • Minimise the adverse socio-economic effects associated with mine closure	• Areas restricted to BMC personnel and contractors; and • Socio-economic impacts to be reviewed at least five years from closure of Bengalla.

Table 24
Bengalla Rehabilitation Status Summary

Mine Area Type	Previous Reporting Period 2018 (ha)	This Reporting Period 2019 (ha)	Next Reporting Period 2020 [7] (ha)
A. Total mine footprint[1]	1,168	1,202	1,320
B. Total Active Disturbance[2]	935	955	1035
C. Land being prepared for rehabilitation[3]	0	0	0
D. Land Under Active Rehabilitation[4]	233	247	285
E. Completed Rehabilitation[5]	0	0[6]	0

Notes:

1. Total mine footprint includes all areas within a mining lease that either have at some point in time or continue to pose a rehabilitation liability due to mining and associated activities. As such it is the sum of total active disturbance, decommissioning, landform establishment, growth medium development, ecosystem establishment, ecosystem development and relinquished lands (as defined in DRE MOP/RMP Guidelines).

2. Includes all areas ultimately requiring rehabilitation including exploration areas, stripped areas ahead of mining, infrastructure and water management areas, topsoil stockpiles, active mining areas, overburden emplacements, tailings dams, etc.

3. Disturbed land that is under decommissioning, landform establishment and growth medium development.

4. Areas under rehabilitation that are being managed to achieve relinquishment.

5. Areas of rehabilitation that have been formally signed off by DPIE-RR as having successfully met agreed land use objectives and rehabilitation completion criteria.

6. 12.8 Ha of the 2019 rehabilitation area was reshaped for micro-relief installation.

*7. BMC are responding to the DPIE-RR rehabilitation notices described in **Section 1** of this review. Data presented for "Next Reporting Period 2020" is consistent with Bengalla Mine Mining Operations Plan 2017 – 2021 Amendment A. A new MOP application will likely be made during 2020 to reflect the BMC responses to the DPIE-RR Notices and other relevant operational requirements.*

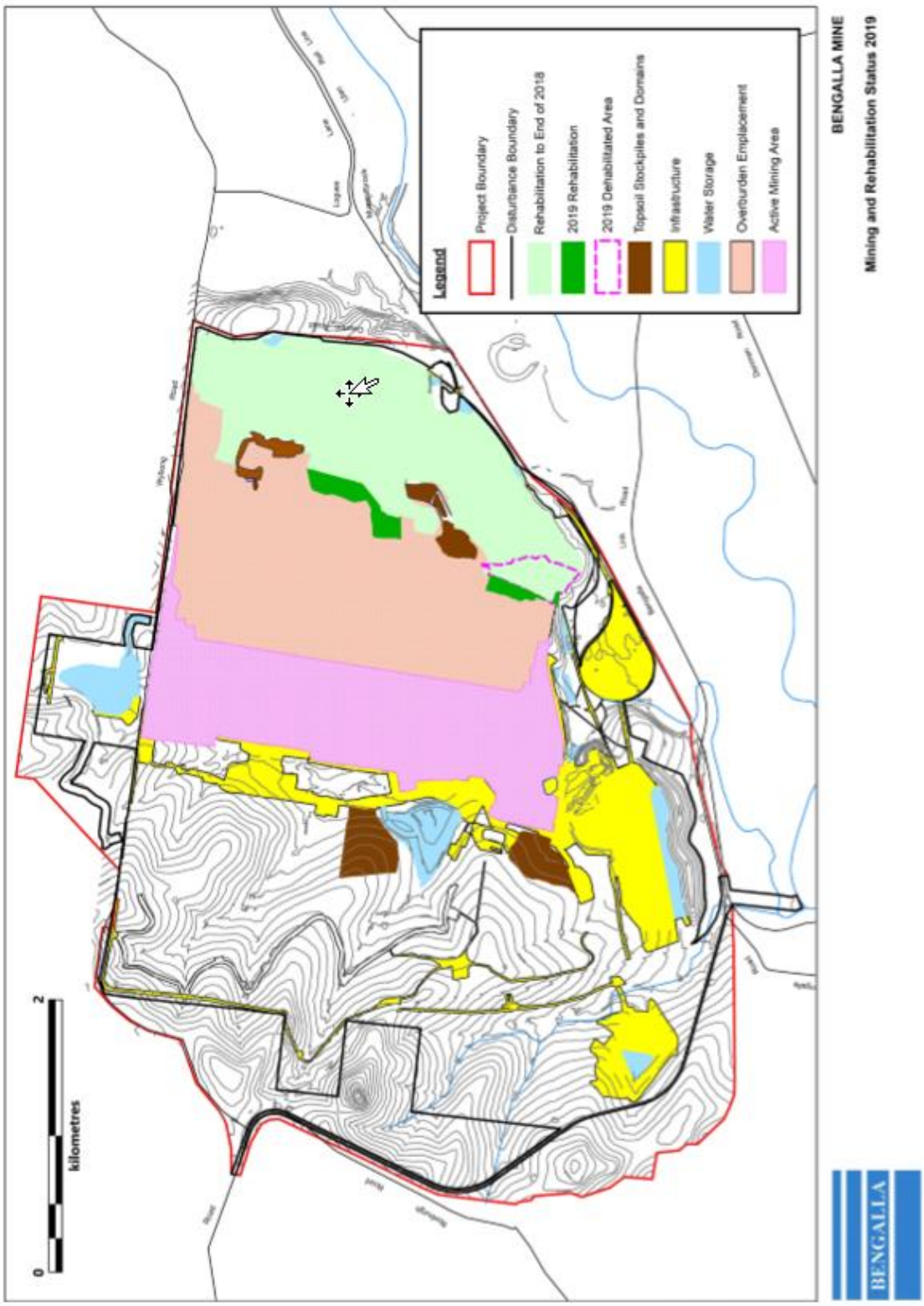


Figure 14 Mining and Rehabilitation Status 2019

8.3 REHABILITATION MONITORING PROGRAM

Rehabilitation monitoring at Bengalla is undertaken annually through the implementation of the following:

- A transect-based monitoring program (the monitoring program); and
- A rehabilitation audit (the audit), consisting of a walk-through assessment of all rehabilitated lands.

During the Reporting Period, rehabilitation monitoring was undertaken in November 2019. The 2019 monitoring program assessed 14 rehabilitation sites, which comprised:

- Fourteen existing sites established during earlier monitoring events – comprising one site within the Class III pasture (P3) and thirteen sites within woodland rehabilitation.

A description of the monitoring sites is included as **Table 245** with the locations of each transect shown on Figure 1 of **Appendix H**.

Table 24
Bengalla Rehabilitation Monitoring Program Transects (2019)

Transect Name	Description	Slope	Rehabilitation Established	Transect Established
RHB NW1	High density woodland on Class IV or V land	18%	2005	2009
RHB NW2	High density woodland on Class IV or V land	23%	2004	2009
RHB NW3	High density woodland on Class IV or V land	11%	2008	2012
RHB NW4	High density woodland on Class IV or V land	15%	2007	2017
RHB NW5	High density woodland on Class IV or V land	19%	2013	2017
RHB NW6	High density woodland on Class IV or V land	20%	2014	2017
RHB NW7	High density woodland on Class IV or V land	15%	2015	2017
RHB NW8	High density woodland on Class IV or V land	23%	2016	2018
RHB NW9	High density woodland on Class IV or V land	21%	2016	2018
RHB NW10	High density woodland on Class IV or V land	19%	2006	2018
RHB NW11	High density woodland on Class IV or V land	14%	2004	2018
RHB NW12	High density woodland on Class IV or V land	20%	2016	2017
RHB NW13	High density woodland on Class IV or V land	18%	2016	2017
RHB P3	Pasture on Class III land	2%	2012	2014

Source: Koru Environmental Pty Limited, 2019

8.3.1 Rehabilitation Monitoring Results

The 2019 monitoring program found that the rehabilitation sites are generally developing in accordance with the relevant MOP criteria. However, it was also noted that continued active management of rehabilitation will likely be required to successfully achieve rehabilitation objectives.

An Independent Rehabilitation Monitoring assessment was undertaken November 2019. It was noted in the report that the ongoing severe state of drought (ongoing for the past 3 years) has affected the condition of rehabilitation and negatively impacted on the 2019 monitoring

results. In addition, the Upper Hunter region has also experienced unusually hot seasonal weather with temperatures exceeding long term averages thus also impacting on moisture evaporation rates.

The rehabilitation monitoring assessment concluded that potential impacts or effects of the ongoing drought included that:

- Conditions were poorly conducive to seed germination and seedling establishment / survival, which may have particularly affected the performance condition in younger rehabilitation areas.
- Detrimental impacts on ground cover plant growth and vigour, reducing vegetative cover.
- Detrimental impacts on species composition, diversity, vegetation structure and foliage cover.
- Compounded issues and grazing impacts on ground cover vegetation from herbivore species.
- Reduced erosive forces and sediment movement associated with poorer rainfall and reduced occurrences of significant rainfall events.

Ongoing drought has impacted on soil salinity levels as there is less water available to leach salts. Soils salinity was reported as unlikely to impact on existing vegetations, however may reduce growth rates and inhibit germination of new growth. Conversely, some areas of rehabilitation exhibited slight alkalinity, potentially inhibiting the germination of native species.

Weeds have impacted on the rehabilitation performance, primarily galenia and African boxthorn. Those weeds were targeted in the annual Weed Action Plan through spraying and removal. This management practice is ongoing.

Vertebrate pests, predominantly kangaroos have also impacted on new rehabilitation establishment.

Rehabilitation activities for 2020 will be generally in accordance with the Mining Operations Plan.

Rehabilitation monitoring findings are detailed in **Appendix H**.

8.4 ACTIONS FOR THE NEXT REPORTING PERIOD

Where relevant the MOP will be revised in 2020 to incorporate appropriate learnings from responses to the DPIE-RR Notices (see **Section 1**) and operational requirements. BMC will lodge the revised MOP with the relevant agencies for comment.

9 COMMUNITY RELATIONS

This section includes a summary of the environmental complaints received at Bengalla and community engagement and support activities undertaken during the reporting.

9.1 COMMUNITY ENGAGEMENT

Bengalla undertook a range of community engagement activities in 2019, including:

- Bengalla Community Consultative Committee (CCC) meetings. The meetings were held in February, May, August and December 2019. Minutes of each of these meetings are available at the Muswellbrook Library, Denman Library and on the Bengalla website. The CCC provides a forum for constructive dialogue and discussion enhancing the relationship between the community and Bengalla The CCC representatives act as a point of contact to provide feedback between Bengalla and the community;
- Near neighbour consultation regarding impacts, sale of land and other interactions;
- Upper Hunter Mining Dialogue events including school mine tours and Upper Hunter Mining Dialogue Forum.
- Bengalla Community Open Day which provides the opportunity for the community to enjoy a free family fun day and guided bus tours of the Bengalla mine.

9.2 COMMUNITY CONTRIBUTION

BMC contributes to programs identified by, and preferably in partnership with the local community. The Bengalla Community Support Team (CST) meets regularly to assess requests from the local community for donations, sponsorship and in-kind contributions. Several projects and events have been developed through sponsorship funding and assistance from the Bengalla CST who provide their time and expertise to support these initiatives.

During 2019, BMC contributed to the education and career development of students from Muswellbrook, Aberdeen and Scone high schools with the provision of undergraduate scholarships. BMC awarded 8 scholarships to local students pursuing an undergraduate degree in 2020, and a full scholarship for a student pursuing a career in engineering which includes vacation work at Bengalla. BMC will continue to support local students with scholarship programs again being made available in 2020.

The work experience program with Muswellbrook High School students continued in 2019, offering 20 placements to local students and the opportunity to experience the various careers in the mining industry.

In December BMC also donated 350 bales of hay to farmers throughout the Muswellbrook Shire and Upper Hunter Shire, including near neighbours. This was made available by the hay which was grown on BMC pastoral land by New Acland Pastoral and came at a time of great need to local farming families.

The Community Development Fund (CDF) provides support to the local community to build community capacity, address development challenges and to take advantage of emerging opportunities. Some of the organisations and projects funded from the CDF in 2019 included:

- Muswellbrook Rotary Model United Nations Assembly
- Aberdeen Highland Games;
- The Polly Farmer Foundation- Muswellbrook Follow the Dream Program
- Merton Court Refurbishment in Denman;
- Muswellbrook Public School Learn to Swim Program.

BMC will continue to focus on ensuring the long-term sustainability of the community, and target issues, needs and opportunities which are a priority to the local community through the CDF.

In 2019 Bengalla sponsored and partnered with community groups including:

- Muswellbrook Shire Council Open Art prize, Blue Heeler Film Festival and the Upper Hunter Show;
- Muswellbrook Race Club Race Day;
- Muswellbrook PCYC Fitness Resource;
- Upper Hunter Education Fund;
- Northern NSW Helicopter Rescue Service Charity Shield Day;
- Group 21 Rugby League Competition Naming Rights; and
- Muswellbrook Amateur Theatrical Society

BMC retained an active partnership program with the following Muswellbrook organisations in 2019:

- Muswellbrook Netball Association 2018 Season Naming Rights Sponsor;
- Muswellbrook Touch Football Association
- Upper Hunter Eisteddfod Naming Rights Sponsorship;
- Aberdeen Junior Rugby League
- Muswellbrook PCYC Charity Golf Day;
- Upper Hunter Show Cattle & Beef Camp; and
- Sponsorship of School Presentation Days in Muswellbrook, Aberdeen, Scone, Denman and Sandy Hollow.

BMC also allocates funds towards events, organizations, clubs and charities in the local community

- Community Development Fund: $200,000

- Scholarships: $74,000
- Community Support Team and Sponsorships: $277,000
- Voluntary Planning Agreement: $653,378

9.3 ENVIRONMENTAL COMPLAINTS

BMC maintains a register of complaints and a complaints hotline (1800 178 984) which operates 24 hours, 7 days per week. BMC received 67 complaints during the 2019 Reporting Period, a decrease compared to the 77 complaints received in 2018. During the Reporting Period, the most common environmental issues raised by Bengalla complainants were related to air quality and blasting. A summary of complaints received during the Reporting Period by issue is provided in **Figure 15**.

During 2019 several actions were undertaken following a complaint received. These actions included reviewing operations relocating lighting plants, supplementary noise monitoring, road maintenance on roads near Bengalla where required.

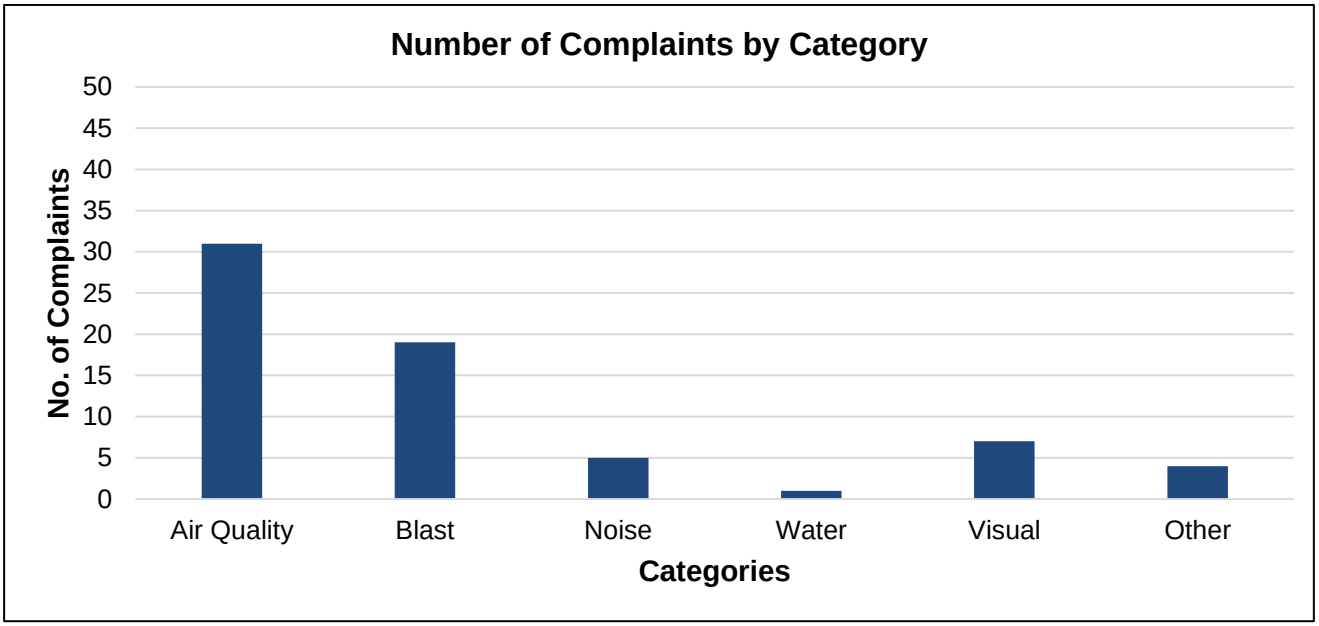


Figure 15
Environmental Complaints Received 2019

10 INDEPENDENT ENVIRONMENTAL AUDIT

This section discusses the SSD-5170 requirement for an Independent Environmental Audit of Bengalla operations.

In accordance with Schedule 5, Condition 9 of SSD-5170, BMC are required to commission an Independent Environmental Audit (IEA) of Bengalla within 1 year of the commencement of SSD-5170 (i.e. 2016) and every 3 years thereafter.

The IEA commenced on 2 December 2019, in accordance with the MOD4.

11 ENVIRONMENTAL INCIDENTS

This section describes the environmental incidents that occurred at Bengalla during the Reporting Period.

During the Reporting Period, all environmental incidents continued to be recorded at Bengalla. The incidents are categorised as either:

- Reportable incidents (being an actual or potential non-compliance with Bengalla regulatory approvals and licences); or
- Non-reportable incidents (being a non-conformance with BMC standards and procedures).

11.1 REPORTABLE ENVIRONMENTAL INCIDENTS

Within the Reporting Period, no reportable environmental incidents were recorded at Bengalla.

11.2 NON-REPORTABLE ENVIRONMENTAL INCIDENTS

One non-reportable environmental incident was recorded at Bengalla during the Reporting Period:

- Hydrocarbon spill incident on 23 January 2019. A stainless-steel pipe in the day tank pump room split resulting in fuel leaking out of the bunded area. The spill occurred within a closed catchment. All relevant valves were closed to stop the spill. The pipe was repaired, and the area returned to operational.

12 ACTIVITIES PROPOSED IN THE NEXT REPORTING PERIOD

This section summarises the operational and environmental management activities proposed to be undertaken during 2020.

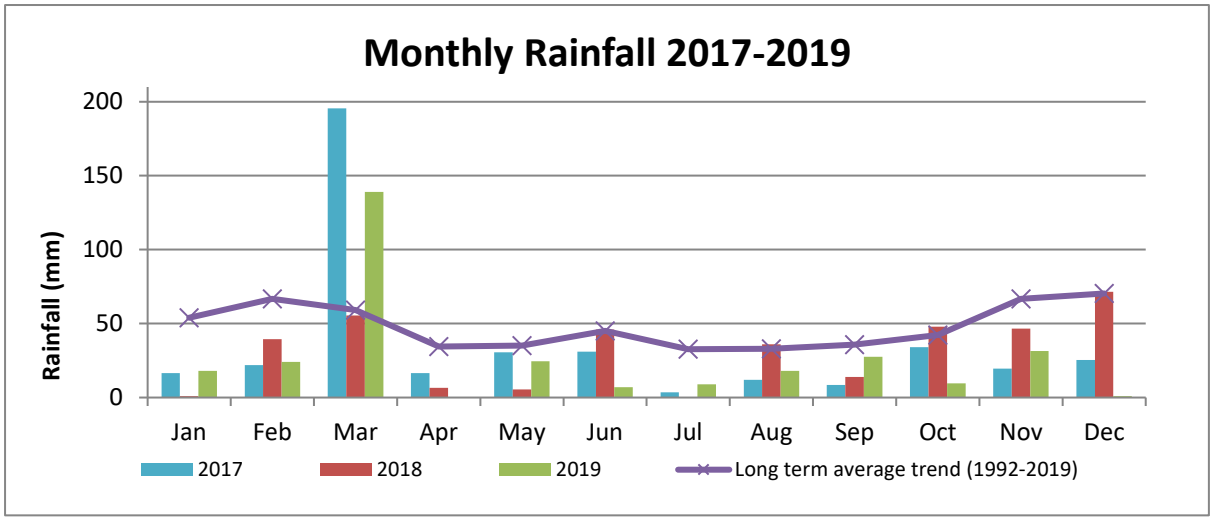
A summary of key environmental management activities proposed for 2019 is presented in **Table 256**. Progress against these activities will be reported in the 2020 Annual Review.

Table 25
Environmental Management Activities Proposed for 2020

Area / Issue	Actions Proposed
Air quality	Implementation of updated Air Quality monitoring network (subject to approval of submitted Air Quality Management Plan)
Water	Decommission Stage Discharge Dam
Regulatory	Responses to Notices
Audit	2019 IEA response
Management Plans	Undertake reviews of management plans in response to IEA and scheduled review periods as required
Tree Screening	Progress Denman Road tree screening
Offsets	Progress long-term security of biodiversity offset areas

APPENDIX A

Meteorological Monitoring Summary



Graph A1
Bengalla Monthly Rainfall 2017 to 2019

Table A1
Monthly Temperatures 2019

Month	Minimum Daily Temperature (°C)	Maximum Daily Temperature (°C)
January	18.3	43.0
February	11.8	39.7
March	11.0	35.6
April	3.7	31.7
May	0.1	25.0
June	-4.8	23.8
July	-3.9	22.8
August	-4.3	25.7
September	0.5	31.8
October	3.0	37.3
November	7.2	39.0
December	9.6	44.0

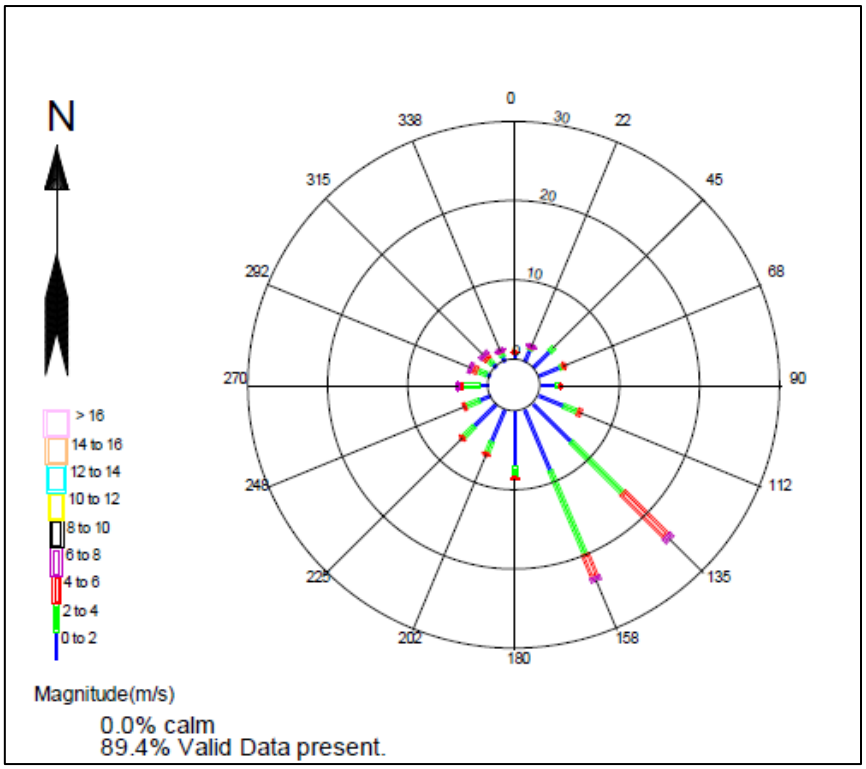


Figure A1
Bengalla January 2019 Windrose

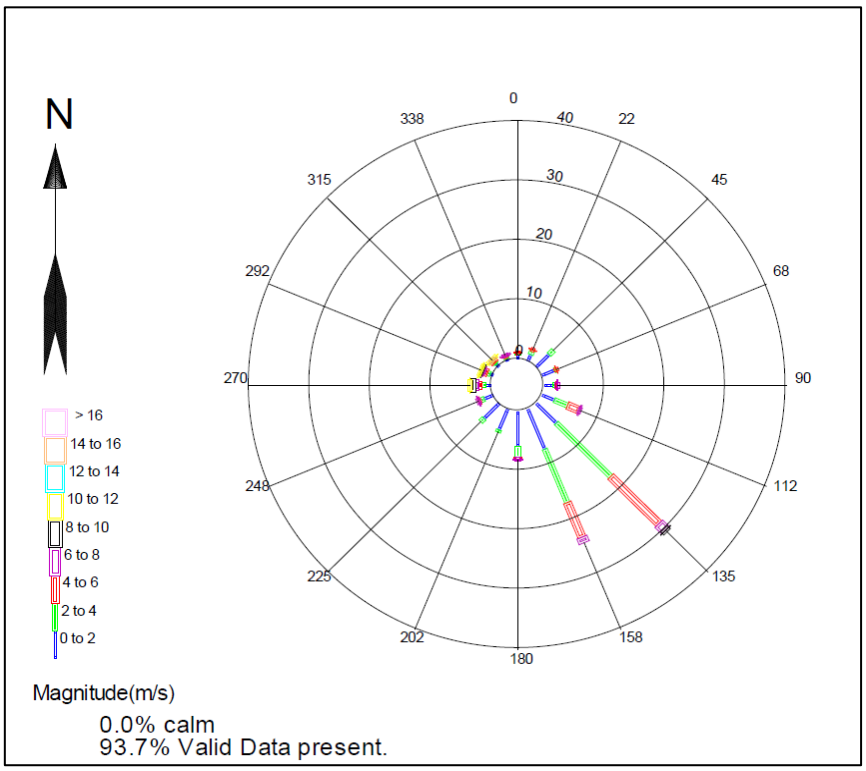


Figure A2
Bengalla February 2019 Windrose

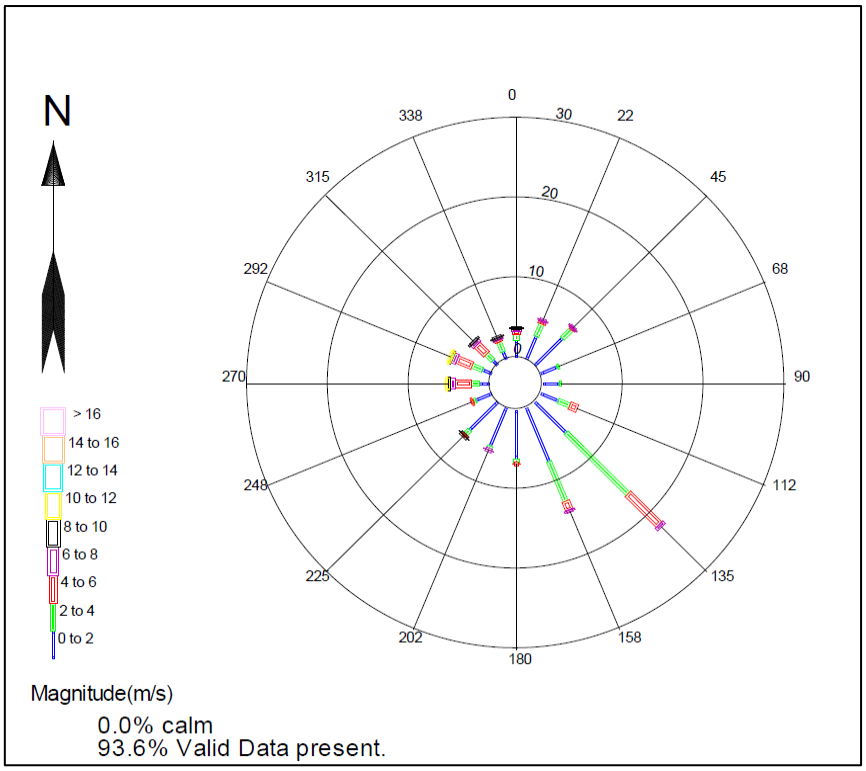


Figure A3
Bengalla March 2019 Windrose

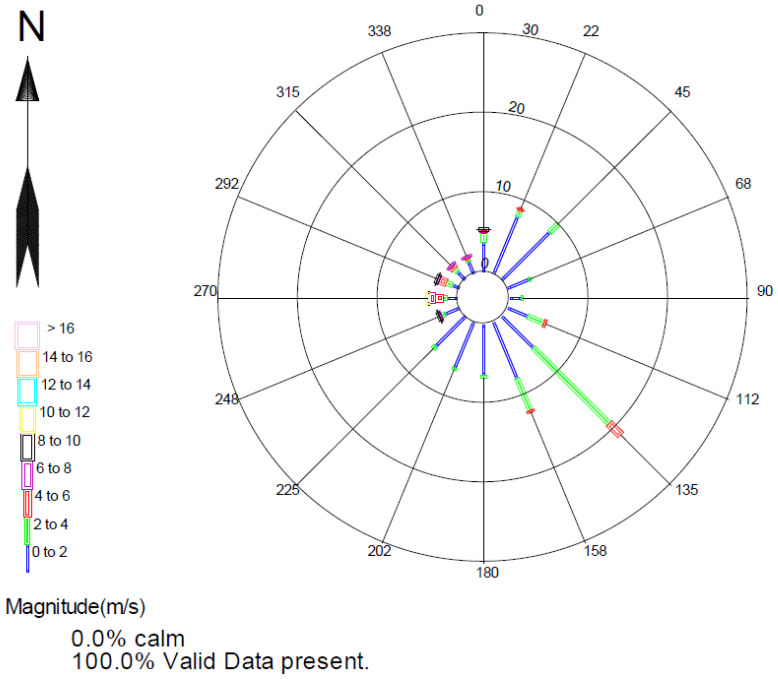


Figure A4
Bengalla April 2019 Windrose

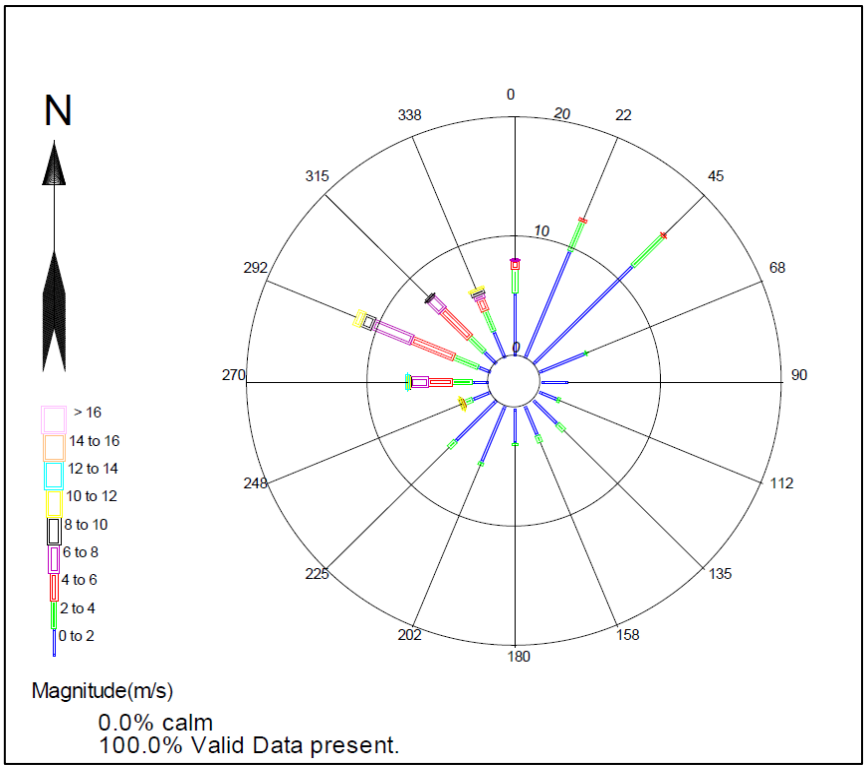


Figure A5
Bengalla May 2019 Windrose

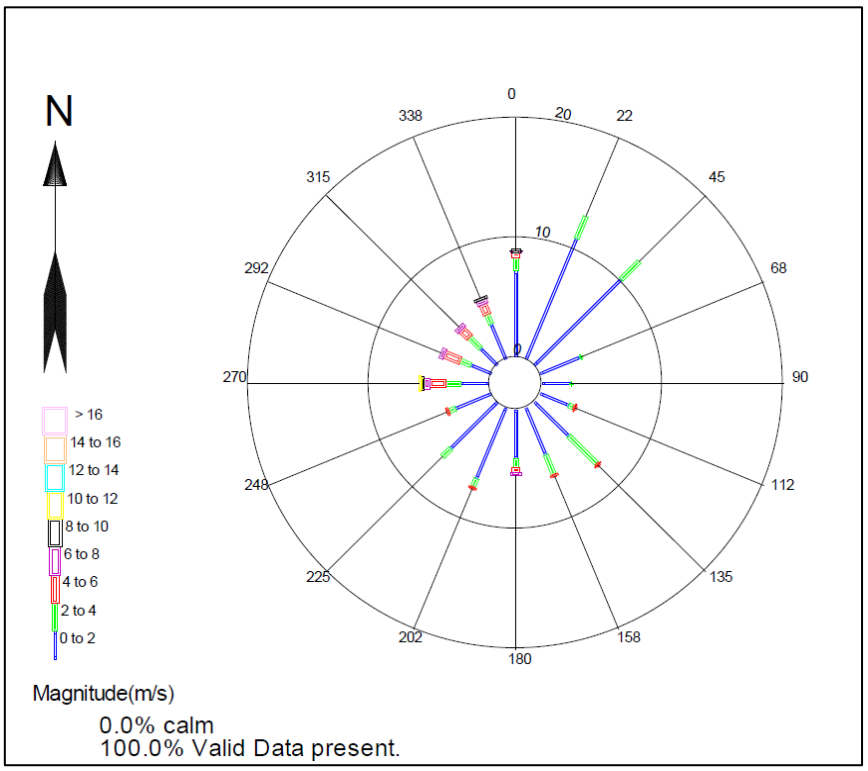


Figure A6
Bengalla June 2019 Windrose

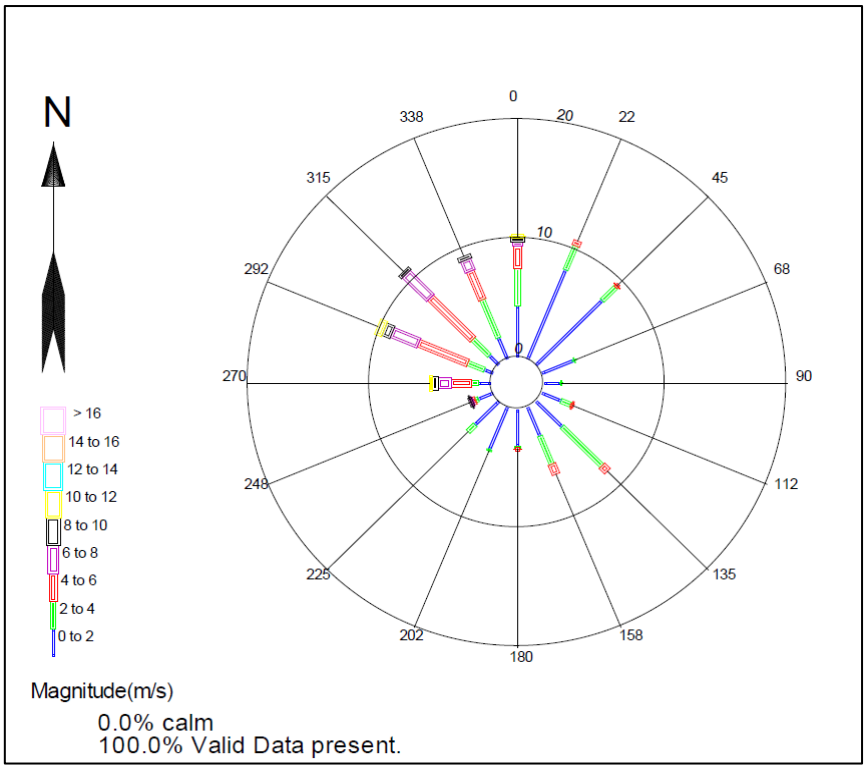


Figure A7
Bengalla July 2019 Windrose

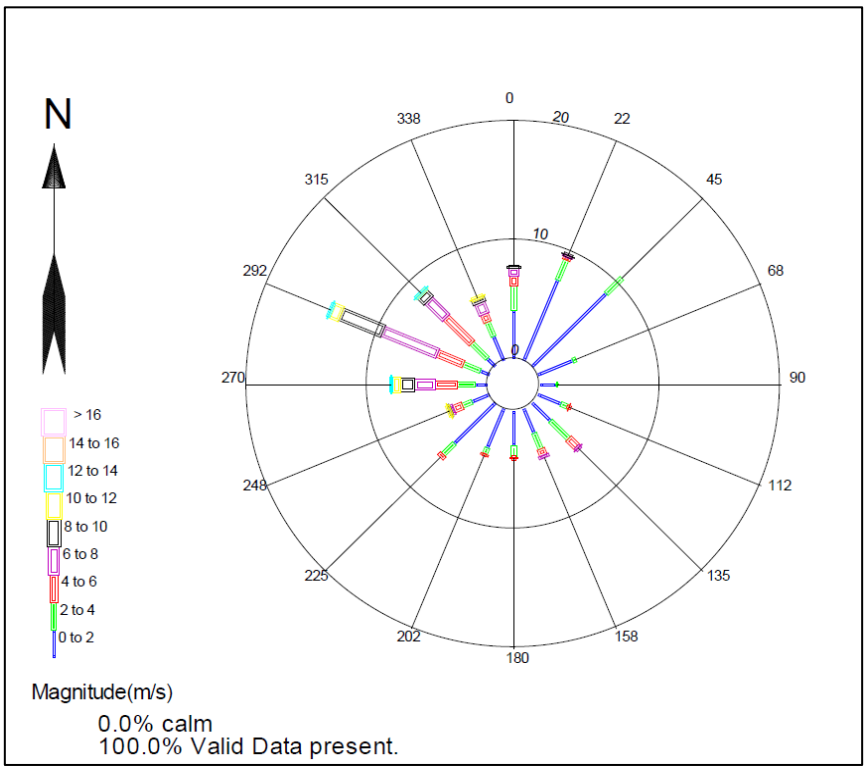


Figure A8
Bengalla August 2019 Windrose

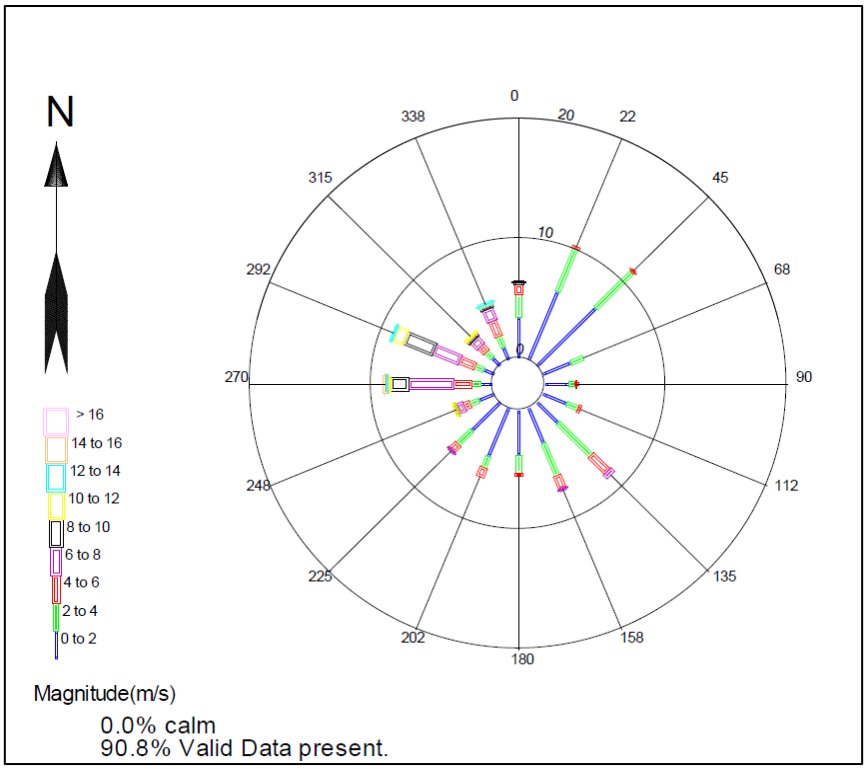


Figure A9
Bengalla September 2019 Windrose

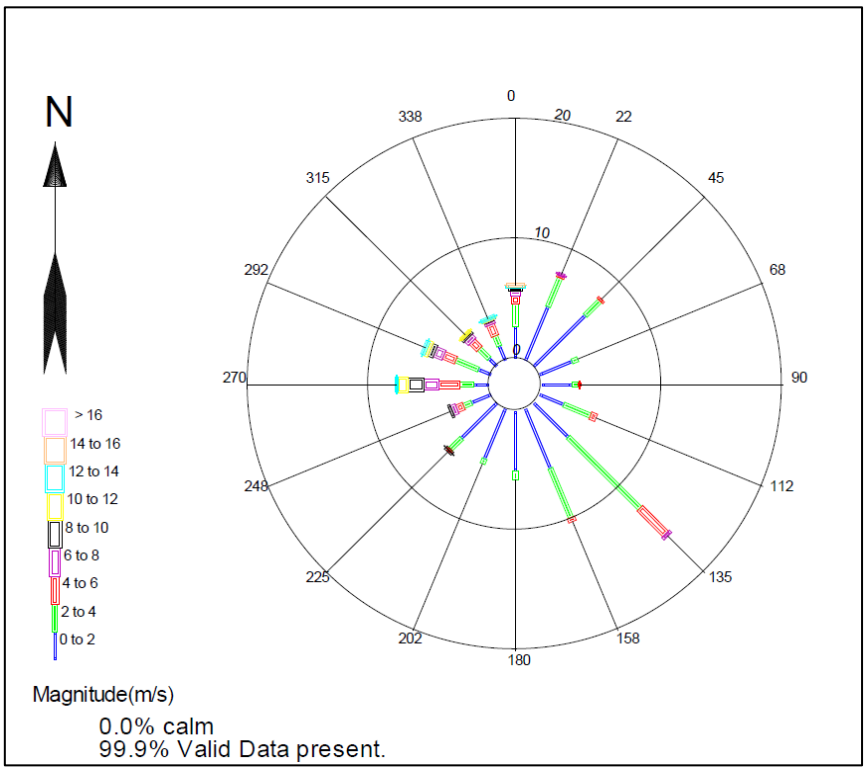


Figure A10
Bengalla October 2019 Windrose

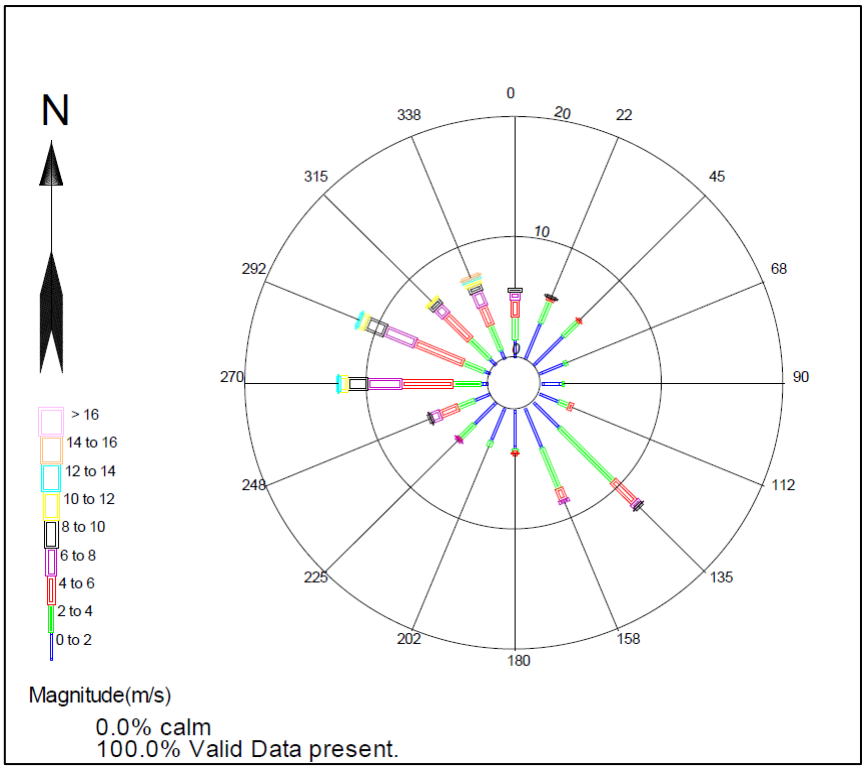


Figure A11
Bengalla November 2019 Windrose

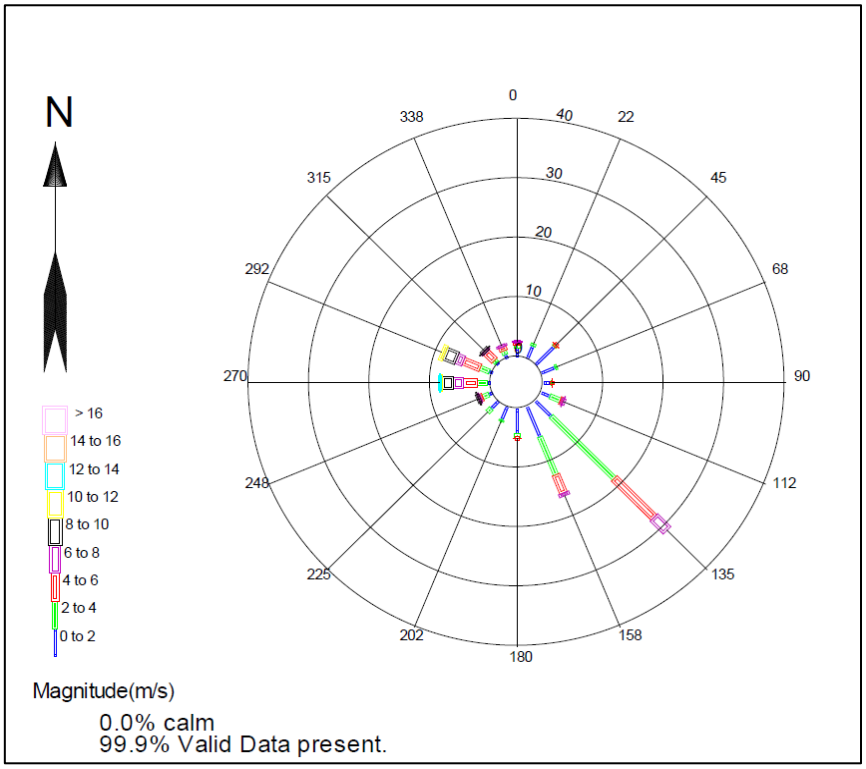


Figure A12
Bengalla December 2019 Windrose

Notes:
Sourced from Benchmark Monitoring Bengalla Mine Monthly Meteorology Reports – January to December 2019.

APPENDIX B

Noise Monitoring Summary

Table B1
Summary of Compliance Attended Noise Monitoring Results 2019

Site	Month	BMC only LA_{eq} dB [1,4]	BMC only LC_{eq} dB [2,4]	Met Conditions within Range? [3]	BMC Impact Assessment LA_{eq} criterion [1]	Exceedance dB [1]	BMC only $LA_{1,1\ min}$ dB [3,4]	Met Conditions within Range? [3]	BMC $LA_{1,1\ min}$ criterion [5]	Exceedance dB [6]
AN01	Jan-19	25	45	Yes	35	No	29	Yes	45	No
	Feb-19	27	46	Yes	35	No	30	Yes	45	No
	Mar-19	27	50	Yes	35	No	32	Yes	45	No
	Apr-19	27	49	Yes	35	No	31	Yes	45	No
	May-19	30	51	No	35	No	33	No	45	No
	Jun-19	26	49	No	35	No	30	No	45	No
	Jul-19	31	51	No	35	No	36	No	45	No
	Aug-19	21	43	No	35	No	24	No	45	No
	Sep-19	30	50	Yes	35	No	34	Yes	45	No
	Oct-19	24	48	Yes	35	No	28	Yes	45	No
	Nov-19	29	48	Yes	35	No	37	Yes	45	No
	Dec-19	28	48	Yes	35	No	38	Yes	45	No

Site	Month	BMC only LA_{eq} dB [1,4]	BMC only LC_{eq} dB [2,4]	Met Conditions within Range?[3]	BMC Impact Assessment LA_{eq} criterion [1]	Exceedance dB[1]	BMC only $LA_{1,1\ min}$ dB [3,4]	Met Conditions within Range?[3]	BMC $LA_{1,1\ min}$ criterion [5]	Exceedance dB[6]
AN03	Jan-19	31	54	No	40	No	34	No	45	No
	Feb-19	NA	NA	No	40	No	NA	No	45	No
	Mar-19	25	NM	Yes	40	No	< 30	Yes	45	No
	Apr-19	20	NM	Yes	40	No	< 25	Yes	45	No
	May-19	28	NM	No	40	No	< 30	No	45	No
	Jun-19	28	50	No	40	No	30	No	45	No
	Jul-19	29	< 50	No	40	No	30	No	45	No
	Aug-19	NA	NA	No	40	No	NA	No	45	No
	Sep-19	NA	NA	Yes	40	No	NA	0	45	No
	Oct-19	NA	NA	No	40	No	NA	No	45	No
	Nov-19	< 25	< 52	Yes	40	No	NA	Yes	45	No
	Dec-19	30	52	Yes	40	No	< 35	Yes	45	No

Site	Month	BMC only LA_{eq} dB [1,4]	BMC only LC_{eq} dB [2,4]	Met Conditions within Range?[3]	BMC Impact Assessment LA_{eq} criterion [1]	Exceedance dB[1]	BMC only $LA_{1,1\ min}$ dB [3,4]	Met Conditions within Range?[3]	BMC $LA_{1,1\ min}$ criterion [5]	Exceedance dB[6]
AN04	Jan-19	< 25	< 50	Yes	35	No	29	Yes	45	No
	Feb-19	NA	NA	Yes	35	No	NA	Yes	45	No
	Mar-19	NA	NA	Yes	35	No	NA	Yes	45	No
	Apr-19	NA	NA	Yes	35	No	NA	Yes	45	No
	May-19	< 35	< 55	No	35	No	41	No	45	No
	Jun-19	30	48	No	35	No	32	No	45	No
	Jul-19	32	< 50	No	35	No	35	No	45	No
	Aug-19	25	NM	No	35	No	< 30	No	45	No
	Sep-19	25	NM	Yes	35	No	< 30	Yes	45	No
	Oct-19	28	NM	No	35	No	30	No	45	No
	Nov-19	NA	NA	Yes	35	No	NA	Yes	45	No
	Dec-19	NA	NM	Yes	35	No	NA	Yes	45	No

Source: Bridges Acoustics (2019)

***Notes** (modified from Bridges Acoustics, 2019)*

1. LAeq,15minute operational noise levels for BMC in the absence of all other noise sources;

2. LCeq,15minute operational noise levels for BMC in the absence of all other noise sources. NA in this column is 'not applicable' and may occur when BMC is inaudible (IA), not measurable (NM) or other low frequency noise sources were more significant during the measurement;

3. 'Yes' denotes meteorological conditions result in relevant criteria being applicable. 'No' denotes meteorological conditions are outside those specified in NSW Industrial Noise Policy;

4. From SSD-5170 (as modified) and EPL 6538. Monitoring locations AN02 and AN03 are closer to mining operations than the nearest private receiver. A correction factor has been applied based on noise modelling for the continuation of Bengalla Mine EIS (Hanson Bailey, 2013) as outlined in the approved NMP;

5. Refers to BMC Impact Assessment LA1,1minute criterion;

6.LA1,1minute operational noise levels for BMC in the absence of all other noise source;

APPENDIX C

Blast Monitoring Summary

Table C1
Summary of Blast Monitoring Results 2019

Blast Details				Ground Vibration Result (mm/s)			Overpressure Result (dBL)		
Event No.	**Date**	**Time of Blast**	**Blast Code**	**Blake**	**Moore**	**School**	**Blake**	**Moore**	**School**
1	02/01/19	2:59:06 PM	S33-14-IB-PF2	0.08	0.64	0.11	88.00	97.20	93.30
2	02/01/19	3:00:35 PM	S35-08-IB-WW3	0.15	1.03	0.11	91.50	104.70	87.00
3	05/01/19	3:21:04 PM	S31-06-CI-BYWN	0.16	0.79	0.05	105.40	98.10	94.90
4	07/01/19	11:19:05 AM	S35-28-IB-PF1	0.02	0.12	0.02	95.40	100.70	89.40
5	09/01/19	11:02:17 AM	S32-19-IB-VA	0.11	0.58	0.07	98.70	102.40	90.90
6	11/01/19	11:26:52 AM	S32-17-IB-VA	0.08	0.44	0.03	95.80	100.20	94.80
7	14/01/19	11:12:05 AM	S31-05-CI-BYWN	0.22	0.72	0.06	92.60	106.20	90.50
8	18/01/19	10:54:06 AM	S32-09-IB-VA	0.18	2.29	0.08	82.70	98.10	84.50
9	18/01/19	10:54:56 AM	S33-10-IB-PF2	0.21	1.54	0.06	93.80	100.80	94.80
10	19/01/19	10:52:41 AM	S35-29-IB-PF1	0.04	0.31	0.03	89.10	93.80	94.10
11	22/01/19	11:25:49 AM	S31-03-CI-BYWN	0.17	0.78	0.08	95.40	97.70	94.60
12	23/01/19	10:55:47 AM	S33-08-IB-PF2	0.14	0.75	0.04	94.80	97.30	95.40
13	25/01/19	3:35:29 PM	S33-02-IB-PF2	0.12	1.22	0.06	99.20	96.20	92.10
14	29/01/19	11:55:02 AM	S35-20-IB-WW4	0.12	1.02	0.08	90.10	105.50	90.90
15	31/01/19	12:22:32 PM	S33-05-IB-PF2	0.17	1.40	0.07	95.90	97.30	101.10
16	04/02/19	11:28:30 AM	S35-19-IB-WW4	0.15	1.27	0.08	89.2	100.5	89.5
17	07/02/19	3:16:22 PM	S33-26-IB-VA	0.27	1.11	0.15	86.30	96.50	89.90
18	07/02/19	3:17:29 PM	S35-31-IB-WW4	0.09	0.34	0.07	91.60	107.10	92.40
19	08/02/19	3:49:08 PM	S31-22-IB-WN	0.04	0.19	0.03	89.70	98.60	85.10
20	11/02/19	3:22:26 PM	S33-24-IB-VA	0.14	0.89	0.14	93.30	97.80	101.00

Blast Details				Ground Vibration Result (mm/s)			Overpressure Result (dBL)		
Event No.	**Date**	**Time of Blast**	**Blast Code**	**Blake**	**Moore**	**School**	**Blake**	**Moore**	**School**
21	14/02/19	11:48:26 AM	S33-21-IB-VA	0.24	1.07	0.12	104.00	107.10	98.50
22	14/02/19	11:49:30 AM	S32-19-IB-BR1 & S32-17-PS-BRWN	0.28	1.09	0.13	105.90	112.70	104.50
23	18/02/19	11:29:56 AM	S23-15-IB-BR1	0.14	0.64	0.05	89.20	92.20	93.50
24	18/02/19	11:36:02 AM	S33-18-IB-VA	0.58	2.49	0.18	84.30	93.80	91.80
25	19/02/19	2:46:22 PM	S35-17-IB-WW4	0.15	2.16	0.13	90.00	98.30	93.60
26	21/02/19	12:50:37 PM	S35-15-IB-WW4	0.25	3.13	0.13	111.00	111.70	99.10
27	26/02/19	11:00:55 AM	S32-13-IB-BR1	0.19	0.96	0.06	88.70	91.10	86.00
28	26/02/19	11:01:40 AM	S33-15-IB-VA	0.43	2.05	0.16	86.80	97.20	90.30
29	28/02/19	3:23:47 PM	S31-05-IB-WN	0.06	0.11	0.02	93.30	95.20	87.10
30	28/02/19	3:24:40 PM	S32-11-IB-BR1	0.24	1.38	0.14	94.30	100.70	94.40
31	05/03/19	3:36:36 PM	S32-22-IB-BR1 & S32-22-PS-BRWN	0.20	0.67	0.21	94.80	102.80	98.00
32	05/03/19	3:39:43 PM	S35-24-IB-PF2	0.19	1.27	0.17	92.50	97.00	93.20
33	09/03/19	10:59:44 AM	S32-11-IB-BR1	0.16	1.21	0.08	107.90	101.00	89.60
34	11/03/19	2:24:39 PM	S31-03-IB-WN	0.05	0.12	0.02	95.10	95.80	92.00
35	11/03/19	2:26:54 PM	S35-13-IB-WW4	0.46	4.53	0.15	93.10	102.10	95.20
36	14/03/19	15:29:28	S31-03-IB-WN Blast 2	0.06	0.15	0.02	99.90	102.70	96.90
37	15/03/19	10:57:16 AM	S32-06-IB-BR1	0.17	1.19	0.08	101.20	101.90	91.10
38	16/03/19	12:02:46 PM	S32-18-IB-BR2A & S32-18-IB-BRWN	0.14	0.38	0.08	104.50	98.30	85.60
39	21/03/19	10:57:35 AM	S35-30-IB-WW4 & S35-31-PS-WW4	0.10	0.53	0.07	87.20	100.20	86.20
40	22/03/19	2:25:57 PM	S35-11-IB-WW4	0.39	2.81	0.12	90.00	106.80	93.90
41	23/03/19	4:37:51 PM	S32-02-IB-BR2_NTH	0.24	1.49	0.08	89.70	94.90	92.30

Blast Details				Ground Vibration Result (mm/s)			Overpressure Result (dBL)		
Event No.	**Date**	**Time of Blast**	**Blast Code**	**Blake**	**Moore**	**School**	**Blake**	**Moore**	**School**
42	25/03/19	10:56:03 AM	S31-03-IB-ED	0.01	0.04	0.01	87.40	82.10	83.60
43	25/03/19	10:56:25 AM	S32-02-IB-BR2_Sth	0.09	0.43	0.05	90.60	92.00	90.80
44	29/03/19	11:01:08 AM	S33-13-IB-VA2	0.27	1.67	0.09	87.20	94.30	87.60
45	02/04/19	11:20:20 AM	S32-25-CI-BYWN	0.13	0.74	0.10	92.20	96.20	88.10
46	04/04/19	11:50:59 AM	S33-11-IB-VA2	0.24	1.87	0.08	90.20	98.40	87.30
47	08/04/19	10:55:06 AM	S32-22-CI-BYWN	0.15	0.37	0.06	88.40	93.10	89.40
48	08/04/19	10:55:58 AM	S33-22-IB-VA2	0.13	0.86	0.10	92.70	92.10	93.10
49	09/04/19	2:56:49 PM	S32-12-PS-BYWN	0.40	1.89	0.13	108.50	107.50	105.60
50	11/04/19	10:42:08 AM	S35-05-IB-WW3	0.44	2.10	0.09	94.80	113.80	94.80
51	13/04/19	2:59:37 PM	S34-19-CI-MAPF	0.08	0.33	0.02	95.20	94.40	85.80
52	13/04/19	2:59:37 PM	S32-12-IB-BY	0.08	0.33	0.02	95.20	94.40	85.80
53	17/04/19	10:59:07 AM	S33-25-IB-VA2	0.16	0.53	0.14	100.20	96.80	88.10
54	18/04/19	3:29:44 AM	S32-13-IB-BY	0.19	1.44	0.12	84.20	95.90	88.90
55	23/04/19	11:37:54 AM	S33-18-IB-BY	0.26	1.28	0.06	92.90	106.10	90.10
56	23/04/19	11:35:37 AM	S34-03-IB-WW3	0.16	0.65	0.08	84.90	98.30	88.00
57	23/04/19	11:37:03 AM	S33-02-PS-VA	0.23	0.41	0.06	86.80	95.10	94.70
58	26/04/19	2:59:10 PM	S33-02-IB-VA	0.39	2.31	0.12	106.50	102.70	107.00
59	29/04/19	1:09:44 PM	S35-29-CI-MAPF	0.08	0.39	0.06	103.10	99.60	91.10
60	29/04/19	1:12:52 PM	S37-23-IB-WW4	0.05	0.49	0.06	109.50	103.10	90.40
61	30/04/19	1:02:06 PM	S33-03-IB-VA	0.66	4.35	0.22	97.80	99.00	96.10
62	02/05/19	3:22:09 PM	S33-05-IB-VA	0.32	3.11	0.13	92.30	99.80	90.40
63	07/05/19	2:00:45 PM	S33-07-IB-VA	0.30	2.94	0.11	101.40	103.00	94.30
64	08/05/19	11:21:05 AM	S32-07-PS-BRWN	0.37	1.71	0.19	103.10	105.80	104.90

Blast Details				Ground Vibration Result (mm/s)			Overpressure Result (dBL)		
Event No.	**Date**	**Time of Blast**	**Blast Code**	**Blake**	**Moore**	**School**	**Blake**	**Moore**	**School**
65	10/05/19	10:59:31 AM	S35-28-IB-VA	0.12	0.45	0.07	97.30	100.50	107.60
66	13/05/19	11:47:34 AM	S32-10-IB-BY	0.31	1.31	0.09	90.00	105.00	93.70
67	16/05/19	9:52:07 AM	S33-17-IB-VA2 & S33-19-IB-VA2	0.19	0.87	0.10	84.20	98.20	88.80
68	18/05/19	3:19:49 PM	S36-23-CI-MAPF	0.09	0.46	0.07	93.00	105.20	96.40
69	21/05/19	10:58:50 AM	S37-15-IB-WW3	0.12	0.89	0.06	97.70	106.00	103.80
70	23/05/19	9:55:18 AM	S32-05-PS-BRWN	0.28	1.27	0.17	81.30	91.00	90.00
71	23/05/19	9:56:34 AM	S33-09-IB-VA	0.22	2.04	0.09	85.90	99.90	88.50
72	24/05/19	1:23:20 PM	S35-29-IB-PF2	0.13	0.45	0.08	84.00	94.40	91.80
73	28/05/19	10:03:35 AM	S32-07-IB-BY	0.31	1.27	0.09	105.30	101.20	106.90
74	30/05/19	10:53:53 AM	S32-03-PS-BYWN	0.28	1.23	0.16	91.20	107.40	95.00
75	30/05/19	10:56:14 AM	S34-01-IB-WW3 & S34-01-PS-MA2	0.20	1.01	0.10	98.50	96.40	95.40
76	03/06/19	9:08:59 AM	S32-05-IB-BY	0.34	1.13	0.11	92.10	97.80	95.70
77	04/06/19	10:08:45 AM	S37-13-IB-WW3	0.10	0.73	0.05	94.30	103.10	90.30
78	05/06/19	4:25:07 PM	S34-09-IB-WW4	0.19	2.17	0.06	86.00	105.80	90.50
79	07/06/19	9:57:38 AM	S34-04-IB-WW4-B1	0.07	0.59	0.02	95.40	101.70	90.10
80	11/06/19	11:18:56 AM	S32-03-IB-BY1	0.07	0.55	0.02	84.00	92.90	88.60
81	11/06/19	11:19:47 AM	S34-04-IB-WW4-B2	0.34	1.38	0.14	88.90	100.90	99.60
82	12/06/19	2:49:43 PM	S34-01-IB-WW4	0.13	1.01	0.03	99.00	93.20	91.80
83	15/06/19	2:56:32 PM	S34-15_CI-MAPF	0.09	0.79	0.04	89.20	106.50	90.30
84	17/06/19	2:49:55 PM	S32-20-IB-WN	0.07	0.32	0.04	102.30	97.90	92.90
85	19/06/19	3:23:56 PM	S34-21-IB-PF2	0.10	0.77	0.11	85.70	99.50	94.00
86	22/06/19	3:24:09 PM	S32-12-IB-WN	0.04	0.38	0.03	86.60	94.40	91.80

Blast Details				Ground Vibration Result (mm/s)			Overpressure Result (dBL)		
Event No.	**Date**	**Time of Blast**	**Blast Code**	**Blake**	**Moore**	**School**	**Blake**	**Moore**	**School**
87	25/06/19	3:27:46 PM	S32-16-IB-WN	0.05	0.26	0.04	93.00	105.40	92.20
88	25/06/19	3:32:12 PM	S33-18-PS-BRWN	0.34	1.15	0.15	93.20	94.70	86.40
89	25/06/19	3:32:12 PM	S33-25-PS-BRWN	0.34	1.15	0.15	93.20	94.70	86.40
90	28/06/19	10:55:49 AM	S33-13-IB-BR1	0.20	0.95	0.08	89.70	99.90	93.40
91	01/07/19	3:10:13 PM	S33-16-IB-BR1	0.04	0.38	0.03	87.70	92.30	86.50
92	01/07/19	3:10:13 PM	S33-18-IB-BR1	0.04	0.38	0.03	87.70	92.30	86.50
93	01/07/19	3:11:29 PM	S35-18-IB-WW3	0.11	0.68	0.07	87.70	105.90	89.50
94	04/07/19	4:08:15 AM	S39-29-IB-RL142	0.05	0.35	0.05	86.30	108.10	79.50
95	06/07/19	2:53:37 PM	S39-29-IB-RL142	0.08	0.61	0.06	92.50	110.90	92.20
96	08/07/19	9:27:17 AM	S33-12-IB-BR1	0.27	1.78	0.09	93.80	97.90	97.10
97	10/07/19	3:58:43 PM	S38-27-IB-WW4(RL142)	0.06	0.43	0.05	104.40	99.90	98.30
98	12/07/19	10:59:58 AM	S34-05-IB-MA1	0.26	1.94	0.11	103.20	103.30	107.00
99	15/07/19	3:45:34 PM	S32-10-CI-BYWN	0.13	0.63	0.05	92.40	97.90	89.90
100	15/07/19	3:46:20 PM	S34-20-IB-PF2	0.06	0.50	0.03	93.30	98.10	91.60
101	18/07/19	4:03:36 PM	S32-03-IB-WN	0.11	0.45	0.04	97.70	104.20	102.80
102	18/07/19	4:04:51 PM	S34-02-IB-MA1	0.17	1.46	0.04	101.00	100.30	98.90
103	20/07/19	2:56:45 PM	S32-05-IB-WN	0.04	0.14	0.02	78.90	94.30	90.50
104	20/07/19	2:58:35 PM	S34-15-IB-PF2	0.04	0.39	0.02	80.00	95.20	87.70
105	23/07/19	10:54:06 AM	S32-08-IB-WN	0.05	0.22	0.03	97.80	104.50	95.20
106	24/07/19	2:59:59 PM	S34-08-IB-MA1	0.20	1.51	0.06	93.30	109.20	110.00
107	26/07/19	11:15:50 AM	S34-10-IB-MA2	0.09	0.41	0.03	91.10	105.70	101.70
108	27/07/19	11:25:52 AM	S33-25-IB-BR2A	0.21	0.77	0.22	85.20	95.20	90.70
109	27/07/19	11:25:52 AM	S33-22-IB-BRWN	0.21	0.77	0.22	85.20	95.20	90.70

Blast Details				Ground Vibration Result (mm/s)			Overpressure Result (dBL)		
Event No.	**Date**	**Time of Blast**	**Blast Code**	**Blake**	**Moore**	**School**	**Blake**	**Moore**	**School**
110	29/07/19	4:06:27 PM	S33-09-IB-BR1	0.3	1.85	0.09	84.9	98.9	92.2
111	31/07/19	4:45:59 PM	S32-12-IB-ED	0.10	0.51	0.04	86.60	98.20	93.20
112	31/07/19	4:46:55 PM	S39-18-IB-WW3	0.11	0.79	0.08	86.70	110.50	92.20
113	02/08/19	4:23:10 PM	S33-06-IB-BR2	0.16	0.58	0.05	78.90	100.00	84.20
114	03/08/19	3:53:30 PM	S33-22-IB-BR2A	0.05	0.17	0.03	88.60	100.90	94.10
115	08/08/19	8:59:13 AM	S37-01-IB-RL171	0.25	1.30	0.06	97.30	109.50	105.80
116	10/08/19	9:05:52 AM	S34-11-IB-MAPF	0.13	0.63	0.04	93.10	110.30	103.20
117	12/08/19	11:07:50 AM	S32-03-IB-ED	0.02	0.07	0.02	86.70	88.10	98.10
118	13/08/19	10:56:00 AM	S33-18-IB-BR2A	0.01	0.03	0.01	82.70	95.60	86.10
119	13/08/19	10:58:19 AM	S34-25-IB-VA1	0.28	1.40	0.21	86.90	95.50	93.40
120	14/08/19	4:11:35 PM	S35-16-IB-WW4	0.31	5.72	0.12	86.90	104.80	95.90
121	17/08/19	10:57:39 AM	S33-02-PS-BR2	0.11	0.18	0.04	96.30	95.80	91.30
122	17/08/19	11:16:38 AM	S34-06-IB-MAPF	0.10	0.53	0.04	87.90	105.80	97.30
123	20/08/19	10:36:18 AM	S33-02-IB-BR2 & S34-02-PS-PF2	0.21	1.22	0.07	91.70	109.30	96.80
124	21/08/19	8:53:23 AM	S34-24-IB-VA1	0.18	0.90	0.11	103.10	101.90	99.60
125	23/08/19	11:03:27 AM	S34-22-IB-VA1	0.20	1.31	0.15	85.20	96.30	89.40
126	26/08/19	10:51:11 AM	S34-18-IB-VA1	0.57	1.65	0.23	82.10	100.30	87.70
127	28/08/19	9:58:26 AM	S34-02-CI-MAPF	0.06	0.38	0.02	87.80	98.30	86.50
128	30/08/19	10:55:57 AM	S37-07-IB-WW3	0.22	2.15	0.09	87.60	111.70	91.40
129	30/08/19	3:34:51 PM	S33-12-PS-BRWN	0.22	1.33	0.17	81.90	93.60	90.30
130	03/09/19	4:04:40 PM	S35-14-IB-WW4	0.23	3.43	0.10	99.80	99.80	94.70
131	05/09/19	11:28:45 AM	S33-13-IB-BY	0.26	1.57	0.16	88.20	103.10	91.50

Blast Details				Ground Vibration Result (mm/s)			Overpressure Result (dBL)		
Event No.	**Date**	**Time of Blast**	**Blast Code**	**Blake**	**Moore**	**School**	**Blake**	**Moore**	**School**
132	10/09/19	11:36:56 AM	S33-15-IB-BY1	0.12	0.75	0.08	81.70	97.70	89.40
133	10/09/19	11:39:28 AM	S33-25-IB-BY2	0.16	0.50	0.11	94.20	100.30	95.00
134	10/09/19	11:41:18 AM	S35-18-IB-WW4	0.14	1.41	0.10	89.40	103.60	97.60
135	11/09/19	10:57:11 AM	S34-13-IB-PF2	0.11	0.65	0.05	82.70	99.90	93.40
136	12/09/19	11:12:27 AM	S33-22-IB-BY1	0.20	0.62	0.14	100.90	104.50	100.50
137	13/09/19	3:01:25 PM	S33-18-IB-BY1	0.15	0.64	0.10	81.10	94.50	89.20
139	16/09/19	11:21:06 AM	S34-26-IB-VA	0.04	0.24	0.03	101.10	97.60	99.60
138	16/09/19	11:23:19 AM	S35-21-IB-WW4	0.14	2.30	0.10	95.60	101.50	99.10
140	20/09/19	3:01:59 PM	S34-08-IB-PF2	0.22	1.25	0.06	97.10	101.70	91.00
141	24/09/19	10:59:38 AM	S36-16-IB-WW4	0.18	2.45	0.10	82.10	100.10	85.00
142	25/09/19	2:33:47 PM	S33-03-PS-BYWN	0.34	2.71	0.33	86.30	95.80	93.90
143	25/09/19	2:35:50 PM	S34-02-IB-PF2	0.01	1.03	0.05	90.60	100.50	92.90
144	30/09/19	12:11:57 PM	S34-25-IB-VA2	0.13	0.48	0.09	78.90	102.40	87.80
145	02/10/19	2:53:29 PM	S34-15-IB-VA1	0.59	3.03	0.33	84.20	98.80	98.20
146	04/10/19	3:38:48 PM	S34-04-IB-PF2	0.13	1.03	0.06	106.60	98.50	102.70
147	09/10/19	3:16:07 PM	S35-19-CI-MAPF	0.01	0.01	0.00	75.10	98.80	84.40
148	10/10/19	12:25:46 PM	S33-08-PS-BYWN	0.38	2.66	0.22	100.60	99.00	91.30
149	11/10/19	2:32:35 PM	S34-22-IB-VA2	0.09	0.47	0.09	102.10	107.90	105.60
150	14/10/19	2:37:27 PM	S33-03-IB-BY1	0.46	2.31	0.20	89.60	99.50	96.50
151	16/10/19	2:57:49 PM	S34-11-IB-VA1	0.38	2.89	0.12	96.40	99.90	93.30
152	18/10/19	11:06:49 AM	S33-10-IB-BY1	0.37	1.33	0.13	93.30	92.30	93.00
153	21/10/19	10:52:39 AM	S33-08-IB-BY1	0.22	1.54	0.16	84.50	98.10	88.60
154	25/10/19	11:17:17 AM	S33-05-IB-BY1	0.33	2.60	0.16	98.10	102.40	108.10

Blast Details				Ground Vibration Result (mm/s)			Overpressure Result (dBL)		
Event No.	**Date**	**Time of Blast**	**Blast Code**	**Blake**	**Moore**	**School**	**Blake**	**Moore**	**School**
155	25/10/19	11:18:41 AM	S35-03-IB-WW3	0.12	0.06	0.08	102.60	104.40	105.20
156	28/10/19	11:11:22 AM	S33-18-IB-WN	0.09	0.44	0.06	97.00	104.70	94.80
159	31/10/19	11:56:06 AM	S33-24-IB-WN	0.08	0.39	0.05	84.80	96.00	96.20
160	31/10/19	11:56:56 PM	S35-20-IB-PF1	0.03	0.16	0.02	77.70	100.80	88.00
157	02/11/19	4:29:55 PM	S33-20-IB-WN	0.08	0.30	0.04	100.00	102.30	98.30
158	02/11/19	4:33:59 PM	S34-02-PS-VA1	0.04	0.24	0.02	90.80	104.60	91.30
161	05/11/19	10:09:56 AM	S34-02-IB-VA	0.41	2.91	0.09	101.60	100.20	95.10
162	07/11/19	8:41:28 AM	S34-19-IB-VA2	0.17	0.75	0.07	96.20	111.80	101.80
163	11/11/19	10:52:58 AM	S34-04-IB-VA1	0.48	2.92	0.18	93.50	97.20	97.00
164	14/11/19	2:56:59 PM	S33-12-IB-WN	0.03	0.20	0.05	90.90	98.50	101.20
165	14/11/19	3:00:30 PM	S34-06-IB-VA1	0.32	1.99	0.11	102.80	105.40	89.60
166	18/11/19	11:03:18 AM	S34-09-IB-VA1	0.34	3.17	0.11	88.40	97.30	94.90
167	22/11/19	4:22:41 PM	S35-09-IB-WW4	0.08	0.61	0.10	90.10	96.80	96.20
168	22/11/19	4:24:23 PM	S34-16-IB-VA2	0.21	3.22	0.12	97.00	96.90	89.00
169	25/11/19	3:34:14 PM	S35-28-IB-VA1	0.21	1.17	0.14	88.70	94.70	102.80
170	25/11/19	3:35:33 PM	S35-22-IB-PF	0.03	0.20	0.02	104.20	101.70	102.50
171	27/11/19	3:22:34 PM	S35-15-CI-MAPF	0.08	0.58	0.05	98.10	107.00	94.90
172	29/11/19	4:11:12 PM	S33-10-IB-WN	0.06	0.25	0.02	91.20	101.70	93.00
173	03/12/19	7:04:16 AM	S37-11-IB-WW3	0.12	1.41	0.05	98.90	99.40	102.50
174	05/12/19	8:37:34 AM	S37-29-IB-WW2 & S37-31-IB-RL141	0.06	0.31	0.05	82.90	97.70	89.50
175	06/12/19	10:54:30 AM	S33-12-IB-ED & S33-14-IB-WN	0.08	0.48	0.03	101.70	104.60	100.40
176	10/12/19	11:15:49 AM	S33-15-IB-PF1	0.08	0.35	0.09	89.10	102.50	94.80

Blast Details				Ground Vibration Result (mm/s)			Overpressure Result (dBL)		
Event No.	**Date**	**Time of Blast**	**Blast Code**	**Blake**	**Moore**	**School**	**Blake**	**Moore**	**School**
177	10/12/19	11:18:08 AM	S35-16-IB-WN	0.06	0.58	0.09	86.70	98.20	88.10
178	11/12/19	2:55:48 PM	S34-24-PS-BRWN & S34-25-PS-BRWN	0.24	1.05	0.20	91.40	105.40	99.20
179	12/12/19	3:22:17 PM	S35-06-IB-WW4	0.07	0.72	0.02	97.50	101.70	102.20
180	16/12/19	2:55:40 PM	S35-23-IB-PF2	0.12	0.71	0.15	112.60	110.00	105.00
181	17/12/19	10:57:39 AM	S35-04-IB-WW4	0.08	0.71	0.03	106.40	101.70	94.40
182	19/12/19	2:57:40 PM	S37-26-IB-PF1	0.05	0.21	0.05	91.00	98.40	95.10
183	21/12/19	10:54:33 AM	S33-09-IB-WN	0.09	0.34	0.03	92.90	97.90	96.80
184	23/12/19	3:03:24 PM	S33-04-IB-WN	0.08	0.27	0.03	102.00	106.40	98.50
185	28/12/19	10:50:46 AM	S33-06-IB-WN	0.05	0.16	0.07	86.90	95.30	91.80
186	28/12/19	10:53:23 AM	S35-01-PS-MA2	0.10	0.94	0.08	85.90	84.00	80.50
187	30/12/19	2:52:29 PM	S34-18-PS-BRWN & S34-12-IB-BR1	0.36	1.31	0.19	89.80	92.50	95.90
188	31/12/19	3:23:05 PM	S34-14-IB-BR1	0.16	1.07	0.11	104.00	99.50	92.20
Min / Max Monitoring Results (2019):				0.01/0.66	0.01/5.72	0.00/0.33	75.1/112.6	82.1/113.8	79.5/110.0

Source – BMC (2019)

Notes: *Results presented for monitoring locations representative of private receivers*

APPENDIX D

Air Quality Monitoring Summary

Table D1
Particulate Matter <10µg/m³ (PM10) Summary

Run Date	PM_{10}-1		PM_{10}-2		PM_{10}-3		PM_{10}-4		24-hour Assessment Criteria (µg/m³)	Annual Assessment Criteria (µg/m³)
	Run Date Reading (µg/m³)	Annual Rolling Average (µg/m³)	Run Date Reading (µg/m³)	Annual Rolling Average (µg/m³)	Run Date Reading (µg/m³)	Annual Rolling Average (µg/m³)	Run Date Reading (µg/m³)	Annual Rolling Average (µg/m³)		
02/01/2019	61	33.7	43	27.3	81	27.7	71	38.4	*50*	*25*
08/01/2019	38	33.6	48	27.4	26	27.8	34	38.7	*50*	*25*
14/01/2019	40	33.1	28	27.1	54	28.0	53	39.1	*50*	*25*
20/01/2019	30	32.7	21	26.8	34	27.0	33	37.7	*50*	*25*
26/01/2019	57	32.8	47	26.9	60	27.3	45	37.2	*50*	*25*
01/02/2019	35	32.6	25	26.8	21	27.3	35	36.7	*50*	*25*
07/02/2019	29	32.6	23	26.7	23	27.1	49	36.5	*50*	*25*
13/02/2019	134	34.0	102	27.8	73	27.6	98	37.1	*50*	*25*
19/02/2019	112	34.8	65	28.2	29	27.2	79	36.8	*50*	*25*
25/02/2019	31	34.7	21	28.2	15	27.4	46	37.0	*50*	*25*
03/03/2019	34	34.7	26	28.2	23	27.2	59	37.1	*50*	*25*
09/03/2019	40	35.1	29	28.4	22	27.2	31	37.2	*50*	*25*
15/03/2019	39	35.3	31	28.5	14	26.8	52	37.3	*50*	*25*
21/03/2019	21	34.5	21	28.4	15	25.9	30	36.3	*50*	*25*
27/03/2019	28	34.6	22	28.5	31	26.3	48	36.9	*50*	*25*
02/04/2019	13	34.3	10	28.1	17	26.1	25	36.9	*50*	*25*
08/04/2019	43	34.5	40	28.4	25	25.8	24	36.6	*50*	*25*
14/04/2019	29	34.5	28	28.4	41	26.3	69	37.4	*50*	*25*
20/04/2019	25	34.5	19	28.4	27	26.3	38	37.5	*50*	*25*
26/04/2019	63	35.0	45	28.7	29	26.5	24	37.5	*50*	*25*
02/05/2019	45	35.6	39	29.1	34	26.6	53	37.9	*50*	*25*
08/05/2019	29	35.5	23	29.1	14	26.5	13	37.7	*50*	*25*
14/05/2019	17	35.3	19	29.1	19	26.7	26	37.6	*50*	*25*
20/05/2019	24	35.1	25	29.1	14	26.7	13	37.1	*50*	*25*
26/05/2019	33	35.1	33	29.3	17	26.4	11	36.4	*50*	*25*

Run Date	PM_{10}-1		PM_{10}-2		PM_{10}-3		PM_{10}-4		24-hour Assessment Criteria ($\mu g/m^3$)	Annual Assessment Criteria ($\mu g/m^3$)
	Run Date Reading ($\mu g/m^3$)	Annual Rolling Average ($\mu g/m^3$)	Run Date Reading ($\mu g/m^3$)	Annual Rolling Average ($\mu g/m^3$)	Run Date Reading ($\mu g/m^3$)	Annual Rolling Average ($\mu g/m^3$)	Run Date Reading ($\mu g/m^3$)	Annual Rolling Average ($\mu g/m^3$)		
01/06/2019	32	35.4	27	29.6	35	26.9	57	37.1	*50*	*25*
07/06/2019	35	35.7	31	29.8	33	27.2	80	38.0	*50*	*25*
13/06/2019	32	35.9	25	30.0	15	27.4	8	38.0	*50*	*25*
19/06/2019	22	35.9	20	30.1	21	27.7	25	38.4	*50*	*25*
25/06/2019	7	35.7	6	29.9	3	27.4	9	37.8	*50*	*25*
01/07/2019	48	36.0	30	30.0	31	27.8	79	39.0	*50*	*25*
07/07/2019	13	35.8	11	29.9	19	27.9	30	39.3	*50*	*25*
13/07/2019	32	36.0	22	29.9	9	27.8	7	39.2	*50*	*25*
19/07/2019	26	35.6	21	29.6	13	27.4	8	38.8	*50*	*25*
25/07/2019	33	34.9	27	29.3	25	27.5	65	39.5	*50*	*25*
31/07/2019	25	35.0	20	29.4	18	27.6	41	40.1	*50*	*25*
06/08/2019	43	35.3	27	29.5	18	27.6	40	40.2	*50*	*25*
12/08/2019	12	35.0	8	29.1	5	27.4	2	40.0	*50*	*25*
18/08/2019	36	35.0	25	29.1	34	27.6	51	40.1	*50*	*25*
24/08/2019	42	35.4	36	29.4	34	27.6	39	39.7	*50*	*25*
30/08/2019	12	35.3	4	29.1	2	27.2	3	39.3	*50*	*25*
05/09/2019	29	35.6	28	29.4	40	27.6	73	40.2	*50*	*25*
11/09/2019	28	35.8	26	29.5	42	27.9	56	40.7	*50*	*25*
17/09/2019	12	35.5	12	29.3	8	27.6	11	40.4	*50*	*25*
23/09/2019	29	35.1	25	28.9	15	27.0	15	39.9	*50*	*25*
29/09/2019	36	35.3	33	29.1	31	27.3	39	40.3	*50*	*25*
05/10/2019	27	35.3	23	29.1	31	27.8	39	40.5	*50*	*25*
11/10/2019	26	35.5	21	29.2	26	27.8	31	40.6	*50*	*25*
17/10/2019	130	37.3	72	29.8	66	28.5	65	41.1	*50*	*25*
23/10/2019	50	37.6	44	30.1	46	29.0	59	41.4	*50*	*25*
29/10/2019	70	38.1	75	30.9	62	29.5	78	42.0	*50*	*25*
04/11/2019	13	37.7	14	30.5	9	29.5	8	41.7	*50*	*25*
10/11/2019	44	38.0	27	30.6	20	29.4	27	41.3	*50*	*25*
16/11/2019	77	38.6	79	31.3	9	29.0	64	41.5	*50*	*25*

Run Date	PM_{10}-1		PM_{10}-2		PM_{10}-3		PM_{10}-4		24-hour Assessment Criteria ($\mu g/m^3$)	Annual Assessment Criteria ($\mu g/m^3$)
	Run Date Reading ($\mu g/m^3$)	Annual Rolling Average ($\mu g/m^3$)	Run Date Reading ($\mu g/m^3$)	Annual Rolling Average ($\mu g/m^3$)	Run Date Reading ($\mu g/m^3$)	Annual Rolling Average ($\mu g/m^3$)	Run Date Reading ($\mu g/m^3$)	Annual Rolling Average ($\mu g/m^3$)		
22/11/2019	158	40.4	136	32.9	112	30.2	99	42.6	*50*	*25*
28/11/2019	93	41.3	89	33.7	153	32.3	127	43.7	*50*	*25*
04/12/2019	104	42.2	79	34.2	67	32.8	43	43.9	*50*	*25*
10/12/2019	172	44.3	119	35.6	168	34.6	157	45.3	*50*	*25*
16/12/2019	187	46.8	93	36.6	118	35.9	143	46.8	*50*	*25*
22/12/2019	152	48.8	84	37.6	158	38.0	113	48.1	*50*	*25*
28/12/2019	72	49.3	59	37.9	106	38.7	133	48.9	*50*	*25*

Source: AECOM (2019)

Table B2
Total Suspended Particulates (TSP) Summary

Run Date	HV1		HV2		HV3		HV4		HV6		Annual Assessment Criteria (<90 µg/m^3)
	Run Date Reading (µg/m^3)	Annual Rolling Average (µg/m^3)	Run Date Reading (µg/m3)	Annual Rolling Average (µg/m3)	Run Date Reading (µg/m^3)	Annual Rolling Average (µg/m^3)	Run Date Reading (µg/m^3)	Annual Rolling Average (µg/m^3)	Run Date Reading (µg/m^3)	Annual Rolling Average (µg/m^3)	
02/01/2019	101	94.7	116	91.6	91	70.0	102	72.0	178	122	*90*
08/01/2019	89	95.2	96	91.4	67	70.1	154	73.7	74	122	*90*
14/01/2019	77	92.9	94	90.1	77	69.0	73	73.0	185	124	*90*
20/01/2019	51	91.4	79	89.1	54	68.1	53	72.3	115	120	*90*
26/01/2019	117	91.1	138	88.8	88	67.6	111	72.2	142	117	*90*
01/02/2019	88	91.0	111	88.5	78	67.0	75	71.8	140	116	*90*
07/02/2019	81	91.1	73	87.9	62	66.6	61	71.6	154	115	*90*
13/02/2019	225	93.0	322	90.8	232	68.5	281	74.3	257	116	*90*
19/02/2019	163	94.0	205	91.8	123	68.6	143	75.2	187	115	*90*
25/02/2019	60	93.5	76	91.1	70	68.3	51	75.1	121	114	*90*
03/03/2019	85	93.9	108	91.8	76	68.6	69	75.4	242	116	*90*
09/03/2019	120	95.3	106	92.8	74	69.3	54	75.7	144	117	*90*
15/03/2019	75	95.4	95	93.2	79	69.6	76	76.0	183	116	*90*
21/03/2019	53	93.5	55	91.7	48	68.4	58	75.7	111	114	*90*
27/03/2019	53	92.5	62	91.5	56	68.3	57	76.0	127	116	*90*
02/04/2019	41	92.2	37	90.8	31	67.8	29	75.4	101	116	*90*
08/04/2019	187	94.0	132	91.4	119	68.7	125	76.4	77	115	*90*
14/04/2019	65	94.0	69	91.2	56	68.7	60	76.2	237	118	*90*
20/04/2019	51	93.9	61	90.4	45	68.7	44	76.1	156	118	*90*
26/04/2019	232	96.1	175	92.0	134	70.0	152	77.6	75	118	*90*
02/05/2019	155	97.9	104	92.9	87	70.8	107	78.6	166	118	*90*
08/05/2019	138	98.6	71	92.3	53	70.6	42	78.1	26	117	*90*
14/05/2019	102	98.7	63	91.7	42	70.0	46	77.6	97	117	*90*
20/05/2019	79	98.3	69	91.5	48	70.3	53	77.2	47	116	*90*
26/05/2019	129	99.1	93	91.7	85	70.6	91	77.7	28	113	*90*
01/06/2019	169	101	94	92.3	73	71.2	74	78.3	157	115	*90*

Run Date	HV1		HV2		HV3		HV4		HV6		Annual Assessment Criteria (<90 µg/m^3)
	Run Date Reading (µg/m^3)	Annual Rolling Average (µg/m^3)	Run Date Reading (µg/m3)	Annual Rolling Average (µg/m3)	Run Date Reading (µg/m^3)	Annual Rolling Average (µg/m^3)	Run Date Reading (µg/m^3)	Annual Rolling Average (µg/m^3)	Run Date Reading (µg/m^3)	Annual Rolling Average (µg/m^3)	
07/06/2019	107	102	93	93.3	68	71.8	73	78.9	203	116	*90*
13/06/2019	149	103	115	94.0	76	72.4	81	79.3	23	116	*90*
19/06/2019	86	102	65	93.6	41	72.0	59	79.3	83	117	*90*
25/06/2019	18	102	19	93.3	17	71.7	15	78.9	45	116	*90*
01/07/2019	143	103	124	94.0	79	72.1	63	78.8	192	119	*90*
07/07/2019	36	102	30	93.1	24	71.6	26	78.1	129	120	*90*
13/07/2019	115	102	84	93.3	54	71.6	71	78.3	21	120	*90*
19/07/2019	112	101	75	92.4	58	70.9	61	77.6	22	119	*90*
25/07/2019	117	100	78	90.3	56	70.2	60	76.6	174	121	*90*
31/07/2019	88	100	79	90.3	54	70.3	57	76.6	166	123	*90*
06/08/2019	120	101	92	91.0	51	70.4	58	76.7	85	124	*90*
12/08/2019	93	100	46	90.1	44	69.6	46	76.0	20	123	*90*
18/08/2019	99	100	77	90.0	49	69.0	72	75.6	122	124	*90*
24/08/2019	162	101	115	90.9	75	69.3	112	76.6	90	122	*90*
30/08/2019	47	100	54	90.6	44	69.1	28	75.7	31	121	*90*
05/09/2019	84	101	69	91.1	53	69.5	62	76.2	188	123	*90*
11/09/2019	134	103	93	91.8	102	70.6	93	77.0	193	124	*90*
17/09/2019	38	102	37	90.8	31	69.7	29	76.0	65	123	*90*
23/09/2019	141	101	90	89.8	65	68.8	84	75.1	44	122	*90*
29/09/2019	125	100	113	90.4	89	69.4	100	75.9	151	123	*90*
05/10/2019	85	101	79	90.5	63	69.4	67	76.1	160	124	*90*
11/10/2019	47	101	85	91.2	36	69.5	78	76.8	123	125	*90*
17/10/2019	244	104	203	93.7	131	71.0	182	77.5	193	127	*90*
23/10/2019	112	105	108	94.1	81	71.3	91	77.9	148	127	*90*
29/10/2019	280	108	138	95.0	142	72.6	157	79.5	242	129	*90*
04/11/2019	79	107	39	93.9	34	71.5	45	78.8	34	128	*90*
10/11/2019	130	108	111	94.8	96	72.4	116	79.9	90	127	*90*
16/11/2019	195	110	182	96.0	156	73.6	201	81.9	173	128	*90*
22/11/2019	270	113	243	98.8	224	76.4	283	85.5	234	131	*90*

Run Date	HV1		HV2		HV3		HV4		HV6		Annual Assessment Criteria (<90 µg/m^3)
	Run Date Reading (µg/m^3)	Annual Rolling Average (µg/m^3)	Run Date Reading (µg/m3)	Annual Rolling Average (µg/m3)	Run Date Reading (µg/m^3)	Annual Rolling Average (µg/m^3)	Run Date Reading (µg/m^3)	Annual Rolling Average (µg/m^3)	Run Date Reading (µg/m^3)	Annual Rolling Average (µg/m^3)	
28/11/2019	169	113	189	100.1	171	77.3	183	86.7	341	134	*90*
04/12/2019	255	113	229	101.8	147	78.0	178	87.8	92	134	*90*
10/12/2019	249	113	297	104.8	211	79.7	234	90.3	353	135	*90*
16/12/2019	279	114	267	108.1	240	82.7	208	92.8	305	138	*90*
22/12/2019	203	114	283	111.4	173	84.4	176	94.5	258	140	*90*
28/12/2019	139	124	155	112.5	113	85.2	114	95.1	381	143	*90*

Source: AECOM (2019)

Table D3
Continuous PM_{10} Monitoring (EPA22, EPA23 and EPA24) 24 Hour Average Summary

Date	EPA-22 PM10 Avg (ug/m3)	EPA-23 PM10 Avg (ug/m3)	EPA-24 PM10 Avg (ug/m3)
1/01/2019	12.3	18.8	16.5
2/01/2019	18.1	16.3	16.8
3/01/2019	21.2	25.1	25.3
4/01/2019	18.8	24.5	24.5
5/01/2019	15.2	18.4	17.3
6/01/2019	13.1	10.3	9.2
7/01/2019	9.2	12.6	11.9
8/01/2019	8.5	12.7	11.3
9/01/2019	18.7	19.6	19
10/01/2019	13.6	15.6	15.1
11/01/2019	31.7	34	31.8
12/01/2019	27.3	28.5	27
13/01/2019	24	23.4	22.3
14/01/2019	19.1	23.5	20.4
15/01/2019	16.7	20.9	19.7
16/01/2019	14.9	17.2	16.8
17/01/2019	23.6	31.1	25.7
18/01/2019	21.9	27.9	26.9
19/01/2019	16.8	19.3	16.7
20/01/2019	16.4	21.8	15.8
21/01/2019	14.1	19.8	11.5
22/01/2019	10.3	12.3	9
23/01/2019	20.4	23.2	17.8
24/01/2019	15.1	15.7	11.6
25/01/2019	25.1	31.1	22.4
26/01/2019	32.1	38.3	29.9
27/01/2019	25.5	41.7	18.8
28/01/2019	22.6	26.1	19.5
29/01/2019	27.9	32.7	24.1
30/01/2019	29.7	36.4	27.7
31/01/2019	24	25.6	23.3
1/02/2019	14.4	16.1	11.2
2/02/2019	7.9	12.7	8
3/02/2019	7.8	9.6	6.9
4/02/2019	11.8	17.7	-
5/02/2019	11.8	16.3	-
6/02/2019	14	20.9	-
7/02/2019	4.1	9.6	-
8/02/2019	5.2	9	5.5
9/02/2019	6.3	6.8	5.5
10/02/2019	5.8	5.6	4.5
11/02/2019	5.9	11.9	7.7
12/02/2019	7.4	12.6	8.5
13/02/2019	8.5	-	6.4
14/02/2019	13.3	-	17.5
15/02/2019	7.5	-	9.2
16/02/2019	6.5	10.2	8
17/02/2019	6.5	10.8	8.4
18/02/2019	10.1	13.7	11.5
19/02/2019	13.8	14.9	13.7
20/02/2019	20.1	20.1	18
21/02/2019	19.2	24.8	17.2
22/02/2019	8.7	13	7.6
23/02/2019	9.2	14.6	8.1
24/02/2019	5.8	10.7	5.3
25/02/2019	10.3	15.2	9.8
26/02/2019	9	14.4	9.5
27/02/2019	8.4	14.6	10.1
28/02/2019	5.6	11.7	7.8
1/03/2019	5.6	11.3	7.6
2/03/2019	6.3	9.8	7.5
3/03/2019	4.7	7.5	7
4/03/2019	6.9	10.3	9.2
5/03/2019	9.1	12.8	11.4
6/03/2019	14.8	14.5	14.3
7/03/2019	15.7	15.8	15.4
8/03/2019	22.2	22.5	22.4
9/03/2019	8.6	13	11.2
10/03/2019	21	16.2	13.2
11/03/2019	36	26.5	23.7
12/03/2019	19.2	22.7	19
13/03/2019	29.3	22.7	24.4
14/03/2019	17.5	13.2	17.1
15/03/2019	16.9	13.1	16.3
16/03/2019	13.7	12	14.9
17/03/2019	7.2	8	10.1
18/03/2019	4.5	3.9	4.2
19/03/2019	8.7	5.3	6.8
20/03/2019	13.7	14.8	13.1
21/03/2019	20.3	19.5	22.7
22/03/2019	7.3	7.8	8.6
23/03/2019	7.4	7.4	9.6
24/03/2019	19.9	19.4	16.6
25/03/2019	14.5	12.8	12.3
26/03/2019	14.4	7.8	9.3
27/03/2019	11.1	5.6	9.1
28/03/2019	7.1	8.9	9.4
29/03/2019	8.7	9.4	7.6
30/03/2019	9.6	13.5	8.8
31/03/2019	5.7	2.1	2.2
1/04/2019	11.1	3.4	3.8
2/04/2019	4	12.4	10.4
3/04/2019	3.8	5.6	4.4
4/04/2019	9.2	10	9.3
5/04/2019	6.3	9.4	7.3
6/04/2019	8.5	9.6	8.8
7/04/2019	8.1	5.5	5.6
8/04/2019	9.9	9.2	4.4
9/04/2019	9.9	12.6	4.7
10/04/2019	6.3	13.2	7.3
11/04/2019	6.4	10.7	7.2
12/04/2019	5.5	10.4	7.6
13/04/2019	7.6	9.6	9
14/04/2019	20.8	19.4	17.2
15/04/2019	24.3	29	26.7
16/04/2019	15.3	18.9	16.3
17/04/2019	8.8	12.7	9
18/04/2019	7.1	12.2	7.2
19/04/2019	11.8	12	8.8
20/04/2019	10.3	21.8	11.1

Date	EPA-22 PM10 Avg (ug/m3)	EPA-23 PM10 Avg (ug/m3)	EPA-24 PM10 Avg (ug/m3)
21/04/2019	11.9	23.3	12.1
22/04/2019	14.8	26.3	15.9
23/04/2019	8.9	19.7	10.6
24/04/2019	6.7	14.4	8.8
25/04/2019	7.6	11.2	7.4
26/04/2019	19.5	31	18
27/04/2019	18.9	15	7.4
28/04/2019	8.4	13.9	10.8
29/04/2019	8.7	11.1	5.7
30/04/2019	10.2	22.8	17
1/05/2019	15.2	19.3	16
2/05/2019	16.6	22.6	13.9
3/05/2019	38	31.3	22.1
4/05/2019	13.4	5	6.1
5/05/2019	4.2	2.8	1.4
6/05/2019	6.4	10.9	3.6
7/05/2019	5.7	16.7	9
8/05/2019	10.6	3.5	3
9/05/2019	9.5	3.9	2.9
10/05/2019	9.1	14.5	6.4
11/05/2019	18.7	25	5.1
12/05/2019	7.8	2.7	2.3
13/05/2019	7.3	13	5.4
14/05/2019	13.9	19.9	16.7
15/05/2019	15.1	20.8	7.9
16/05/2019	11.4	23.3	15
17/05/2019	16.1	19	23.9
18/05/2019	17.1	22.7	16.6
19/05/2019	21.7	48.4	33.1
20/05/2019	25.9	34.1	29.2
21/05/2019	24.2	30.3	13.5
22/05/2019	11.6	21.2	5.9
23/05/2019	10.1	31.8	9.5
24/05/2019	25.3	28.6	27.5
25/05/2019	24.1	38.9	20.8
26/05/2019	13.8	33.1	7.4
27/05/2019	13.7	16.2	5.2
28/05/2019	10.9	3	2.2
29/05/2019	8.9	4.1	2.6
30/05/2019	4.7	3.6	2.3
31/05/2019	6.4	2.7	1.6
1/06/2019	8.8	4.8	2.1
2/06/2019	35.3	46.2	30.8
3/06/2019	43.5	61.6	37
4/06/2019	16.5	19.7	8.4
5/06/2019	3.2	1.4	0.3
6/06/2019	4	5.9	4.3
7/06/2019	9.3	21.9	9.4
8/06/2019	13.9	43.2	17.9
9/06/2019	28.4	33.6	18.8
10/06/2019	15.4	14.6	8
11/06/2019	12.6	-	4.9
12/06/2019	12.2	7.1	6.4
13/06/2019	10	25.1	7.5
14/06/2019	8.5	10.9	3.7
15/06/2019	7.5	14.5	9
16/06/2019	13	42.9	18.9
17/06/2019	18.3	35.5	18.5
18/06/2019	10.8	18.5	1.5

Date	EPA-22 PM10 Avg (ug/m3)	EPA-23 PM10 Avg (ug/m3)	EPA-24 PM10 Avg (ug/m3)
19/06/2019	9.3	6	3.8
20/06/2019	7.5	13.4	5
21/06/2019	12.8	14.5	17.1
22/06/2019	17.2	23.3	11.7
23/06/2019	9.5	26.3	16.3
24/06/2019	9.3	20.8	4.3
25/06/2019	5.9	8.3	3.8
26/06/2019	5.3	9.2	5.7
27/06/2019	6.5	12.4	9.4
28/06/2019	6.8	8.4	9.3
29/06/2019	13.5	16.4	12.1
30/06/2019	10.8	26.4	7.5
1/07/2019	4.5	2.2	1.4
2/07/2019	10	23.4	13.8
3/07/2019	12.4	33.6	12.7
4/07/2019	11.5	27.6	10.9
5/07/2019	5.5	8.1	6.7
6/07/2019	5.5	9.2	6.9
7/07/2019	7	9.9	8
8/07/2019	19.7	22.4	16.8
9/07/2019	11.5	12.3	8.3
10/07/2019	8	1.9	2
11/07/2019	10.9	13	4.7
12/07/2019	7.8	4.1	3.2
13/07/2019	6.4	4.6	3.3
14/07/2019	7.9	2.9	2.7
15/07/2019	7.6	2.4	2.1
16/07/2019	5.5	1.4	1.3
17/07/2019	6	2.8	2.2
18/07/2019	6.1	1.9	1.2
19/07/2019	6.5	1.4	1.1
20/07/2019	7.4	6.8	3
21/07/2019	16.1	32	11
22/07/2019	16	36.4	11.2
23/07/2019	10.4	21.4	8.2
24/07/2019	10.9	23	4.7
25/07/2019	7.4	3.5	2.4
26/07/2019	9.3	18.5	12
27/07/2019	15.2	31.4	23.2
28/07/2019	13.8	26.7	14.6
29/07/2019	16.9	29.7	16.5
30/07/2019	14.7	26	17.3
31/07/2019	9.6	12	9.7
1/08/2019	6.5	9.2	7.6
2/08/2019	10.6	19.3	8.2
3/08/2019	13.6	25.7	15.6
4/08/2019	17.2	27.3	10.3
5/08/2019	13.6	28.3	15.4
6/08/2019	21.3	32.6	25.5
7/08/2019	13.2	45.5	12.7
8/08/2019	9.5	31.8	9.3
9/08/2019	10.2	11.8	6
10/08/2019	7.5	4.5	4.4
11/08/2019	7.1	1.8	1.6
12/08/2019	4.8	1.2	1.2
13/08/2019	6.2	2.4	1.2
14/08/2019	12.1	13.7	5.3
15/08/2019	9.5	40.7	23.7
16/08/2019	9.5	39.3	10.6

Date	EPA-22 PM10 Avg (ug/m3)	EPA-23 PM10 Avg (ug/m3)	EPA-24 PM10 Avg (ug/m3)
17/08/2019	9.4	31.1	3.2
18/08/2019	10.6	27.5	7.9
19/08/2019	11.5	22.2	13.2
20/08/2019	8.3	5.1	5.6
21/08/2019	5.4	2.2	1.9
22/08/2019	5.8	2.5	1.9
23/08/2019	5.6	5.6	4.5
24/08/2019	11.9	19.7	16.6
25/08/2019	14.8	35.6	11.3
26/08/2019	12.8	21.8	9.9
27/08/2019	15.7	20.9	18.1
28/08/2019	9.9	15.5	12.2
29/08/2019	9.8	9.1	7.8
30/08/2019	9.3	23.1	11.3
31/08/2019	1.8	1.1	0.5
1/09/2019	4.5	5.5	3.3
2/09/2019	9.7	12.4	6.3
3/09/2019	7.7	14.5	7.5
4/09/2019	8.4	7.6	4.9
5/09/2019	7.6	22.7	9.6
6/09/2019	6.2	21.2	10.3
7/09/2019	20.4	20.2	17.2
8/09/2019	4.3	2.4	2.6
9/09/2019	4	0.7	0.9
10/09/2019	2.8	2.2	2.7
11/09/2019	4	16.2	4.7
12/09/2019	7.7	14.1	10.4
13/09/2019	10.6	31.3	8.1
14/09/2019	-	28.6	10.1
15/09/2019	-	24.3	9.9
16/09/2019	-	19.9	9.2
17/09/2019	-	32.1	9.3
18/09/2019	-	5	3
19/09/2019	6.1	3.5	2.4
20/09/2019	14.7	18.4	17
21/09/2019	9	16.6	14.4
22/09/2019	23	24.4	23.1
23/09/2019	23.6	19.5	16.3
24/09/2019	5.3	5.4	3
25/09/2019	6.4	12.2	7.9
26/09/2019	4.1	17	13.1
27/09/2019	26.8	28.6	28
28/09/2019	24	18.8	17
29/09/2019	9.4	11	4.7
30/09/2019	8.8	11.9	8.5
1/10/2019	9.4	15	12.4
2/10/2019	7.5	10.6	8.9
3/10/2019	11	19.3	11.6
4/10/2019	12.7	34.9	9.4
5/10/2019	14.9	32.6	12.2
6/10/2019	12.1	16.4	13.1
7/10/2019	16.5	19	14.4
8/10/2019	18.9	37.9	17.5
9/10/2019	12.9	13.7	9.9
10/10/2019	3.7	7	2.4
11/10/2019	5.5	8.4	6.4
12/10/2019	4.9	6.9	5.4
13/10/2019	3.6	9.1	5.4
14/10/2019	5.6	10.9	7.3

Date	EPA-22 PM10 Avg (ug/m3)	EPA-23 PM10 Avg (ug/m3)	EPA-24 PM10 Avg (ug/m3)
15/10/2019	6.9	10.2	10.7
16/10/2019	9.7	14.4	11.3
17/10/2019	15.6	27.2	17.2
18/10/2019	21.9	18.3	18.5
19/10/2019	15.4	3.7	2.7
20/10/2019	6.3	6.6	4.5
21/10/2019	5.5	11.8	7.2
22/10/2019	12.6	16.7	17.2
23/10/2019	12	15.9	15
24/10/2019	28.8	31.4	31.3
25/10/2019	39.9	52.5	45.1
26/10/2019	26.4	44.5	33
27/10/2019	19.8	19.3	18
28/10/2019	9.6	12	8.5
29/10/2019	48	55.1	52.9
30/10/2019	74.6	74.4	74.6
31/10/2019	69.9	85.1	67.4
1/11/2019	60.4	63	55.5
2/11/2019	147.4	142.1	141.5
3/11/2019	48.2	64.9	50.9
4/11/2019	12.9	10.5	7.6
5/11/2019	12.6	4	3.6
6/11/2019	3.7	4.4	4
7/11/2019	11.9	5.5	4
8/11/2019	12.8	9.8	9.9
9/11/2019	10.6	10.3	9.9
10/11/2019	3.7	1.7	1.9
11/11/2019	6.6	3.7	3.9
12/11/2019	7	9.6	5.4
13/11/2019	22.5	25.2	14.2
14/11/2019	8	3.6	3.5
15/11/2019	10.3	6.8	4
16/11/2019	9.3	3.7	2.7
17/11/2019	41.6	55.7	46.5
18/11/2019	101.5	93.3	94
19/11/2019	96.7	80.8	82.9
20/11/2019	58.3	30.7	22.7
21/11/2019	75.5	78.4	81
22/11/2019	267.6	241.1	232
23/11/2019	144.3	93.2	95.9
24/11/2019	88.3	83.3	80.6
25/11/2019	29.9	29.2	27.3
26/11/2019	53.3	54.9	51.8
27/11/2019	42.6	48.3	45.2
28/11/2019	9.3	11.3	10
29/11/2019	168.6	154.5	166.3
30/11/2019	156.9	133.3	133.6
1/12/2019	28.8	28.2	25.7
2/12/2019	37.4	34.3	34.1
3/12/2019	13.4	10.9	11.6
4/12/2019	19.9	10	11.1
5/12/2019	64.6	45.9	50.2
6/12/2019	49.6	36.4	34.8
7/12/2019	50.2	56.6	47.8
8/12/2019	296.4	290.9	335.2
9/12/2019	77.8	84.8	91.9
10/12/2019	179.5	181.5	190.2
11/12/2019	173.8	191.3	219.3
12/12/2019	246	235.5	256.6

Date	EPA-22 PM10 Avg (ug/m3)	EPA-23 PM10 Avg (ug/m3)	EPA-24 PM10 Avg (ug/m3)
13/12/2019	90.8	94	98.1
14/12/2019	25.9	28.4	29.4
15/12/2019	91.4	92	101.6
16/12/2019	81.5	74.5	79.9
17/12/2019	93.5	109.7	114.1
18/12/2019	7.8	12.1	10.8
19/12/2019	29.6	34.6	34.1
20/12/2019	147.9	155.9	149
21/12/2019	30.8	35.5	36.6
22/12/2019	94.9	94.7	93.8
23/12/2019	31.6	37.4	36.5
24/12/2019	18.1	20.2	20.1
25/12/2019	35	38.1	38.7
26/12/2019	28.4	26.9	28.4
27/12/2019	39.2	41.5	42.6
28/12/2019	28.5	35.7	42.2
29/12/2019	52.3	56.1	60.5
30/12/2019	47.9	93.2	-
31/12/2019	104.4	129.5	-

Source: AECOM (2019)

APPENDIX E

Annual Compliance Report for EPBC 2012/6378

BENGALLA MINE
(EPBC 2012/6378)

2019 ANNUAL COMPLIANCE REPORT

Prepared by:

BENGALLA MINING COMPANY PTY LIMITED
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March 2020

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BENGALLA MINE
ANNUAL COMPLIANCE REPORT FOR EPBC 2012/6378

1 INTRODUCTION

1.1 BACKGROUND

Bengalla Mining Company Pty Limited (BMC) operates the Bengalla Mine (Bengalla) which is located 130 km north-west of Newcastle and 4 km west of the township of Muswellbrook.

Bengalla commenced operations in 1998 and is approved to extract up to 15 Million tonnes per annum of run of mine coal until 2039.

On 3 March 2015, BMC was granted State Significant Development Consent (SSD-5170) by the NSW Secretary of Department of Planning and Environment (DPE) under the *Environmental Planning & Assessment Act 1979* (EP&A Act).

On 27 May 2015, BMC was granted *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Approval 2012/6378.

Both of the EPBC2012/6378 and SSD-5170 approvals are supported by the '*Continuation of Bengalla Mine Environmental Impact Statement*' (Hansen Bailey, 2013) (EIS) and *Continuation of Bengalla Mine Response to Submissions* (Hansen Bailey, 2014) (RTS).

The Biodiversity Offset Management Plan (BOMP) was approved by Department of Environment and Energy (DoEE) on 8 March 2017 and approved by DPE on 18 August 2017.

The Biodiversity Management Plan (BDMP) was approved by DPE on 18 August 2017 and approved by DoEE on 20 September 2017.

1.2 PURPOSE AND SCOPE

This report has been prepared in accordance with Condition 12 of EPBC2012/6378 which states:

> *"By the end of March each year, the approval holder must publish a report on their website addressing compliance with each of the conditions of this approval, including implementation of the BOMP and VCLMP as specified in the conditions. Documentary evidence providing proof of the date of publication must be provided to the Department at the same time as the compliance report is published.*
>
> *Note: The Annual Review required under NSW Approval condition 4 (of Schedule 5) may be used to satisfy this condition if it meets the above content and submission requirements)."*

This report applies to the period 1 January 2019 to 31 December 2019 (Reporting Period).

This report will form an Appendix to the 2019 Annual Review for Bengalla as required under SSD-5170 Schedule 5 Condition 4.

2 ACTIVITIES UNDERTAKEN IN 2019

Clearing works in 2019 were in relation to, but not limited to the:

- Relocation and development of surface infrastructure (dragline shutdown maintenance pad, relocated Orica reload facility);
- Pre-clearances in advancement of approved mining operations; and
- Exploration drilling.

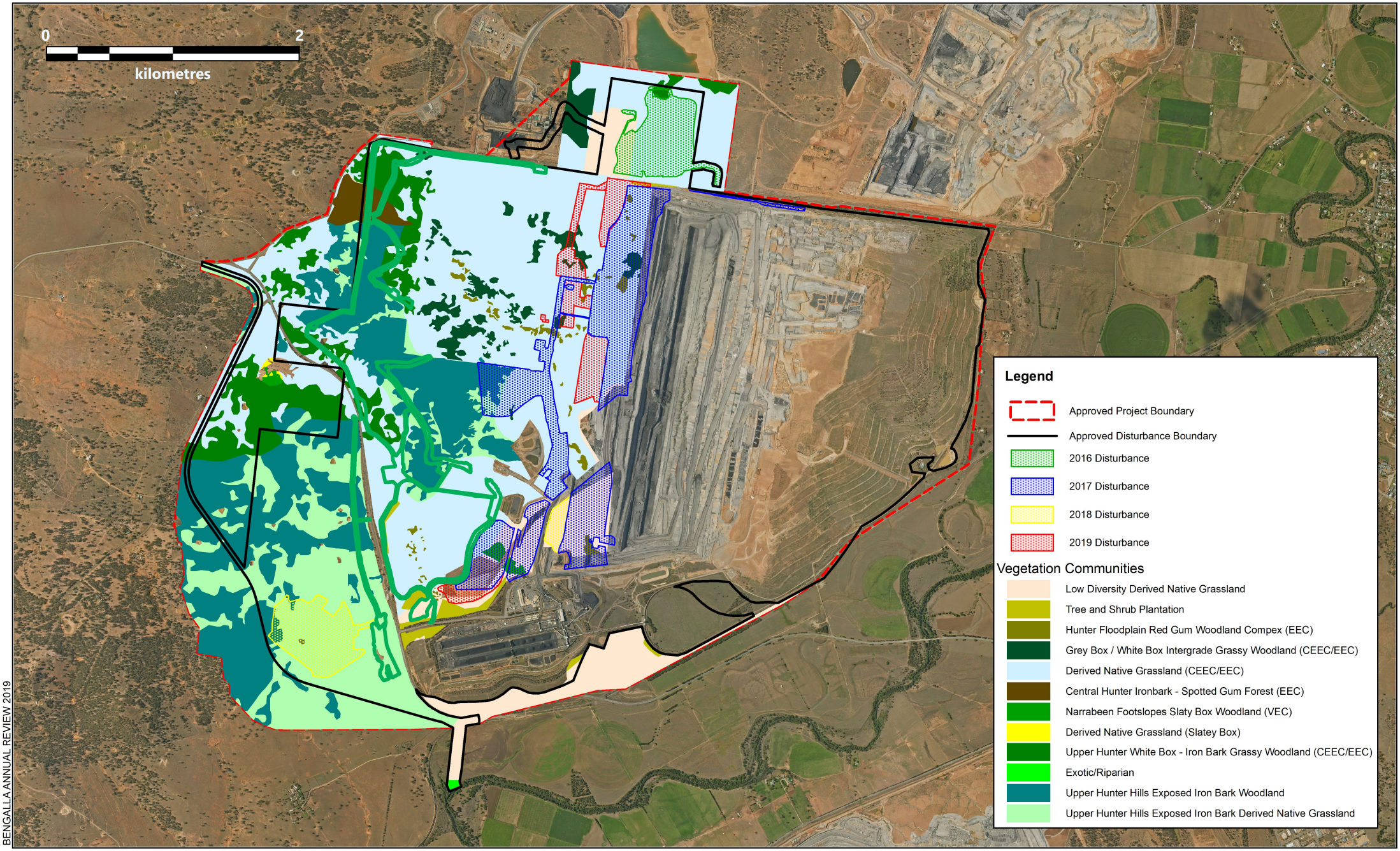
The Clearing Report summarises the 2019 pre-clearance and clearance surveys, which included:

- Identification of 23 hollow-bearing trees and 9 habitat trees, which were felled;
- No animals were relocated or captured during pre-clearance and clearance surveys;
- Observation of 2 animals that evaded capture during clearing;
- No animals were killed or euthanised as a result of clearing operations;
- No injured or immature animals were taken to either the local veterinary centre or directly to Wildlife Aid; and
- No *Cymbidium canaliculatum* (listed as endangered under the EPBC Act) were recorded during 2019 clearing operations.

Figure 1 is a reproduction of Figure 3 from the approved BOMP and has been updated to illustrate areas cleared during the Reporting Period, including Critically Endangered Ecological Communities (CEEC) listed under the EPBC Act.

CEEC identified in environmental assessments completed for the EIS and RTS included the following four communities identified as conforming to Upper Hunter White Box-Ironbark Grassy Woodland (Box Gum Woodland):

- Grey Box/White Box Intergrade Grassy Woodland;
- Upper Hunter White Box -Ironbark Grassy Woodland;
- Central Hunter Ironbark – Spotted Gum Forest; and
- Derived Native Grassland.



BENGALLA ANNUAL REVIEW 2019

BENGALLA

BENGALLA MINE

Vegetation Communities

FIGURE 1

3 COMPLIANCE REPORT

The commitments made in the approved BDMP and BOMP, along with the compliance status of each are presented in **Appendix A** and **Appendix B,** respectively, with comments provided against each, where required.

Table 1 is a reproduction of Figure 6 from the BDMP. It provides details of the staged clearing approach undertaken at BMC.

Table 2 lists the conditions of EPBC2012/6378 and indicates the compliance status of each as 'compliant', 'not compliant' or 'not triggered'. Comments are provided against each condition, where required.

Table 3.1 of the Clearing Report (**Appendix C**) outlines dates the pre-clearing inspections and clearing activities were undertaken.

Table 1
Staged Clearing Approach

Stage	Actions
Pre-Clearing Survey	• Performed within one month of clearing • All fauna, flora and *Cymbidium canaliculatum* recorded • Vegetation health assessed and documented • Habitat features marked and flagged • Fauna captured and relocated
Clearing – Stage 1	• Removal of all vegetation other than habitat trees • Habitat features left standing overnight
Clearing – Stage 2	• A final pre-clearing inspection will be conducted to identify and capture any fauna • Habitat trees lightly shaken by machinery prior to felling • Appropriate machinery used to fell the tree • Any *Cymbidium canaliculatum* (Tiger Orchid) translocated • Remaining fauna captured and relocated • Felled habitat trees left overnight and then appropriate sections are removed and relocated to a storage location, rehabilitation areas or disposed

Table 2
BMC Compliance Status against Conditions of EPBC 2012/6378

Ref	Condition	Status	Comment
1	The approval holder must not clear more than 535 hectares of *White Box-Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland* ecological community (Box Gum Woodland) and must limit clearing to within the project disturbance boundary defined at Schedule 1.	Compliant	In 2019 clearing was undertaken within the Project Disturbance Boundary. BMC has not cleared more than 535 hectares of Box Gum Woodland (see **Figure 1**).
2	To mitigate impacts of the action on Box Gum Woodland, the Grey Headed Flying Fox, Large-eared Pied Bat, South-eastern Long-eared Bat, Regent Honeyeater, Swift Parrot and Spotted-tail Quoll, the approval holder must prepare and submit, prior to the proposed date of commencement of the action, a mine site Vegetation Clearance Protocol and Landscape Management Plan (VCPLMP) for the Minister's written approval. The VCPLMP must: a. Delineate areas to be cleared, describe pre-clearance survey methods, specify actions to minimise fauna impacts and detail vegetation clearance procedures b. Require collection and stockpiling of habitat features important to threatened fauna species for reinstatement in rehabilitation areas c. Require use of native, locally sourced seed for propagation for rehabilitation activities d. Include measures to avoid, suppress and control the spread of plant pathogens (such as *Phytophthora cinnamomi*) e. Specify a two stage clearing protocol where non-habitat trees are cleared 24 hours prior to any habitat trees being cleared, to encourage fauna to move out of an area.	Compliant	A BDMP was developed to meet this requirement (see **Appendix A**). NSW approval for the initial BDMP was provided on 14 August 2015. Final approval from Department of Environment and Energy (DoEE) was provided on 14 August 2015. BMC commenced implementation of the BDMP after 14 August 2015. The BDMP was revised and approved by DoEE on 20 September 2017 and by NSW DPE on 18 August 2017. Section 1.3 of the BDMP describes where sub-conditions a) to e) are addressed.
	The approval holder must not commence the action until the VCPLMP is approved by the Minister. The approved VCPLMP must be implemented. Note: The Biodiversity Management Plan required under NSW Approval condition 29 may be used to satisfy this condition if it meets the above content and submission requirements.	Compliant	A BDMP was developed to meet this requirement (see **Appendix A**). NSW approval for the initial BDMP was provided on 14 August 2015. Final approval from Department of Environment and Energy (DoEE) was provided on 14 August 2015. BMC commenced implementation of the BDMP after 14 August 2015.

Ref	Condition	Status	Comment
			The BDMP was revised and approved by DoEE on 20 September 2017 and by NSW DPE on 18 August 2017.
3	To compensate for the loss of 535 hectares of Box Gum Woodland ecological community and 272 hectares of habitat for the Grey Headed Flying Fox, Large-eared Pied Bat, South-eastern Long-eared Bat, Regent Honeyeater, Swift Parrot and the Spotted-tail Quoll, the approval holder must prepare and submit, by 3 September 2015, a Biodiversity Offset Management Plan (BOMP) for the Minister's written approval. The BOMP must: a. Identify those lands described as the Offset Areas at Schedule 2 (Figures 1- 6) of this notice. This must include offset attributes, shape files, textual descriptions and maps to clearly define the location and boundaries of the offset area(s) b. Provide a survey and description of the current condition (prior to any management activities) of the offset areas identified in Condition 3a c. Detail management actions and regeneration and revegetation strategies to be undertaken on the offset areas to improve the ecological quality of these areas, including: (i) a description and timeframe of measures that would be implemented to improve the condition of Box Gum Woodland and habitat for the Grey Headed Flying Fox, Large-eared Pied Bat, South-eastern Long-eared Bat, Regent Honeyeater, Swift Parrot and the Spotted-tail Quoll on the offsets sites; (ii) performance and completion criteria for evaluating the management of the offset areas, and criteria for triggering remedial action; (iii) a program to monitor and report on the effectiveness of these measures, and progress against the performance and completion criteria; (iv) a description of potential risks to the successful implementation of the plan, a description of the measures that will be implemented to mitigate against these risks and a description of the contingency measures that will be implemented if defined triggers arise; and (v) details of who would be responsible for monitoring, reviewing, and implementing the plan.	Compliant	Following extensive consultation (Appendix A of BOMP), the BOMP received approval from DoEE on 8 March 2017. The BOMP was later granted approval by NSW DPE on 18 August 2017 (see **Appendix B**). Table 1 of the approved BOMP details where each requirement of Condition 3 is satisfied.

Ref	Condition	Status	Comment
	The approved BOMP must be implemented. The approved BOMP must be published on the approval holder's internet web site within 1 month of being approved. The most recently approved version of the BOMP must be published on the approval holder's internet web site for a period of 5 years after it is approved. Note: The Biodiversity Management Plan required under NSW Approval condition 29 may be used to satisfy this condition if it meets the above content and submission requirements.		
4	The approval holder must secure the lands identified as the *Offset Areas* at Schedule 2 (Figures 1- 6) of this notice as a biodiversity offset, in accordance with NSW Approval condition 28.	Compliant	All Biodiversity Offset Areas identified in Schedule 2 (Figures 1-6) of EPBC 2012/3678 conditions of approval are under the ownership of and management of BMC. All Biodiversity Offset Areas identified in EPBC 2012/3678 are managed in accordance with the BOMP. Discussions with NSW OEH, NPWS and DPIE continued throughout 2019 in relation to determining the appropriate long-term mechanism for biodiversity offset areas, in accordance with Condition 28 of SSD-5170.
5	In order to protect listed threatened species and listed threatened ecological communities, the approval holder must undertake rehabilitation activities in accordance with NSW approval conditions 44, 45 and 46.	Compliant	See Section 8 of the 2019 Annual Review.
6	The approval holder must undertake management and monitoring of water resources in accordance with NSW approval conditions 23 to 25.	Compliant	See Section 7 of the 2019 Annual Review.
7	In order to protect water resources, the approval holder must undertake rehabilitation activities in accordance with NSW approval conditions 44 and 46.	Compliant	See Section 8 of the 2019 Annual Review.
8	Upon request, the approval holder shall supply the groundwater monitoring data for the Bengalla Mine to the Department, NSW Government agencies, operators of the Mt Arthur and/or Mount Pleasant mines or other adjacent mine operators. A protocol for the supply of the data must be included in the approval holder's Water Management Plan.	Not Triggered	No request was made during the Reporting Period.

Ref	Condition	Status	Comment
9	The approval holder must make available to the Minister on request, all plans or programs and any review of plans or programs required under the Project Approval issued for the project under *the Environmental Planning and Assessment Act, 1979* (NSW), including the Biodiversity Management Plan, the Rehabilitation Management Plan and the Water Management Plan, which must include a Site Water Balance, Surface Water Management Plan and Groundwater Management Plan.	Not Triggered	No request was made during the Reporting Period. Approved Bengalla management plans are available on the BMC website.
10	Within 30 days after the commencement of the action, the approval holder must advise the Department in writing of the actual date of commencement.	Compliant	In an email dated 30 October 2015, BMC advised DoE that the Action commenced 1 October 2015.
11	The approval holder must maintain accurate records substantiating all activities associated with or relevant to these conditions of approval, including measures taken to implement the BOMP and VCPLMP, and make them available upon request to the Department. Such records may be subject to audit by the Department or an independent auditor in accordance with section 458 of the EPBC Act, or used to verify compliance with the conditions of approval. Summaries of audits will be posted on the Department's website. The results of audits may also be publicised through the general media.	Not Triggered	No request was made during the Reporting Period. **Appendix C** describes activities implemented under the BDMP.
12	By the end of March each year, the approval holder must publish a report on their website addressing compliance with each of the conditions of this approval, including implementation of the BOMP and VCPLMP as specified in the conditions. Documentary evidence providing proof of the date of publication must be provided to the Department at the same time as the compliance report is published. Note: The Annual Review required under NSW Approval condition 4 (of Schedule 5) may be used to satisfy this condition if it meets the above content and submission requirements.	Compliant	The 2019 Annual Review (to which this is an appendix) meets this requirement. NSW DPIE correspondence dated 26 March 2020 provided an extension in time for BMC to lodge the 2019 Annual Review to 10 April 2020. **Appendix A** of this report provides a summary of commitments from the BDMP and how each has been addressed in the Reporting Period. **Appendix B** of this report provides a summary of the commitments from the BOMP and how each has been addressed in the Reporting Period.
13	Non-compliance with any of the conditions of this approval must be reported to the Department within 2 business days of the approval holder becoming aware of the non-compliance.	Compliant	No non-compliances occurred during the Reporting Period
14	Upon the direction of the Minister, the approval holder must ensure that an independent audit of compliance with the conditions of approval is conducted and a report submitted to	Not Triggered	No request was made during the Reporting Period.

Ref	Condition	Status	Comment
	the Minister. The independent auditor must be approved by the Minister prior to the commencement of the audit. Audit criteria must be agreed to by the Minister and the audit report must address the criteria to the satisfaction of the Minister.		
15	If the approval holder wishes to carry out any activity other than in accordance with a Plan as specified in the conditions, the approval holder must submit to the Department for the Minister's written approval a revised version of that Plan. The approval holder must not commence the varied activity until the Minister has approved the varied Plan in writing. The Minister will not approve a varied Plan unless the revised Plan would result in an equivalent or improved environmental outcome over time. If the Minister approves the revised Plan, that Plan must be implemented in place of the Plan originally approved.	Not Triggered	No activities other than those described in the BDMP or BOMP have been required during the Reporting Period.
16	If the Minister believes that it is necessary or convenient for the better protection of listed threatened species and ecological communities to do so, the Minister may request that the approval holder make specified revisions to a Plan specified in the conditions and submit the revised Plan for the Minister's written approval. The approval holder must comply with any such request. The revised approved Plan must be implemented. Unless the Minister has approved the revised Plan then the approval holder must continue to implement the Plan originally approved, as specified in the conditions.	Not Triggered	No request was made during in the Reporting Period.
17	If, at any time after 5 years from the date of this approval, the approval holder has not commenced the action, then the approval holder must not commence the action without the written agreement of the Minister.	Not Triggered	In an email dated 30 October 2015, BMC advised DoE that the Action commenced 1 October 2015.

4 CONCLUSION

This review of the compliance status of the Bengalla operations during the 2019 Reporting Period against the EPBC 2012/6378 approval identified no non-compliances.

BMC will continue to review and document all relevant activities at Bengalla during the 2020 Reporting Period to assist in maintaining compliance with the EPBC 2012/6378 conditions.

Appendix A and **Appendix B** provide comment in regard to the implementation of BDMP and BOMP commitments during the Reporting Period.

Appendix A
BDMP Commitments

BMP Section	Control / Action	Timing / Trigger	Responsibility	Monitoring	Reporting	Status	Comment
4.1	Marking Limits of Clearing	Prior to clearing	Environmental Superintendent / Mining Manager / Surveyors	Inspection to be undertaken throughout duration of clearing.	Documented in GDP form and signed off.	Compliant	GDP boundaries are demarcated prior to clearing, where required.
4.2	Identification of suitable fauna relocation sites	Prior to clearing	Environmental Superintendent / Mining Manager	N/A	Documented in GDP form and/or pre-clearing report.	Compliant	Section 2.2.6 of **Appendix C**.
4.2	Pre-clearing surveys	Within one month prior to clearing	Suitably qualified person	Monitoring of fauna and flora (including Tiger Orchid, pest and weed species), habitat features and plant pathogens.	To be documented and signed off in the pre-clearing report. Results to be reported in Annual Review. OEH notified if new threatened species identified.	Compliant	Section 3.1 of **Appendix C**.
4.2	Clearing Surveys	Within one month of the pre-clearing survey	Suitably qualified person	Monitoring of fauna and flora (including Tiger Orchid, pest and weed species), habitat features and plant pathogens.	To be documented and in the clearing report. Results to be reported in Annual Review. OEH notified if new threatened species identified.	Compliant	Section 3.2 of **Appendix C**.

BMP Section	Control / Action	Timing / Trigger	Responsibility	Monitoring	Reporting	Status	Comment
4.3	Pre-clearing weed management	Prior to clearing and during clearing	Suitably qualified person and Environmental Superintendent	Inspection to be undertaken prior to clearing.	Documented and signed off in the GDP. Results to be reported in the Annual Review.	Compliant	Section 3.1.7 of **Appendix C**.
4.2.3	Relocation of habitat features to rehabilitation areas, adjacent vegetation or storage location.	During and/or after clearing	Environmental Superintendent	N/A	Documented and signed off in the GDP. Results to be reported in the Annual Review.	Compliant	Section 3.1.8 of **Appendix C**.
4.1	Inductions and Staff Education	Ongoing as part of the existing induction process or as part of toolbox talks prior to commencement of ground disturbance works.	Environmental Superintendent Safety Specialist	N/A	As per Induction procedure	Compliant	Inductions provided to BMC staff and contractors include a component on biodiversity management.
4.2	Vehicle Driving Policy and Signage	Ongoing or when wildlife crossing areas are identified	Mining Manager / Environmental Superintendent	N/A	N/A	Compliant	No wildlife crossing areas were identified by WSP during 2019. Site access tracks and controls are included in site procedures.
4.2.5	Seed collection	Targeted throughout year; and opportunistically before and immediately after clearing	Environmental Superintendent	Observations to be made throughout year to check flowering / seeding development of key species. Ensure correct licences are held by any contractors.	To be documented and reported in the Annual Review.	Compliant	Section 3.1.6 of **Appendix C**.

BMP Section	Control / Action	Timing / Trigger	Responsibility	Monitoring	Reporting	Status	Comment
4.3	Weed control	Ongoing over life of mine	Environmental Superintendent	Routine field observations in Weed Control Zones, including rehabilitation areas.	Results to be reported in Annual Review.	Compliant	Section 6.13 of the 2019 Annual Review.
4.4	Feral control	Ongoing over life of mine	Environmental Superintendent	Routine field observations in Weed Control Zones including rehabilitation areas	Results to be reported in Annual Review.	Compliant	Section 6.13 of the 2019 Annual Review.
5.0	Monitoring Program	Ongoing over life of mine	Ecologist	N/A	Results to be reported in the Annual Review	Compliant	Section 8 of the 2019 Annual Review.

Appendix B
BOMP Commitments

BOMP Section	Commitment	Status	Comment
Notification			
2.3	Following approval, all actions detailed within this BOMP will be implemented. Within one month of receiving approval, this BOMP will be made available to the public on the BMC website.	Compliant	At the time of this compliance review, the BOMP (with regulatory approval letters) (August 2017) was available on the BMC website.
Fencing, Gates and Signage			
8.1	Boundary fencing will remain around all BOS Areas and will be inspected annually to identify area that may require maintenance.	Complaint	Fencing and maintenance works were undertaken at Kenalea (approx. 3km) during 2018.
8.1	Internal fencing within Kenalea Properties and Black Mountain will be maintained (where appropriate) to allow for the management of controlled grazing in these properties.	Compliant	Fencing and maintenance works were undertaken at Kenalea (approx. 3km) during 2018.
8.1	Stock proof fencing will be utilised where existing fences are absent to protect sensitive areas.	Not Triggered	Not required during the Reporting Period.
8.1	Current gates for access to BOS Areas will be retained and kept locked.	Complaint	All gates to BOS area remained secured and locked during 2019.
8.1	BMC will install signage at the entrances to the BOS Area to inform the public of restricted access to properties.	Compliant	Restricted access signage at the entrances to the BOS Areas has been installed.
Controlled Activities			
8.2	All contractors, stakeholders and visitors to the BOS Areas will be inducted. The induction will include information on activities prohibited in BOS Area unless explicitly undertaken for the purposes of ongoing management.	Compliant	As required by internal polices, all staff, stakeholders and visitors working at Bengalla (or offsets) are required to be inducted prior to undertaking specified bodies of work.
Control Grazing			
8.3	Controlled grazing will only be permitted in Zone 1 and Zone 2 management areas.	Not Triggered	No controlled grazing undertaken during 2019.

BOMP Section	Commitment	Status	Comment
8.3	Best practice guidelines for control grazing will be implemented wherever control grazing is employed, including: • Providing adequate rest periods and adjusting rest periods to suit the recovery needs and growth rates of the desirable plants; • Targeting defined areas with high fuel loads or weed infestations; • Cattle stocking numbers kept below 4 Dry Sheep Equivalent; • Pre and Post-grazing monitoring; • Periods of grazing must be kept as short as practicable; and • Control grazing will not be conducted during declared drought periods.	Not Triggered	No cattle grazing undertaken during 2019.
8.3	Control grazing will be monitored against Trigger and Performance Criteria	Not Triggered	Trigger and Performance Criteria comment from Year 5 onwards.
8.3	Should monitoring results indicate that regeneration is not occurring naturally after Year 5, assisted revegetation will take place in areas that require this management action.	Not Triggered	Trigger and Performance Criteria comment from Year 5 onwards.
8.3	Stock will be excluded from riparian areas and will access water primarily from farm dams or water troughs.	Not Triggered	No cattle grazing undertaken during 2019.
8.3	Monitoring will be undertaken pre- and post-grazing with the use of photo-reference points. Areas subject to control grazing will be monitored as part of annual monitoring program.	Not Triggered	No cattle grazing undertaken during 2019.
Bushfire Management			

BOMP Section	Commitment	Status	Comment
8.4	BMC will take practicable steps to prevent the occurrence of bushfires on the land and minimise the spread of bushfire.	Compliant	Fire trail maintenance was completed on all BOS Areas during 2019. A small fire occurred on an adjoining property to Kenalea Offset during 2019. Bengalla assisted in the control of the fire and it was extinguished without impacting on BMC Offset area.
8.4	BMC will provide maps (including water fill points) and contact details of the properties to the RFS.	Compliant	Maps, keys and relevant contact information have previously been provided to local area RFS captains. Locations of water fill points were provided to the RFS in 2018 following the ground truthing of these locations.
Weed Control			
8.5	Weed management actions will target Weeds of National Significance and Noxious Weeds across BOS Area.	Complaint	HLM undertook a weed monitoring and control program in BOS areas during the Reporting Period. HLM records the location of weed identified during the program and records their location for GIS input (HLM, 2018). Section 6.13 of the 2019 Annual Review.
8.5	Weed control will focus on species that exclude or have the potential to exclude native species, disrupt the recruitment of native species or impede ecological progress.	Compliant	A summary of the weed monitoring and control program undertaken on BOS areas during the Reporting Period is provided in Section 6.13 of the 2019 Annual Review.
8.5	Weed management will be undertaken in accordance with the management principles listed in Section 8.5 of the BOMP.	Compliant	Weed management practices were undertaken in accordance with Section 8.5 of the BOMP.
8.5	The results and outcomes of weed management will be documented and analysed for each year in the Annual Review. This will include documentation of areas subject to weeding, techniques used, target species controlled, new species identified, chemicals used and revised approaches to weed control in light of learnings during the previous Reporting Period.	Compliant	A summary of the weed monitoring and control program is provided in Section 6.13 of the 2019 Annual Review.

BOMP Section	Commitment	Status	Comment
8.5	Weed infestation maps will be updated annually and annotated as required with information about previously implemented weed controls	Compliant	A weed monitoring and control program was undertaken in BOS areas during the Reporting Period. The location of weeds identified during the program was recorded for GIS input.
Feral Animal Control			
8.6	BMC will conduct an annual feral animal control program in conjunction with current Local Land Services programs	Compliant	A feral animal control program was undertaken during 2019. This was undertaken in line with neighbouring properties and the LLS Baiting program. Section 6.13 of the 2019 Annual Review.
8.6	Should any native fauna deaths be recorded during 1080 baiting and if sufficient carcass is available, the animal will be sent to a veterinarian to provide a cause of death. Should there be any evidence of poisoning of native animals	Not Triggered	No native fauna deaths were reported during the 2019 feral animal control program.
8.6	The results and outcomes of feral animal management will be documented for each year in the Annual Review. This will include documentation of the techniques used for each feral species, the quantity of bait material purchased and deployed, the areas subject to control, estimate of the numbers of animals culled, new species identified (if any) and any other chemicals used.	Complaint	A summary of the 2019 feral animal control program is provided in Section 6.12 and 6.13 of the 2018 Annual Review.
8.6	All personnel involve in feral animal management must hold relevant and valid licences/permits, including any relevant chemical licences for pesticide use or a firearms licence for shooting.	Compliant	Staff and/or contractors involved in feral animal management held all relevant licences and accreditation to undertake the feral control program works in 2019.
Maintenance Track Improvement and Additional Infrastructure			

BOMP Section	Commitment	Status	Comment
8.7	Maintenance of existing tracks and installation of additional infrastructure may be required to provide safe access to BOS Areas. Maintenance or construction works may result in minor/localised disturbance. BMC will ensure compliance with all legal and environmental protection measures prior to any significant disturbance.	Complaint	All existing access tracks in Kenalea and Black Mountain Offsets were assessed and regraded where required during 2019. Merriwa River Offset will be assessed in 2020.
	BMC will record and store all relevant GIS information related to the improvement or installation of additional infrastructure.	Complaint	BMC has recorded and stored all improvements and installation of additional infrastructure on the BMC GIS Database.
	BMC will undertake routine inspections and maintenance of BOS infrastructure (e.g. tracks, fence lines and gates).	Compliant	Inspections and maintenance of tracks was undertaken during 2019.
Contingency Measures			
8.8	Contingency measures will be utilised should monitoring indicate that performance.	Not Triggered	No contingency measures were required during the monitoring period.

Appendix C

Annual Clearing Report 2019

BENGALLA MINE

FEBRUARY 2020

2019 ANNUAL CLEARING REPORT

Question today
Imagine tomorrow
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2019 Annual Clearing Report

Bengalla Mine

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ABBREVIATIONS

BMC	Bengalla Mining Company Pty Ltd
Bengalla	Bengalla Mine
BMP	Biodiversity Management Plan
EEC	Endangered Ecological Community
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
GDP	Ground Disturbance Permit
TSC Act	*Threatened Species Conservation Act 1995*
BC Act	*Biodiversity Conservation Act 2016*

EXECUTIVE SUMMARY

The Bengalla Mining Company (BMC) Biodiversity Management Plan (BMP) (Bengalla Mining Company Pty Ltd 2017) provides a framework for biodiversity management, reporting and auditing of ecological issues across the Bengalla Mine. As part of the Ground Disturbance Permit (GDP) process, the BMP requires that ecological pre-clearing and clearing surveys be carried out by a suitably qualified person to minimise harm to native flora and fauna.

This report summarises the pre-clearing and clearing surveys completed at Bengalla between January and December of 2019 (reporting period). These works were in relation to:

- general pit progression and relocation of infrastructure
- construction of new infrastructure
- maintenance work.

During the reporting period, pre-clearing and clearing surveys were undertaken by appropriately qualified WSP ecologists in accordance with the BMP.

During pre-clearing surveys habitat features such as hollow trees were recorded, marked with the letter “H” (for habitat) and flagged with fluorescent tape. A total of 23 hollow-bearing / habitat trees were identified within GDP areas, 9 of which were felled in 2019. Salvaged habitat items were stockpiled, with the intention to relocate them to rehabilitation areas as the areas become available.

Immediately prior to the habitat trees being felled, the ecologist generally conducted a final pre-clearance survey and recorded the results as part of the clearance documentation. Following the felling of the tree, the ecologist investigated hollows for the presence of animals. During the 2019 clearing activities, no animals were relocated, 2 were observed but evaded capture and no animals died or were euthanised. No injured or immature animals were taken to either the local veterinary centre or directly to the wildlife care group Wildlife Aid, for treatment and/or rehabilitation.

Clearing activities undertaken throughout 2020 will continue to follow the methodology outlined within the BMP.

1 INTRODUCTION

1.1 EXISTING OPERATION

The Bengalla Mining Company (BMC) operates Bengalla Mine (Bengalla), an open cut coal mine located approximately four kilometres (km) west of Muswellbrook in the Upper Hunter Valley, NSW.

Activities associated with clearing operations during the reporting period relate to the construction of new infrastructure, the relocation and maintenance of infrastructure and service roads, in addition to an extension of the open cut mining pit towards the west.

1.2 AIMS AND OBJECTIVES

The aims of this annual clearing report are to detail the procedures and results for all pre-clearing and clearing operations completed at Bengalla in 2019, inclusive of:

- ecology pre-clearing surveys
- Stage 1 and Stage 2 clearing operations
- fauna handling and relocation
- habitat salvage and procedures.

2 METHODS

2.1 PERSONNEL

The contributors to the delivery of clearing operations and reporting, their qualifications and roles are listed in Table 2.1.

Table 2.1 Contributors and their role

NAME	QUALIFICATION	ROLE
Paul Shelley	Grad Cert Ornithology	Senior ecologist – pre-clearing surveys and spotter catcher
Troy Jennings	B. Biodiversity and Conservation M. Wildlife Management	Ecologist – pre-clearing surveys, spotter catcher and reporting
Gavin Shelley	B.Env Sc. Mgmt	Ecologist – pre-clearing surveys, spotter catcher and reporting
Nathan Cooper	B.Env.Sc. Grad Dip Ornithology	Senior Ecologist – technical review
Alex Cockerill	B.Sc. (Hons)	Principal Ecologist – project manager

All pre-clearing and clearing works were carried out under the appropriate licences, including a Scientific Licence as required under Clause 22 of the *National Parks and Wildlife Regulations 2002* and Section 132C of the *National Parks and Wildlife Act 1974*, and *Animal Research Authority* issued by the *Department of Primary Industries* as supplied in 2019.

2.2 PRE-CLEARING SURVEY PROCEDURE

The ecology pre-clearance surveys were conducted throughout 2019 and were completed in accordance with Section 4.2.1 of the BMP, which outlines management actions for vegetation pre-clearance procedures. The aims and objectives of the ecology pre-clearing survey include:

- detecting the presence/absence of threatened species and their habitat, including *Cymbidium canaliculatum* (Tiger Orchid)
- recording the presence of any fauna or flora species
- identification and demarcation of habitat trees, large logs and boulders
- identification and demarcation of salvageable material including hollow bearing trees, debris, and boulders
- searching for evidence of plant pathogen *Phytophthora cinnamomi*
- identification of appropriate fauna relocation sites for captured fauna species
- identification of plants suitable for seed collection
- identification of weed and pest species infestations.

Clearing boundaries were initially marked by a surveyor with survey pegs, generally incorporating spacing commensurate with visible line of sight. A hard copy map of the GDP area was also used as a reference when in the field.

It should be noted that throughout the year some GDP areas were assessed more than once due to only part of the GDP area being disturbed or an extended time frame between the initial pre-clearance inspection and commencement of works (Section 3.1).

2.2.1 FAUNA HABITAT IDENTIFICATION

Each clearing area was traversed by a field ecologist to identify important fauna habitat values, including:

- habitat trees, identified as any substantial non- hollow-bearing tree that either provided significant canopy cover and thus significant potential foraging resources, or was observed to contain nesting material
- hollow-bearing trees, which include any tree that was observed to contain a visible hollow or fissure that may support microhabitat values for native fauna.

All identified habitat, hollow-bearing or significant trees were marked with "H" (habitat tree) in high visibility paint as well as pink flagging tape to ensure dark trees, such as *Eucalyptus crebra*, were clearly marked prior to the commencement of clearing activities. The number of habitat, hollow-bearing or significant trees were recorded on field proforma.

2.2.2 SPECIES INVENTORY

All flora and fauna species identified during the ecology pre-clearance surveys and clearing surveys were recorded, and are presented in Appendix A and Appendix B.

2.2.3 SURVEYS FOR CYMBIDIUM CANALICULATUM

Trees within the clearing area were visually examined for the presence of *Cymbidium canaliculatum*, which is listed as an Endangered Population in the Hunter Catchment under the NSW *Biodiversity Conservation Act 2016* (BC Act).

2.2.4 SALVAGEABLE HABITAT MATERIAL

In accordance with the BMP, selected salvageable hollow logs and rocks were identified for later reuse in rehabilitation areas. Since materials vary in abundance and quality throughout Bengalla, ecologists are guided by the selection criteria for salvageable materials (as outlined in Table 5 of the BMP) when identifying logs and rocks for re-use.

2.2.5 SURVEYS FOR PHYTOPHTHORA CINNAMOMI

Vegetation health assessments were undertaken to detect the presence of the plant pathogen *Phytophthora cinnamomi*. This involved assessing vegetation for any visible signs of disease and conformation of its presence through laboratory analysis of soils and plant tissue if necessary.

2.2.6 FAUNA RELOCATION SITES

Sites suitable for the relocation of displaced native fauna were assessed prior to the commencement of the ecology pre-clearance survey. Relocation sites were assessed for habitat attributes which represent similar or commensurate habitat attributes as those within the clearing areas. All relocation sites are located outside of the clearing area and consist of the same vegetation community. Fauna relocation sites are illustrated on Figure 3.1 and Figure 3.2.

2.2.7 COLLECTION OF SEEDS FOR REHABILITATION PURPOSES

In accordance with the BMP, native trees and shrubs suitable for the harvesting and propagation of native seed for use in rehabilitation activities are required to be identified. Any areas of particularly high seed yield were marked on maps for future reference. During pre-clearing surveys throughout 2019, there was a lack of seed availability and as such no seed was collected for use in rehabilitation.

2.2.8 IDENTIFICATION OF WEED AND PEST SPECIES INFESTATIONS

Significant infestations of Weeds of National Significance (WONS) and noxious weeds identified during the field surveys were recorded and notified to BMC Environmental Department.

2.3 CLEARING PROCEDURE

In accordance with Section 4.2.2 of the BMP, clearing activities in 2019 were undertaken as a two-stage process as follows:

- **Stage 1 clearing** – removal of understory vegetation other than marked/flagged habitat features. Habitat trees, marked with an 'H', were left to stand overnight to enable any resident fauna to self-relocate into adjacent habitat.
- **Stage 2 clearing** – commenced no less than 24 hours following the completion of Stage 1 clearing. Felled habitat trees were left undisturbed over night to allow any undetected fauna further opportunity to relocate.

2.3.1 FAUNA HANDLING AND RELOCATION

The following information was recorded in relation to fauna species observed during the clearing activities:

- details of animals sighted, captured, relocated, injured, or killed as a result of vegetation clearing activities
- the relocation of fauna within designated relocation areas
- tree species used for breeding or roosting by fauna
- micro-habitat features of where the species was found on the tree.

Uninjured adult fauna were relocated into suitable habitat within designated relocation sites. Juvenile and injured fauna were passed on to the Muswellbrook Veterinary Hospital, local Wildlife Aid carers or euthanized in accordance with the Animal Research Authority Code of Practice.

3 RESULTS

3.1 ECOLOGY PRE-CLEARANCE SURVEYS

Pre-clearing surveys completed on behalf of BMC in 2019 are summarised in Table 3.1 and illustrated in Figure 3.1. It should be noted that throughout 2019, some GDP areas were assessed on more than occasion due to only part of the GDP area being disturbed, or an extended time frame between the initial pre-clearance inspection and commencement of works.

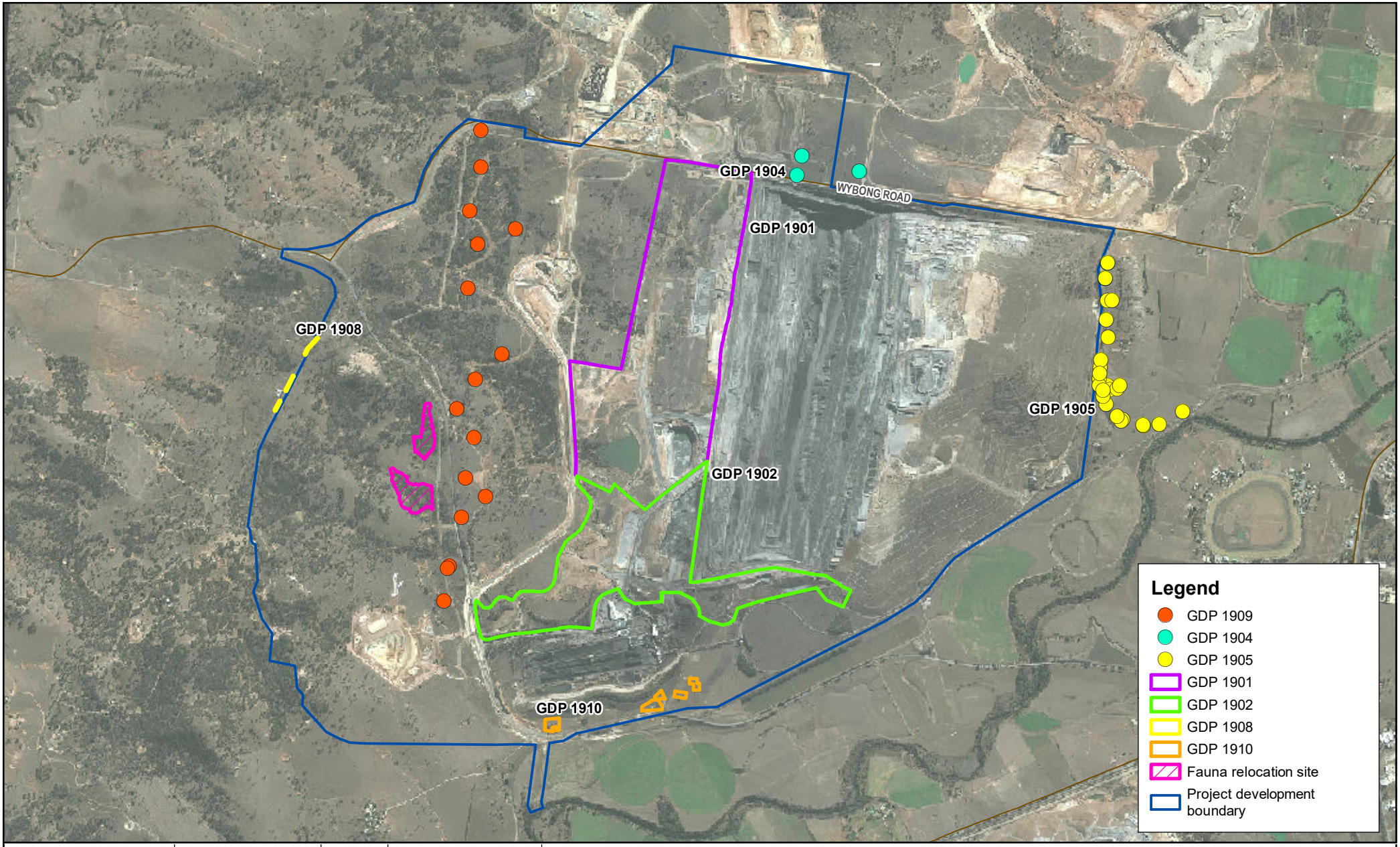
Table 3.1 Pre-clearing surveys completed in 2019

GROUND DISTURBANCE PERMIT AREA (GDP)	DATE PRE-CLEARANCE UNDERTAKEN	VEGETATION COMMUNITY
GDP 1901	03/01/2019	Derived Native and Exotic Grassland with isolated pockets of *Eucalyptus crebra* woodland.
GDP 1827 & 1907	12/02/2019	Derived Native and Exotic Grassland
GDP 1901, 1902, 1909	06/03/2019	GDP 1901 - Derived Native and Exotic Grassland with isolated pockets of Hunter Floodplain Red Gum Woodland. GDP 1902 - Derived Native and Exotic Grassland & scattered *Allocasuarina luehmannii.* GDP 1909 - Derived Native and Exotic Grassland with isolated pockets of *Eucalyptus crebra and Corymbia maculata* woodland.
GDP 1805, 1901, 1902	05/04/2019 & 15/04/2019	GDP 1805 - Derived Native and Exotic Grassland with isolated pockets of *Allocasuarina luehmannii* Regrowth. GDP 1901 - Derived Native and Exotic Grassland with isolated pockets of *Eucalyptus mollucana* Woodland. GDP 1902 – *Eucalyptus camaldulensis*
GDP 1902	24/07/2019	*Eucalyptus crebra Woodland*, planted *Corymbia maculata* and *Allocasuarina luehmannii*
GDP 1909	11/09/2019	Derived Native Grassland with isolated pockets of *Eucalyptus crebra, Eucalyptus mollucana* Woodland.

3.1.1 VEGETATION COMMUNITY STRUCTURE

The following vegetation communities were identified in the areas cleared in 2019:

- Derived Native and Exotic Grassland
- Derived Native and Exotic Grassland & scattered *Allocasuarina luehmannii.*
- Derived Native and exotic Grassland with isolated pockets of Hunter Floodplain Red Gum Woodland.
- Derived Native Grassland with isolated pockets of *Allocasuarina luehmannii* and *Eucalyptus crebra*
- Derived Native and Exotic Grassland with isolated pockets of *Eucalyptus mollucana.*
- Derived Native and Exotic Grassland some eucalypt regeneration
- *Eucalyptus camaldulensis*
- Derived Native and Exotic Grassland with pockets of *Eucalyptus crebra, Eucalyotus mollucana* Woodland.



Map: PS118424_ENV_001_B1	Author: suansrir
Date: 3/24/2020	Approved by: N.Cooper

Source: Bengalla Mine Satellite Orthophoto July 2018

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1:45,000

Coordinate system:
WGS 1984 Web Mercator Auxiliary Sphere
Scale ratio correct when printed at A4

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Bengalla Mining Company

www.wsp.com

BENGALLA MINE ANNUAL CLEARING REPORT 2019

Figure 3.1
Ground disturbance permit areas subject to pre-clearing in 2019

3.1.2 HABITAT, HOLLOW-BEARING AND SIGNIFICANT TREES

A total of 23 hollow-bearing/ habitat trees were identified within GDP areas subject to pre-clearing surveys.

3.1.3 SPECIES INVENTORY

3.1.3.1 FLORA

A total of 47 flora species were recorded in 2019 during pre-clearing surveys. Of these, 21 were introduced species (Appendix A).

3.1.3.2 FAUNA

A total of 41 fauna species were recorded in 2019 during pre-clearing surveys. Of these, four were introduced species (Appendix B). The Grey-crowned Babbler, which is listed as Vulnerable under the BC Act, was also recorded during pre-clearing surveys.

3.1.4 CYMBIDIUM CANALICULATUM SURVEYS

No *Cymbidium canaliculatum* were identified during pre-clearing surveys in 2019.

3.1.5 PHYTOPHTHORA CINNAMOMI SURVEYS

No evidence of disease or plant die-back was identified within GDP areas subject to pre-clearing surveys in 2019.

3.1.6 COLLECTION OF SEEDS FOR REHABILITATION PURPOSES

During pre-clearing surveys throughout 2019, no seed was identified within survey areas to be collected for use in rehabilitation. The lack of seed may be possibly due to dry conditions throughout the majority of 2019. Due to the lack of seeding from native flora species, no seed collection was conducted.

3.1.7 WEED SPECIES

Table 3.2 Noxious weeds recorded during pre-clearance surveys

SPECIES	CLASS	LEGAL REQUIREMENTS
Lycium ferocissimum (African Boxthorn)	3	This plant must be continually suppressed and destroyed and the plant must not be sold propagated or knowingly distributed
Olea europaea subsp. *cuspidata* (African Olive)	4	The growth of the plant must be managed that reduces its numbers, spread and incidence and continuously inhibits its reproduction and the plant must not be sold propagated or knowingly distributed
Opuntia stricta (Prickly Pear)	4	The growth of the plant must be managed that reduces its numbers, spread and incidence and continuously inhibits its reproduction and the plant must not be sold propagated or knowingly distributed

3.1.8 SALVAGEABLE MATERIAL

A total of nine habitat trees were felled during Stage 2 tree clearing operations, of which one was identified as potentially suitable for salvage. In addition, 20 lineal metres of hollow ground logs were identified for salvage in 2019.

3.2 STAGE 1 AND STAGE 2 CLEARING

The GDP areas cleared in full or in part in 2019 are summarised in Table 3.3 and illustrated on Figure 3.2. The removal of understory vegetation surrounding habitat trees was undertaken a minimum of 24 hours prior to habitat tree removal. Stage 2 clearing of habitat trees was undertaken over several periods in 2019, with a total of nine habitat trees felled.

Table 3.3 Stage 2 clearing completed in 2019

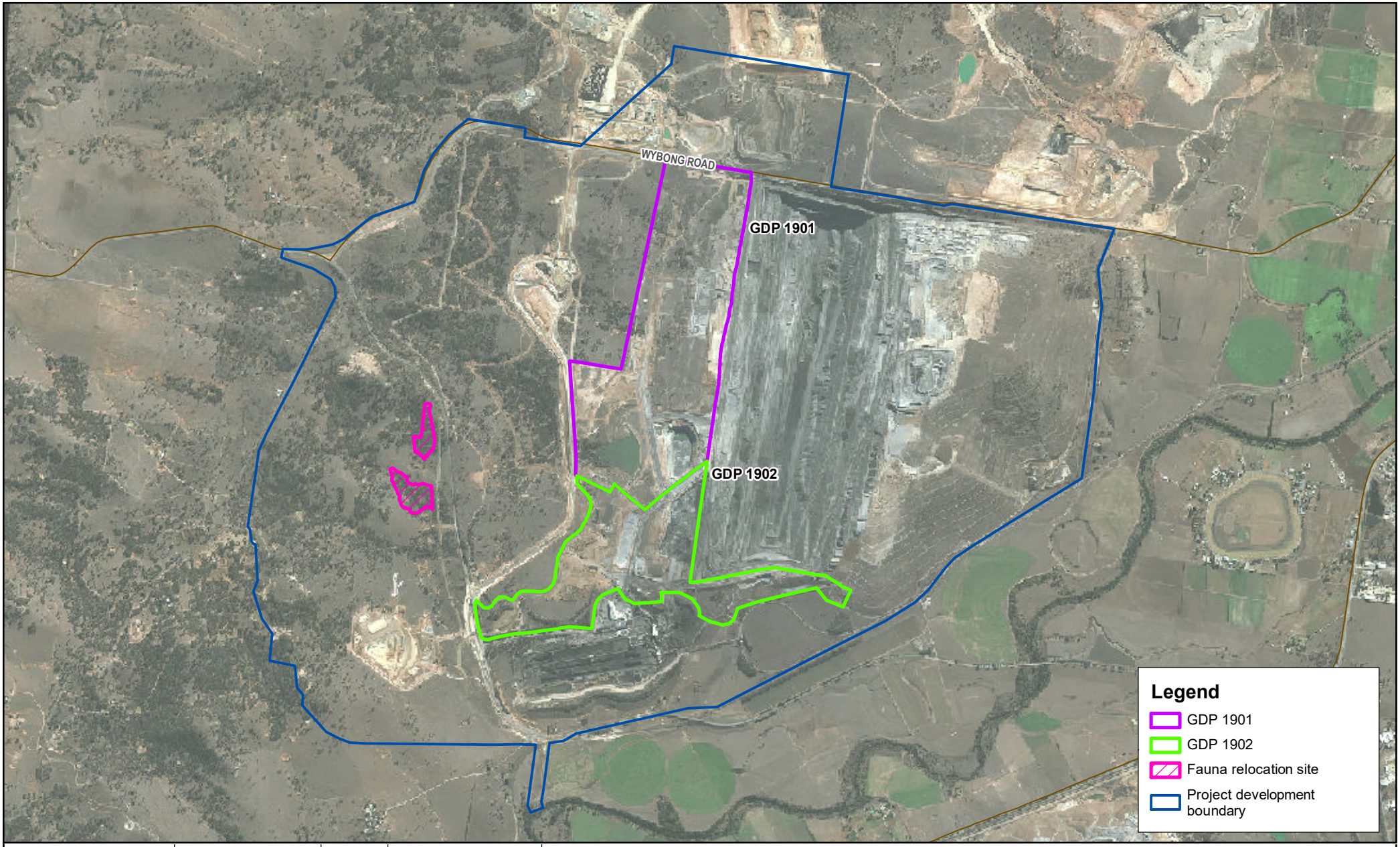
GROUND DISTURBANCE PERMIT AREA (GDP)	DATE STAGE 2 CLEARANCE UNDERTAKEN	VEGETATION COMMUNITY
GDP 1901	5/4/2019 & 15/4/2019	Derived Native and Exotic Grassland & scattered *Allocasuarina luehmannii.* Derived Native and Exotic Grassland with isolated pockets of *Eucalyptus mollucana* Woodland.
GDP 1902	5/4/2019	Derived Native and Exotic Grassland with isolated pockets of Hunter Floodplain Red Gum Woodland.

Prior to the habitat trees being felled, the trees were visually inspected to identify signs of fauna utilisation. Habitat trees were gently shaken prior to felling to encourage any resident fauna to vacate any fissure and/ or hollow. Habitat trees were then felled sequentially when directed by the supervising ecologist.

Immediately following the felling of each habitat tree, the supervising ecologist inspected the trees for remaining fauna. Tree hollows were inspected using a hand-held torch. Felled habitat trees were left undisturbed over night to allow any undetected fauna further opportunity to relocate. The habitat trees were then stockpiled for utilisation in rehabilitation areas.

Photo 3.1 Stage 2 – clearing – GDP 1901

Photo 3.2 Stage 2 – clearing – post felling



Map: PS118424_ENV_002_A1	Author: SuansriR
Date: 10/02/2020	Approved by: N.Cooper

Source: Bengalla Mine Satellite Orthophoto July 2018

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Coordinate system:
WGS 1984 Web Mercator Auxiliary Sphere
Scale ratio correct when printed at A4

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BENGALLA MINE ANNUAL CLEARING REPORT 2019

Figure 3.2
Ground disturbance permit areas cleared in 2019

3.2.1 FAUNA RECORDED AND RELOCATED

Fauna were handled in accordance with the Animal Research Authority Code of Practice. Details on fauna encountered during 2019 clearing activities are outlined below and are presented in Appendix B. A total of 41 species of fauna were observed whilst onsite at Bengalla. Of these 41 species, only two skinks were recorded using habitat trees to be removed/impacted within the GDP areas (Table 3.4). The remaining species observed within the GDP areas were birds. During the 2019 clearing operations:

- no animals required relocation
- no animals were killed
- no animals were euthanised
- no animals required veterinarian treatment or rehabilitation.

Table 3.4 Fauna recorded during Stage 2 clearing operations in 2019

GUILD	NUMBER OF INDIVIDUALS RECORDED				
	Relocated	**Observed**	**Injured**	**Dead/Euthanised**	**Taken to Wildlife carer**
Reptiles	0	2	0	0	0
Microchiropteran bats / mammals	0	0	0	0	0
Amphibians	0	0	0	0	0
Birds	0	21	0	0	0
Total	0	23	0	0	0

3.2.2 SALVAGE OF HABITAT RESOURCES

Pre-clearing surveys and clearing operations identified one tree and 20 lineal metres of hollow ground logs as potentially suitable for salvage and reuse in rehabilitation works. Salvaged habitat items have been stockpiled, with the intention to relocate within rehabilitation areas as work progresses.

4 CONCLUSION

This report documents the pre-clearing and clearing activities completed at Bengalla Mine in 2019. In 2019, pre-clearing and clearing surveys at Bengalla were undertaken by appropriately qualified WSP ecologists to allow for the safe removal and relocation of native flora and fauna, where practicable.

During Stage 2 clearing operations, no animals required relocation, were killed or euthanised, or required veterinarian treatment or rehabilitation. However, two reptiles were observed using habitat trees but evaded capture.

A total of 23 hollow-bearing/ habitat trees were identified within GDP areas, nine of which were felled in 2019. In total, one hollow-bearing/ habitat tree and 20 lineal metres of hollow ground logs were identified as potentially suitable for salvage and have been stockpiled, with the intention to relocate within rehabilitation areas as work progresses.

Clearing activities undertaken throughout 2020 will continue to follow the methodology outlined within the BMP.

5 LIMITATIONS

This Report is provided by WSP Australia Pty Limited (*WSP*) for Bengalla Mining Company (*Client*) in response to specific instructions from the Client and in accordance with WSP's proposal dated 05/12/2017 and agreement with the Client dated 13/01/2020 (*Agreement*).

5.1 PERMITTED PURPOSE

This Report is provided by WSP for the purpose described in the Agreement and no responsibility is accepted by WSP for the use of the Report in whole or in part, for any other purpose (*Permitted Purpose*).

5.2 QUALIFICATIONS AND ASSUMPTIONS

The services undertaken by WSP in preparing this Report were limited to those specifically detailed in the Report and are subject to the scope, qualifications, assumptions and limitations set out in the Report or otherwise communicated to the Client.

Except as otherwise stated in the Report and to the extent that statements, opinions, facts, conclusion and / or recommendations in the Report (*Conclusions*) are based in whole or in part on information provided by the Client and other parties identified in the report (*Information)*, those Conclusions are based on assumptions by WSP of the reliability, adequacy, accuracy and completeness of the Information and have not been verified. WSP accepts no responsibility for the Information.

WSP has prepared the Report without regard to any special interest of any person other than the Client when undertaking the services described in the Agreement or in preparing the Report.

5.3 USE AND RELIANCE

This Report should be read in its entirety and must not be copied, distributed or referred to in part only. The Report must not be reproduced without the written approval of WSP. WSP will not be responsible for interpretations or conclusions drawn by the reader. This Report (or sections of the Report) should not be used as part of a specification for a project or for incorporation into any other document without the prior agreement of WSP.

WSP is not (and will not be) obliged to provide an update of this Report to include any event, circumstance, revised Information or any matter coming to WSP's attention after the date of this Report. Data reported and Conclusions drawn are based solely on information made available to WSP at the time of preparing the Report. The passage of time; unexpected variations in ground conditions; manifestations of latent conditions; or the impact of future events (including (without limitation) changes in policy, legislation, guidelines, scientific knowledge; and changes in interpretation of policy by statutory authorities); may require further investigation or subsequent re-evaluation of the Conclusions.

This Report can only be relied upon for the Permitted Purpose and may not be relied upon for any other purpose. The Report does not purport to recommend or induce a decision to make (or not make) any purchase, disposal, investment, divestment, financial commitment or otherwise. It is the responsibility of the Client to accept (if the Client so chooses) any Conclusions contained within the Report and implement them in an appropriate, suitable and timely manner.

In the absence of express written consent of WSP, no responsibility is accepted by WSP for the use of the Report in whole or in part by any party other than the Client for any purpose whatsoever. Without the express written consent of WSP, any use which a third party makes of this Report or any reliance on (or decisions to be made) based on this Report is at the sole risk of those third parties without recourse to WSP. Third parties should make their own enquiries and obtain independent advice in relation to any matter dealt with or Conclusions expressed in the Report.

5.4 DISCLAIMER

No warranty, undertaking or guarantee whether expressed or implied, is made with respect to the data reported or the Conclusions drawn. To the fullest extent permitted at law, WSP, its related bodies corporate and its officers, employees and agents assumes no responsibility and will not be liable to any third party for, or in relation to any losses, damages or expenses (including any indirect, consequential or punitive losses or damages or any amounts for loss of profit, loss of revenue, loss of opportunity to earn profit, loss of production, loss of contract, increased operational costs, loss of business opportunity, site depredation costs, business interruption or economic loss) of any kind whatsoever, suffered on incurred by a third party.

BIBLIOGRAPHY

- Bengalla Mining Company Pty Ltd (2017). Bengalla Mine - Biodiversity Management Plan. Hansen Bailey on behalf of Bengalla Mining Company Pty Ltd.

APPENDIX A

RECORDED FLORA

Table A.1 Recorded flora

SCIENTIFIC NAME	COMMON NAME	INTRODUCED	EPBC ACT[1]	BC ACT[2]
Acacia sp.	Wattle			
Allocasuarina luehmannii	Bulloak			
Angophora floribunda	Rough-barked Apple			
Austrodanthonia caespitosa	Wallaby Grass			
Bidens pilosa	Cobblers Pegs	*		
Brachychiton populneus	Kurrajong			
Bursaria spinosa	Blackthorn			
Carthamus lanatus	Saffron Thistle	*		
Cheilanthes distans	Bristly Cloak Fern			
Chloris gayana	Rhodes Grass	*		
Chrysocephalum apiculatum	Golden Buttons			
Conyza sp.	Fleabane	*		
Cymbopogon refractus	Barbed-wire Grass			
Cynodon sp.	Couch	*		
Dichondra repens	Kidney Weed			
Digitaria sp.	–			
Eragrostis curvula	African Lovegrass	*		
Eucalyptus camaldulensis	River Red-Gum			
Eucalyptus crebra	Narrow-leaved Ironbark			
Eucalyptus moluccana	Grey Box			
Eucalyptus tereticornis	Forest Red Gum			
Glycene sp.	-			
Gomphocarpus fruticosus	Balloon Cotton	*		
Hypochaeris radicata	Catsear	*		
Lomandra sp.	-			
Lycium ferocissimum	African Boxthorn	*		
Magenta sp.	Geranium			
Medicago sp.	-			
Melinis repens	Red-natail Grass	*		
Onopordum acanthium	Scotch Thistle	*		
Opuntia stricta	Prickly Pear	*		
Panicum sp.	Panic Grass			

SCIENTIFIC NAME	COMMON NAME	INTRODUCED	EPBC ACT[1]	BC ACT[2]
Paspalum sp.	Paspalum	*		
Plantago sp.	Plantain	*		
Ricinus communis	Castor Oil	*		
Rumex sp.	-	*		
Salsola australis	Soft Roly-poly			
Schinus sp.	Peppercorn			
Sclerolaena birchii	Galvanised Burr			
Senecio madagascariensis	Fireweed	*		
Sida rhombifolia	Paddys Lucerne	*		
Sisymbrium officinale	Mustard Weed	*		
Solanum sp.	–			
Taraxacum officinale	Common Dandelion	*		
Themeda triandra	Kangaroo Grass			
Verbena rigida		*		
Wahlenbergia sp.	Blue Bells			

(1) *Environment Protection and Biodiversity Conservation Act*

(2) *Biodiversity Conservation Act 2016*.

APPENDIX B

RECORDED FAUNA

Table B.1 Recorded fauna

SCIENTIFIC NAME	COMMON NAME	INTRODUCED	EPBC ACT[1]	BC ACT[2]
Amphibians (1)				
Limnodynastes tasmaniensis	Spotted Marsh Frog			
Birds (33)				
Acanthiza chrysorrhoa	Yellow-rumped Thornbill			
Acridotheres tristis	Common Myna	*		
Aquila audax	Wedge-tailed Eagle			
Corcorax melanorhamphos	White-winged Chough			
Cormobates leucophaeus	White-throated Treecreeper			
Corvus coronoides	Australian Raven			
Cracticus tibicen	Australian Magpie			
Cracticus nigrogularis	Pied Butcherbird			
Dicaeum hirundinaceum	Mistletoebird			
Egretta novaehollandiae	White-faced Heron			
Elanus axillaris	Black-shouldered Kite			
Eolophus roseicapilla	Galah			
Falco berigora	Brown Falcon			
Grallina cyanoleuca	Magpie Lark			
Hirundo neoxena	Welcome Swallow			
Malurus cyaneus	Superb Fairywren			
Manorina melanocephala	Noisy Miner			
Ocyphaps lophotes	Crested Pigeon			
Pardalotus punctatus	Spotted Pardalote			
Pardalotus striatus	Striated Pardalote			
Pelecanus conspicillatus	Australian Pelican			
Petrochelidon ariel	Fairy Martin			
Philemon corniculatus	Noisy Friarbird			
Platycerus eximius	Eastern Rosella			
Pomatostomus temporalis temporalis	Grey-crowned babbler			V
Psephotus haematonotus	Red-rumped Parrot			
Rhipidura leucophrys	Willie Wagtail			
Sturnus vulgaris	Common Starling	*		
Streptopelia chinensis	Spotted Dove			

SCIENTIFIC NAME	COMMON NAME	INTRODUCED	EPBC ACT[1]	BC ACT[2]
Taeniopygia bichenovii	Doubled-barred Finch			
Taeniopygia guttata	Zebra Finch			
Threskiornis spinicollis	Straw-necked Ibis			
Vanellus miles	Masked Lapwing			
Mammals (6)				
Macropus giganteus	Eastern-grey Kangaroo			
Macropus robustus	Common Wallaroo			
Macropus rufogriseus	Red-necked Wallaby			
Oryctolagus cuniculus	Rabbit	*		
Vulpes vulpes	Fox	*		
Wallabia bicolor	Swamp Wallaby			
Reptiles (1)				
Cryptoblepharus virgartus	Wall Skink			

(1) *Environment Protection and Biodiversity Conservation Act*

(2) *Biodiversity Conservation Act 2016*.

APPENDIX C

SCIENTIFIC LICENCES

NSW National Parks & Wildlife Service
Office of Environment & Heritage

SCIENTIFIC LICENCE

Biodiversity Conservation Act 2016

Name and postal address of principal licensee	Nominated premises (where appropriate)
Mr Alex Cockerill Parsons Brinckerhoff Se 1 L 3 51-55 Bolton St NEWCASTLE NSW 2300	

Your licence number is: SL100630

This licence is valid from: 01 February 2019

This licence will expire on: 31 May 2020

Additional authorisations:

Project Title: General flora and fauna surveys for environmental impact assessments

This class of biodiversity conservation licence granted under Part 2 of the *Biodiversity Conservation Act 2016* authorises the following activities: Pick protected plants for identification purposes; Harm, trap, release protected animals.

This licence authorises the principal licensee and any associates named in **Attachment A** to conduct those activities authorised above, to those species, communities or materials listed in **Attachment B**, at the locations specified in **Attachment C** of this licence.

This licence also authorises the principal licensee to conduct research on National Park estate under clause 23 of the *National Parks and Wildlife Regulation 2009 (*NPW Reg*),* where this forms part of a project approved by a delegated officer of the Office of Environment and Heritage (OEH).

This licence is granted subject to the provisions of *Biodiversity Conservation Act 2016*, Biodiversity Conservation Regulation 2017, the general conditions listed below, any special conditions as may be notified in writing to the licensee by the Environment Agency Head of the Department of Planning and Environment or a 'delegated officer' of OEH ("delegated officer") and the OEH "Scientific Licensing Policy".

.....

Signature of Delegated Officer

Date: 03 June 2019

.....

Signature of Principal Licensee*

Date: 3/6/2019

* This licence is not valid unless it is signed by the principal licensee. By signing this licence the licensee agrees that they have read, understood and agree to comply with all of the conditions listed on the licence.

LICENCE CONDITIONS

Specific

a) Work on NPWS estate may only be conducted under a NPWS contract or with the prior written consent of the relevant area manager.
b) The licensee must comply with any restrictions or conditions imposed by the NPWS local area office.
c) Animals are to be managed in accordance with a current Animal Care and Ethics Committee approval and released at the point of capture.
d) The NPWS Frog hygiene protocol is to be followed when working in habitat likely to contain frogs.
e) Clean, sharp secateurs are to be used to sample plants.

General

1. Only the person/s named on the licence, or authorised to operate under the terms and conditions of the licence, may undertake the work. This licence is not transferable except with written confirmation from the Wildlife Team ("WT").
2. The principal licensee may vary the associated parties authorised during the term of the licence only by maintaining a signed and dated register of the associates. A copy of the register must be provided to the WT at renewal or on request by an authorised officer.
3. The licensee must carry this licence at all times whilst work is being undertaken in the field. Where multiple parties are listed, photocopies will suffice provided some other proof of identity can be provided e.g. Driver's licence.
4. The licensee must provide other parties authorised to conduct the specified activities with a copy of this licence.
5. The licensee must obtain the permission of the owner, manager or occupier of lands upon which research is conducted **(for persons working on NPWS lands see also conditions 18-20).**
6. Specimens or samples taken under this licence must not be sold, bartered, given, lent or promised to others without the prior written approval of the Environment Agency Head or delegate.
7. Collections or research shall, as far as is possible, be carried out away from the view of the public.
8. The licensee shall indemnify and keep indemnified, so far as the law allows, Her Majesty Queen Elizabeth II, the Minister administering the *Biodiversity Conservation Act 2016*, the Government of New South Wales, the Environment Agency Head of the Department of Planning and Environment, and the National Parks and Wildlife Service and its servants, agents or contractors (herein jointly and severally referred to as "OEH"), FROM AND AGAINST all lawful suits, claims, demands, proceedings, costs, (including solicitor - client costs) and expenses of any nature whatsoever which the OEH may suffer or incur in connection with loss of life, personal injury or damage to property from an occurrence in connection with any land, premises, vehicle or other mode of conveyance or other item under the care, control or management of the OEH, and arising either directly or indirectly from any negligent or wrongful act or omission of the licensee in the course of an operation or activities pursuant to the licence or otherwise.

Reporting requirements

9. The licensee undertaking survey, research or other biodiversity assessment works must provide a full report of the work carried out under this licence online via Bionet using the most recent version of the Atlas data sheet available at www.environment.nsw.gov.au/resources/atlas/AtlasDatasheet.xls.
10. The licensee must ensure that all coordinates provided as part of the data submitted to OEH include a measurement of the accuracy of those coordinates. Coordinate accuracy should not be greater than zero but no greater than **100m**.
11. The licensee must submit reports online using a secure login acquired from OEH Biodiversity Information Systems. Contact bionet@environment.nsw.gov.au for account details and guidelines.
12. Licensees undertaking work that cannot be supplied in the above format must provide a report to the OEH specifying:
    a. Title of the project
    b. A precise description of the locality including geographic coordinates where practical
    c. Results of the project
13. The licensee may also be required to complete a metadata proforma for works on NPWS estate.
14. Licensees undertaking permanent/semi-permanent marking, banding or tagging must provide marking details (e.g. tag number, date, location, species) to BWT with any renewal application.
15. The licensee must provide a copy of any final report and/or any scientific papers relating to this work to the Environment Agency Head (marked "attention Wildlife Team") when the study is completed.

Additional reporting requirements for consultants

16. Licences granted to consultants and consulting companies for survey and assessment purposes are required to provide a list of the sites where work was conducted and a list of the reports produced. A copy of these reports may be requested.
17. Reports in accordance with licence conditions 9. to 16. must be provided annually, from the "valid from" date of the licence.

Projects undertaken on NPWS managed land

18. The licensee may only undertake works in NPWS managed lands with the prior written approval of the relevant Area Manager and comply with any imposed restrictions or conditions.
19. The licensee must maintain regular contact with the NPWS Area office throughout the project as park management activities and other events may affect access to research locations. Access to reserves may be restricted during management activities or while the reserve is closed for other reasons.
20. The licensee must only use vehicles on public roads unless otherwise approved by an authorised officer.

It is an offence under the *Biodiversity Conservation Act 2016* to breach any of the conditions of this licence, issue any false receipt, make a false entry in any record, or otherwise keep a false record or provide false or misleading records or information.

Records, notifications and inquiries should be directed to:

Wildlife Team
Office of Environment and Heritage
PO Box 1967
Hurstville NSW 1481

Phone: 02 9585 6406
Fax: 02 9585 6401
Email: scientific.licensing@environment.nsw.gov.au

Additional Information for licence holders

It is the licence holder's responsibility to ensure they are familiar with any other relevant statutory or regulatory provisions relevant to this licence such as the ***National Parks and Wildlife Regulation 2009***, particularly with respect to activities undertaken on NPWS managed lands, the ***Firearms Act 1999,*** any local council, building and health requirements and codes of practice under the ***Prevention of Cruelty to Animals Act 1979***, as well as specific requirements under the ***Animal Research Act 1985***. On the expiration of your permit the onus is on you to renew. While OEH forwards renewal notices to permit holders, it will not be responsible for the non-receipt of such a notice.

It is the licensee's responsibility to inform themselves of any likely hazards and ensure that appropriate risk management and emergency procedures are developed and in place for works undertaken on NPWS managed lands. The risk management and emergency procedures will also extend to cover OEH staff and any other third parties which may be impacted by the licensee's works. OEH accepts no responsibility for any event which results in the licensee suffering any loss. The licensee will be held liable for any damages resulting from their works which have impacted on OEH staff or any other third party.

Attachment A

Other parties

In addition to the principal licensee identified above, the following parties are also authorised under this licence:

Title	Name
Ms	Tanya Bangel
Mr	Nathan Cooper
Ms	Selga Harrington
Mr	Robert Harrison
Mr	Troy Jennings
Mr	Steve Lyngoln
Mr	Nicholas McCaffrey
Mr	Justin Pegg
Mr	Allan Richardson
Ms	Lauren Smith
Mr	Mark Stables
Ms	Zoe Steven
Ms	Jessica Wait
Ms	Clementine Watson
Mr	Sam Wilson
Ms	Julia Wyllie

Attachment B

Licence Class

Class Name	Class Start Date
Ecological survey/consultancy	30/01/2012

Focus of work

This project authorises the licensee to Harm, Pick, collect or otherwise interact with the following species, communities or materials as described on this licence in the listed quantities:

Species Type	Family	Genus	Species	Species Code	Common Name	Target Parts	Units	Qty
FA FL	ALL FAUNA ALL FLORA				ALL FAUNA ALL FLORA	Individuals Individuals	Sites Sites	

Attachment C

Project location

This project is authorised in the following areas:

NPWS Estate

Tenure Type	Branch	Region	Area	Park
NPWS Estate				All NPWS estate under NPWS contract or with Area Manager approval.

Other

Tenure Type	State Forests	LLS Region	LGA	Lot Sec DP	Other Location
Other					All non-NPWS estate with land manager approval.

ANIMAL RESEARCH AUTHORITY

Issued by

THE SECRETARY
NSW DEPARTMENT OF PLANNING, INDUSTRY & ENVIRONMENT

Principal Investigator: **Mr Alex Cockerill**
Principal Ecologist
WSP Australia Pty Ltd
PO Box 1162
NEWCASTLE NSW 2300

Associate Investigators:
Mr Nathan Cooper
Mr Troy Jennings
Mr Rob Harrison
Ms Selga Harrington
Mr Allan Richardson
Ms Julia Wylie
Mr Paul Shelley
Mr Sam Wilson
Mr Mark Stables
Ms Tanya Bangel
Ms Clementine Watson
Mr Gavin Shelley

are authorised to conduct the following research

GENERAL FAUNA SURVEYS ASSOCIATED WITH ENVIRONMENTAL IMPACT ASSESSMENT

Being fauna survey for environmental impact assessments

Location: Various locations throughout New South Wales

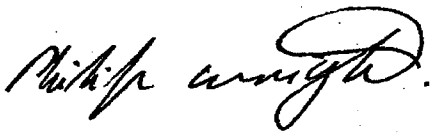
As approved by and in accordance with the
ANIMAL CARE AND ETHICS COMMITTEE OF THE SECRETARY NSW DEPARTMENT OF PLANNING, INDUSTRY & ENVIRONMENT

Being animal research carried out in accordance with the Code of Practice, for a recognised research purpose and in connection with animals (other than exempt animals) that have been obtained from the holder of an animal suppliers licence.

Approved with the following conditions:-

1 The Secretary's Animal Care and Ethics Committee is to be informed of the specific location of each study and the procedures to be undertaken prior to work being commenced;
2 The Secretary's Animal Care and Ethics Committee must be notified if toe clipping is undertaken, include species and number of animals;
3 Traps must be cleared within two hours of sunrise;
4 The number of nights trapping is limited to four consecutive nights at any one site.

This authority remains in force from **6 June 2019** to **6 June 2020** unless suspended, cancelled or surrendered



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CHIEF SCIENTIST BRANCH

NSW Department of Primary Industries (DPI), an office of NSW Department of Planning, Industry & Environment (DPIE)
*Delegate of the Secretary of the Department of Planning, Industry & Environment (DPIE)

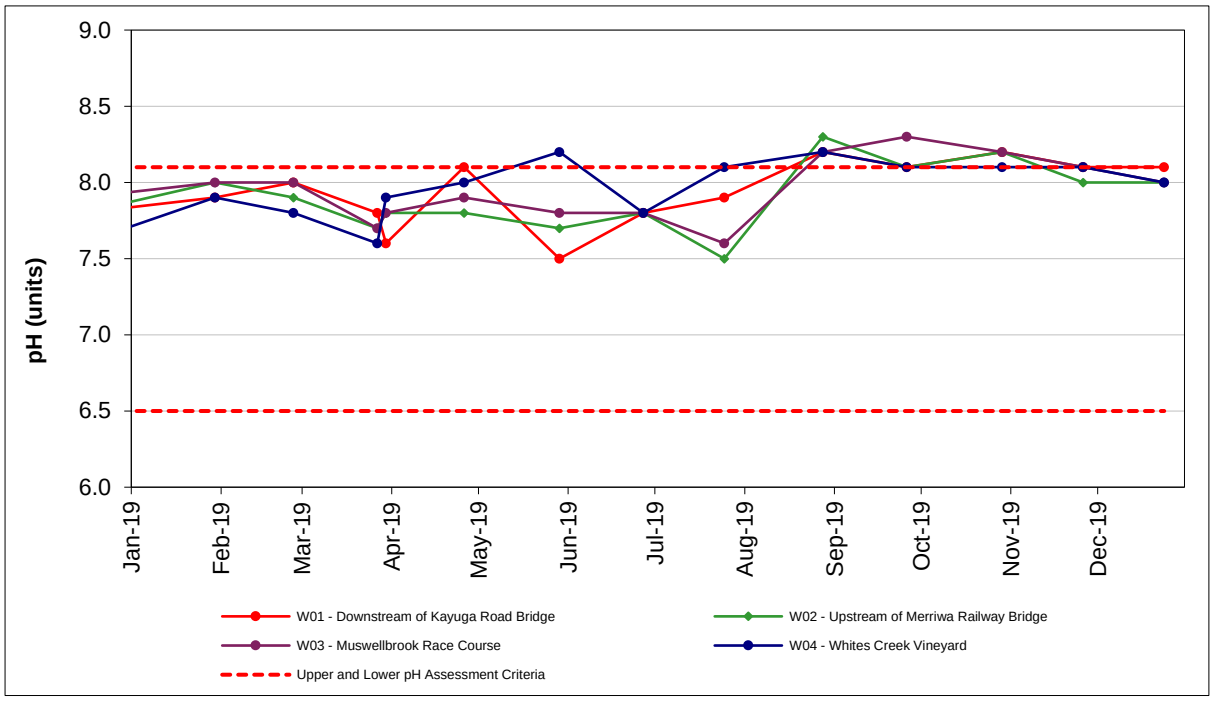
APPENDIX F

Surface Water Monitoring Summary

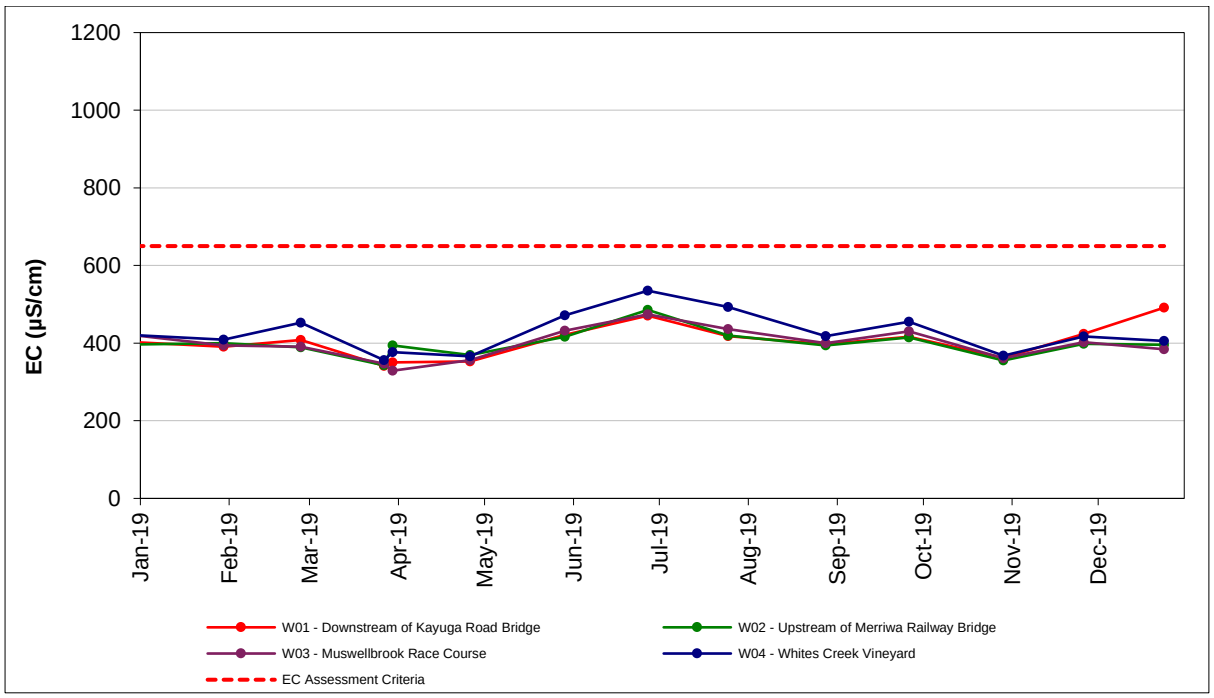
Table F1
Hunter River (W01 – W04) Surface Water Monitoring Results 2019

	Criteria	30-Jan-19	26-Feb-19	27-Mar-19	30-Mar-19*	26-Apr-19	29-May-19	27-Jun-19	25-Jul-19	28-Aug-19	26-Sep-19	29-Oct-19	26-Nov-19	24-Dec-19
W01														
pH	6.5 – 8.1	7.9	8.0	7.8	7.6	8.1	7.5	7.8	7.9	8.2	8.1	8.2	8.1	8.1
TSS (mg/L)	40	8	9	26	492	<5	<5	<5	7	<5	6	20	<5	12
EC (µS/cm)	650	391	408	341	350	353	421	471	418	397	416	362	424	491
W02														
pH	6.5 – 8.1	8.0	7.9	7.7	7.8	7.8	7.7	7.8	7.5	8.3	8.1	8.2	8.0	8.0
TSS (mg/L)	40	<5	13	21	264	14	<5	8	6	<5	<5	15	<5	<5
EC (µS/cm)	650	400	389	343	394	369	416	486	420	394	415	355	398	396
W03														
pH	6.5 – 8.1	8.0	8.0	7.7	7.8	7.9	7.8	7.8	7.6	8.2	8.3	8.2	8.1	8.0
TSS (mg/L)	40	<5	17	13	37	17	<5	<5	6	8	<5	19	<5	7
EC (µS/cm)	650	394	391	347	329	356	432	474	436	400	430	361	402	384
W04														
pH	6.5 – 8.1	7.9	7.8	7.6	7.9	8.0	8.2	7.8	8.1	8.2	8.1	8.1	8.1	8.0
TSS (mg/L)	40	17	10	29	22	26	15	<5	11	<5	<5	19	<5	<5
EC (µS/cm)	650	409	453	356	377	366	472	535	493	418	455	368	417	406

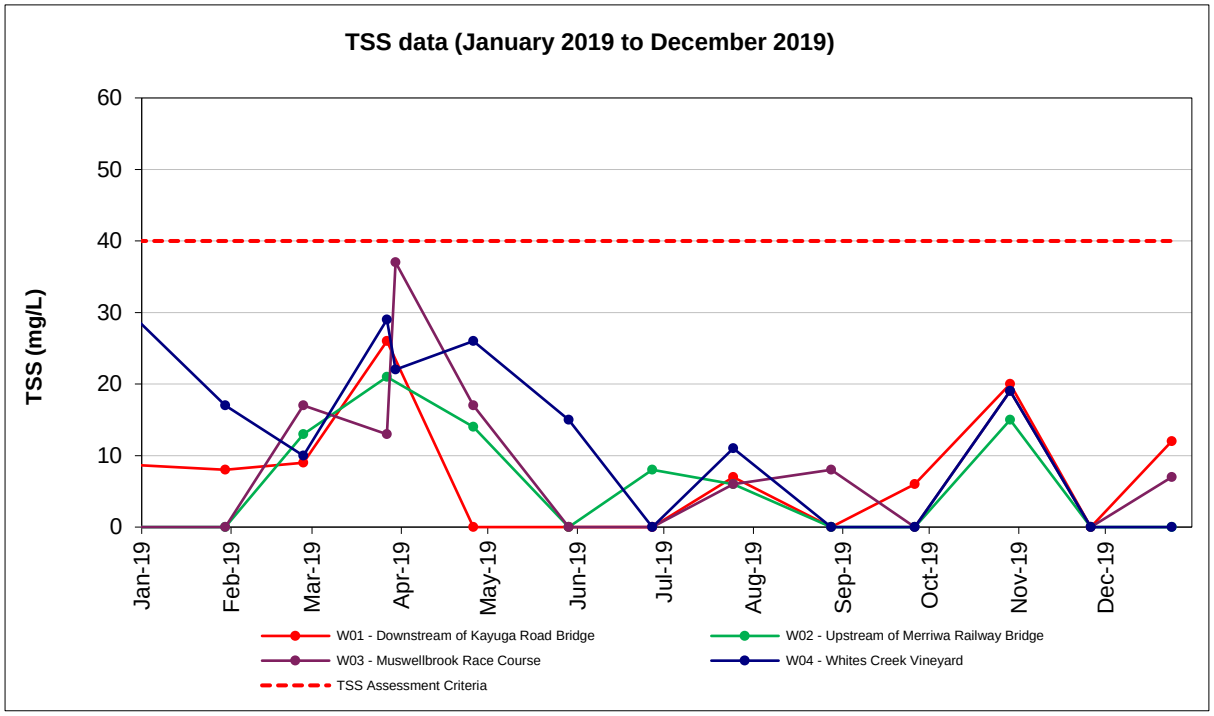
Data sourced from AECOM.
**Rain event occurred.*



Graph F1
Hunter River pH Results 2019



Graph F2
Hunter River EC Results 2019



Graph F3

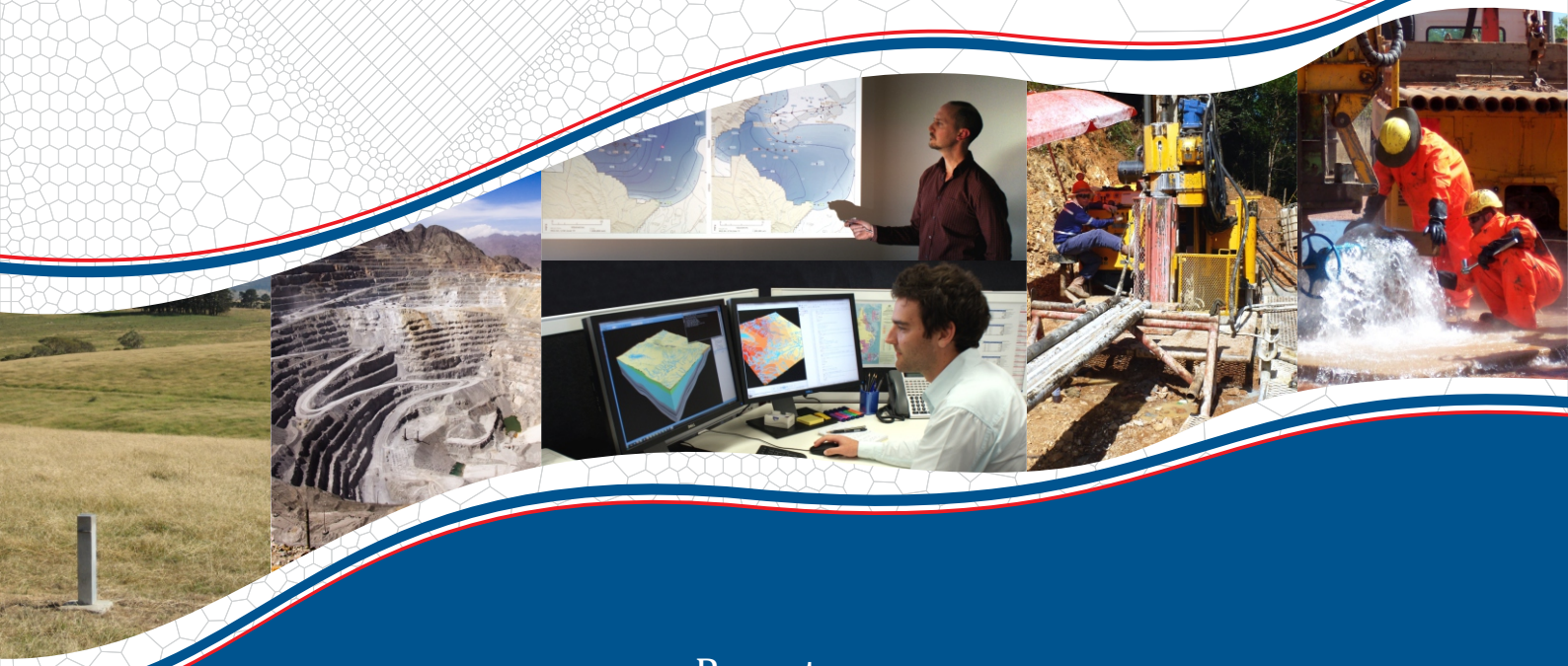
Hunter River TSS Results 2019

(Note TSS for W101 and W02 for march were 492 mg/L and 264mg/L respectively however graph is presented without these values for ease of presentation of data. These results were the result of an extreme rainfall event in late March)

APPENDIX G

Annual Groundwater Monitoring Report 2019

Australasian Groundwater and
Environmental Consultants Pty Ltd



Report on

Bengalla Mine
Annual Groundwater Monitoring Report for 2019

Prepared for
Bengalla Mining Company Pty Ltd

Project No. G1543W March 2020
www.ageconsultants.com.au ABN 64 080 238 642

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Appendix A Monitoring bore summary data

Report on

Bengalla Mine
Annual Groundwater Monitoring Report for 2019

1 Introduction and scope of work

The Bengalla Mining Company Pty Ltd (BMC) operates the Bengalla open cut coal mine (Bengalla) which was officially opened in 1999. Bengalla is located approximately 4 km west of Muswellbrook in the Upper Hunter Valley of New South Wales (NSW). Mining operations target coal from the Warkworth to Edderton Seams of the Permian Wittingham Coal Measures.

This report is a review of groundwater monitoring data collected during the one-year monitoring period 1 January 2019 to 31 December 2019. Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) were commissioned by BMC to undertake the following scope of work:

- update all groundwater monitoring hydrographs;
- discuss how groundwater levels respond to rainfall and mining over the reporting period;
- discuss groundwater chemistry trend analyses;
- identify any changes/observations made during the past 12 months;
- assess the adequacy of the existing monitoring bore network and monitoring program; and
- provide recommendations if necessary.

The review shall also address the additional scope:

- fulfil the requirements of Schedule 5, Condition 4 of SSD-5170 which states:

  "*By the end of March each year (or as otherwise agreed by the Secretary), the Applicant must review the environmental performance of the development for the previous calendar year to the satisfaction of the Secretary. This review must:*

  a) describe the development (including any rehabilitation) that was carried out in the past calendar year, and the development that is proposed to be carried out over the current calendar year;

  b) include a comprehensive review of the monitoring results and complaints records of the development over the past year, which includes a comparison of these results against the:

  - *relevant statutory requirements, limits or performance measures/criteria;*
  - *monitoring results of previous years; and*
  - *relevant predictions in the EIS;*

  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 development;

  e) identify any discrepancies between the predicted and actual impacts of the development, 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 development."

AGE will report on the above with regards to groundwater issues, for all items except item (a).

2 Climate

The climate of Bengalla is temperate and characterised by hot, wet summers and mild, dry winters. Temperature data for 2019 was sourced from BoM Scone weather station (061089), 23.3 km from Bengalla. The maximum monthly mean temperature for the year was recorded in January 2019 (35.5°C), whilst a minimum monthly mean temperature of 17.5 C was recorded in June 2019.

Long-term rainfall data covering the period 1992 to 2019 were obtained from the onsite Bengalla weather station, and are summarised in Table 2.1.

The mine is situated within the Upper Hunter Valley region, which was in drought over the 2019 reporting period. The total annual rainfall at Bengalla for 2019 was 297 mm, with March being the wettest month, with 126 mm of recorded rain, and April being the driest with no precipitation recorded. A comparison of the total annual 2019 rainfall (297 mm) at Bengalla in 2019 with the longer-term 1992 to 2019 average (585 mm) clearly illustrates these drought conditions (Table 2.1).

Table 2.1 Rainfall data 2019 – Bengalla weather station

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Bengalla Monthly Total Rainfall (mm) 2019	19	24	126	0	24.5	7	9	18	27.5	9.5	31.5	1	297
Bengalla long term monthly average rainfall (mm) 1992 - 2019	55.3	68.3	56.2	35.8	35.4	46.5	33.6	33.3	36.1	43.6	68.1	72.9	585

Historical rainfall was contextualised using the Cumulative Rainfall Departure (CRD) method (Figure 2.1). This method is a summation of the monthly departure of rainfall from the long-term average monthly rainfall. A rising trend in the CRD plot indicates periods of above average rainfall, whilst a falling slope indicates periods when rainfall is below average. The Hunter River water level was also plotted with rainfall (Figure 2.1) using data from the Muswellbrook Bridge monitoring station (210002), which is located approximately 5 km up-stream of Bengalla.

The CRD graph for 2019 (Figure 2.1) displays these drought conditions, which began in early 2017 and continued throughout 2019, with March being the only month in 2019 to record rainfall in excess of the long-term average. The Hunter River water level data indicates that, whilst periods of higher rainfall correlate with elevated river levels, the Hunter River generally displays relatively stable water levels due to being regulated by the Glenbawn Dam.

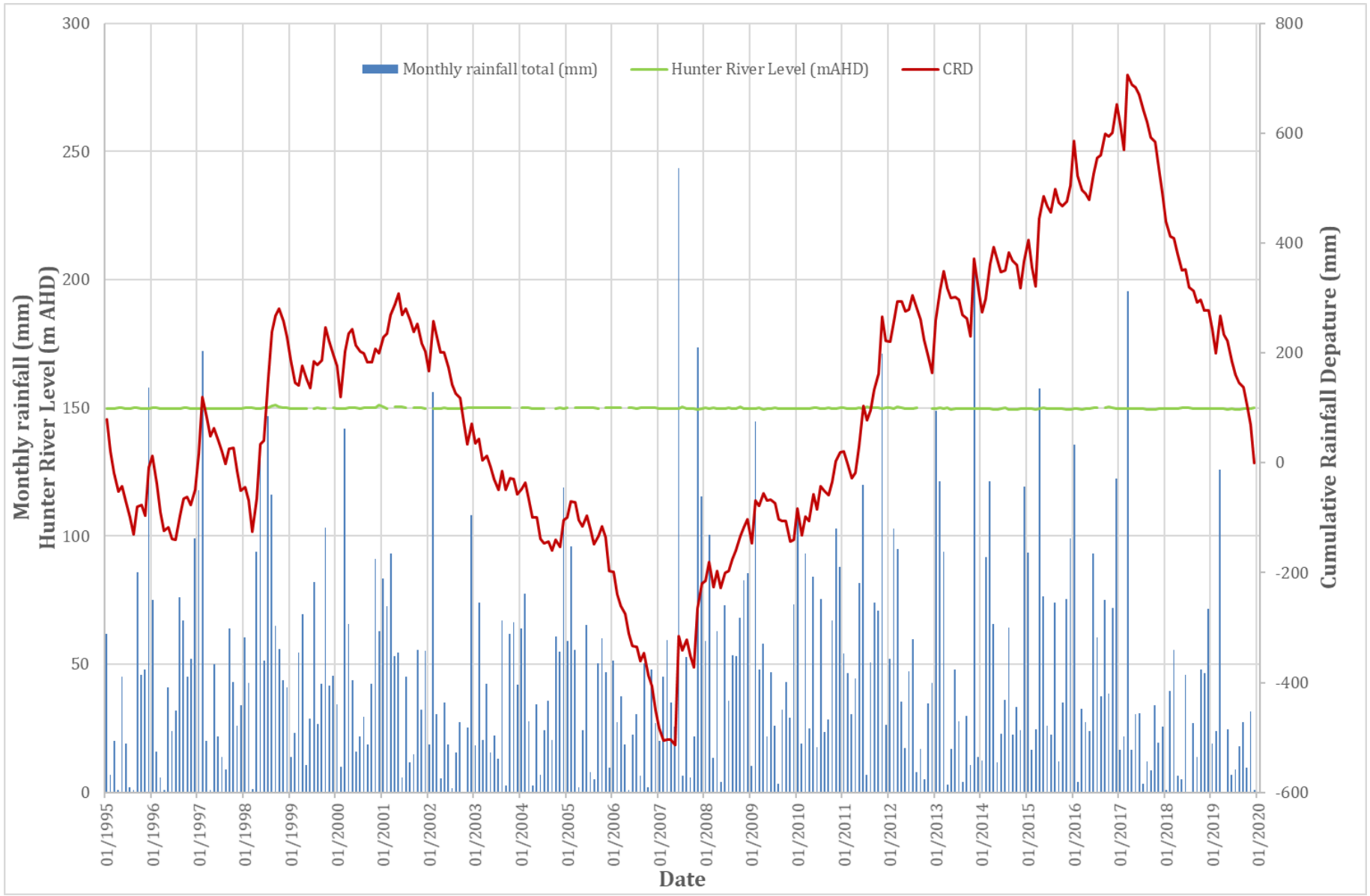


Figure 2.1 Cumulative rainfall departure (1995 to 2019) for Bengalla weather monitoring station

3 Groundwater regime

The groundwater regime at Bengalla consists primarily of two systems:

- the porous-medium aquifer of the Hunter River alluvial deposits, which is up to 14 m thick and consists of a silty clay layer overlying a basal gravel; and
- the Permian coal measures, comprising a multi-layered bedrock aquifer in which the coal seams are the prime water bearing strata and the interburden is hydrogeologically "tight" and very low yielding to essentially dry.

The coal seams strike in a generally north-south direction, and dip westward at approximately 5 degrees. The coal seams subcrop beneath the Hunter River alluvium to the south of Bengalla. Table 3.1 summarises the approximate thicknesses of seam and interburden units currently mined at Bengalla.

Table 3.1 Coal seams and interburden at Bengalla Mine

	Seam name	Average seam thickness (m)	Average thickness of overlying interburden (m)
Mined at Bengalla	Warkworth	1	35
	Mount Arthur	4.5	5
	Piercefield	2.3	12
	Vaux	4	35
	Broonie	1.3	13
	Bayswater	2.5	10
	Wynn	2.5	5
	Edderton	2	10
Not mined at Bengalla	Clanricard	1.8	10
	Bengalla	2.5	10
	Edinglassie	3.9	30
	Ramrod Creek	6.5	-

Generally, in undisturbed conditions, the potentiometric surface (pressure head) of groundwater in the coal seams is higher than the alluvial water table (i.e. an upward hydraulic gradient). Therefore, in areas where the coal seams subcrop beneath the alluvium, there is potential for groundwater from the coal measures to discharge to the Hunter River alluvium. Depressurisation of the coal seams by open cut mining has the following potential impacts on the Hunter River alluvial aquifer:

- reduced discharge rate from the coal seams to the alluvium; and
- reversed hydraulic gradients, resulting in leakage from the Hunter River alluvial aquifer to the coal seams where they subcrop beneath the alluvium to the south of Bengalla, and eventual discharge of this alluvial water to the Bengalla pit.

Generally, the Hunter River level is above the water table in the Hunter River alluvium, and near Bengalla the river is losing water to the alluvium. The level of the Hunter River is relatively constant under normal conditions due to the regulation of water discharge from Glenbawn Dam (Figure 2.1).

The objective of the groundwater monitoring program at Bengalla is to assess these potential impacts.

4 Bengalla groundwater monitoring network

BMC has established a groundwater monitoring network around Bengalla with data from 1992 onwards. Table 4.1 summarises the monitoring bore network and the vibrating wire piezometer locations. Figure 4.1 shows the bore and VWP locations.

In March 2009 and June 2010, nine bores were installed in the alluvial fringe area as part of a commitment from the Wantana Extension Statement of Environmental Effects (SEE; March 2009). Three of these were bore clusters, with one bore screened in the alluvium and one in an underlying coal seam at each monitoring location (e.g. WAN8A/B, WAN9A/B and WAN10A/B). A bedrock bore (REPI7) was installed to replace bore I7. Two alluvial monitoring bores – SMB1 and SMB2 – were installed in June 2010 to the east of Wantana Extension as part of the investigations to obtain approval for spoil placement on an alluvial embayment adjacent to the mine.

Monitoring bore A10 was mined out in 2014. This was the sole bore monitored for potential effects to the north of the Bengalla pit. The removal of A10 left an absence of coverage in this area.

In 2017, two new VWPs, BE4 and BE5, were installed between ML 1645 and the westward advancing pit. The BE4 and BE5 VWPs are positioned to replace the A10 and E12 bores (E12 was mined out in 2017) and to complement the existing BE1 and BE3 VWPs further to the west.

In 2018, a downhole bore survey was undertaken by AGE on WAN2, WAN5, WAN7 and WAN8 bore clusters. As a result, the construction details of these bores have been updated in Table 4.1. The locations WAN5A and WAN5B have historically been mistakenly interchanged. Following the downhole investigation, it was found that WAN5A targets the deep Permian and WAN5B targets the alluvium (now rectified in Table 4.1).

In late 2018 BMC commenced drilling five new monitoring bores that target both alluvial and shallow Permian strata (GW01A, GW01B, WAN11A, WAN11B and WAN12). These bores have been included in the monitoring bore network summary (Appendix A) for record completeness however are not part of this compliance review.

As the neighbouring Mount Pleasant Project progresses, access to some Bengalla groundwater monitoring sites (11953, 42927, 47277, 64092, 42701, and 53007) north of Wybong Road has become restricted and no data have been recorded for these bores in 2019. Monitoring bore E12 was mined through in May 2017, and 46737 is also no longer accessible.

Table 4.1 Current Bengalla groundwater monitoring network

Bore ID	Easting MGA94 z56	Northing MGA94 z56	Ground level (mAHD)	Top of casing (mAHD)	Stick-up (m)	Screen (mbGL)	Total depth (mBGL)	Bore base elevation (mAHD)	Geology/ Target Seam
18298 [c]	294375	6423521	132.86	133.47	0.61	-	-	-	Alluvium
19116 [c]	296078	6425589	135.6	136.43	0.82	-	-	-	Alluvium
28510 [c]	298649	6429105	142.7	144	1.3	-	-	-	Deep Permian
37774 [c]	298488	6428998	145.6	146	0.4	-	-	-	Deep Permian
42701 [c]	298586	6428632	144	144.91	0.97	-	-	-	Deep Permian
42927 [c]	298843	6428570	144.26	145.36	1.1	-	-	-	Alluvium
46737 [c]	291862	6427143	227.69	227.9	0.21	-	-	-	Shallow Permian
47277 [b c]	299145	6428643	143.54	144.59	1.06	-	-	-	Alluvium
53007 [c]	298720	6428857	143.97	144.01	0.04	-	-	-	Deep Permian
BE1 (bore)	293469	6429033	241.48	242.67	1.19	69-75	75	166.48	Permian Sandstone
BE2 (bore)	293374	6425866	204.22	205.38	1.16	45-48	48	156.22	Permian Sandstone
BE3 (bore)	292977	6427587	175.21	176.39	1.18	48-54	54	121.21	Permian Sandstone
BG1 [c]	296656	6426003	138.2	138.78	0.58	-	-	-	Alluvium
BG3 [b c]	294731	6424413	133.60	133.76	0.16	-	-	-	Alluvium
BG5 [c]	298609	6427874	142.2	142.51	0.31	-	-	-	Alluvium
REPI7	295575	6425832	135.47	136.38	0.91	49-52	52	83.47	Vaux Seam
SMB1	296955	6426391	141.2	142.47	1.27	13-19	19	122.2	Alluvium
SMB2	297124	6426549	141.69	142.61	0.92	15-21	21	120.69	Alluvium
WAN10A	295828	6425571	135.07	136.13	1.06	10-13	13.83	121.24	Alluvium
WAN10B	295825	6425578	135.04	136.1	1.06	44-47	47	88.04	Vaux Seam
WAN1A	296519	6426099	140.6	141.35	0.75	16-20	20	120.6	Alluvium/ Wynn seam
WAN1B	296519	6426099	140.6	141.35	0.75	29-33	33	107.6	Edderton Seam
WAN2A	296217	6425824	137.7	138.4	0.7	13-16	16	121.7	Alluvium/ Vaux seam
WAN2B	296217	6425824	137.7	138.44	0.74	36-39	39	98.7	Wynn Seam
WAN2C	296217	6425824	137.7	138.43	0.73	51-54	55	83.7	Edderton Seam
WAN3 [a]	295772	6425713	136.4	136.7	0.3	2.5-87	87	49.4	Deep Permian
WAN4A	295442	6425690	135.1	135.93	0.83	11.5-14.5	14.5	120.6	Alluvium
WAN4B	295442	6425690	135.1	135.89	0.79	21-24	24	111.1	Deep Permian
WAN5A	296019	6425360	135.9	136.78	0.88	26-29	28.98	107.8	Deep Permian
WAN5B	296019	6425360	135.9	136.74	0.84	10.5-13.5	15.57	121.17	Alluvium
WAN6A	296553	6425634	136.9	137.67	0.77	7.5-10.5	10.5	126.4	Alluvium
WAN6B	296553	6425634	136.9	137.66	0.76	30-33	33	103.9	Edderton Seam
WAN7A	296856	6426254	138.1	138.86	0.76	12.0-15.0	15	123.1	Alluvium
WAN7B	296856	6426254	138.1	138.89	0.79	80-83	83	55.1	Edinglassie Seam
WAN8A	296457	6425854	136.41	137.47	1.07	10.7-11.9	12.94	124.53	Alluvium
WAN8B	296450	6425855	136.33	137.42	1.09	15-18.6	19.6	117.82	Wynn Seam

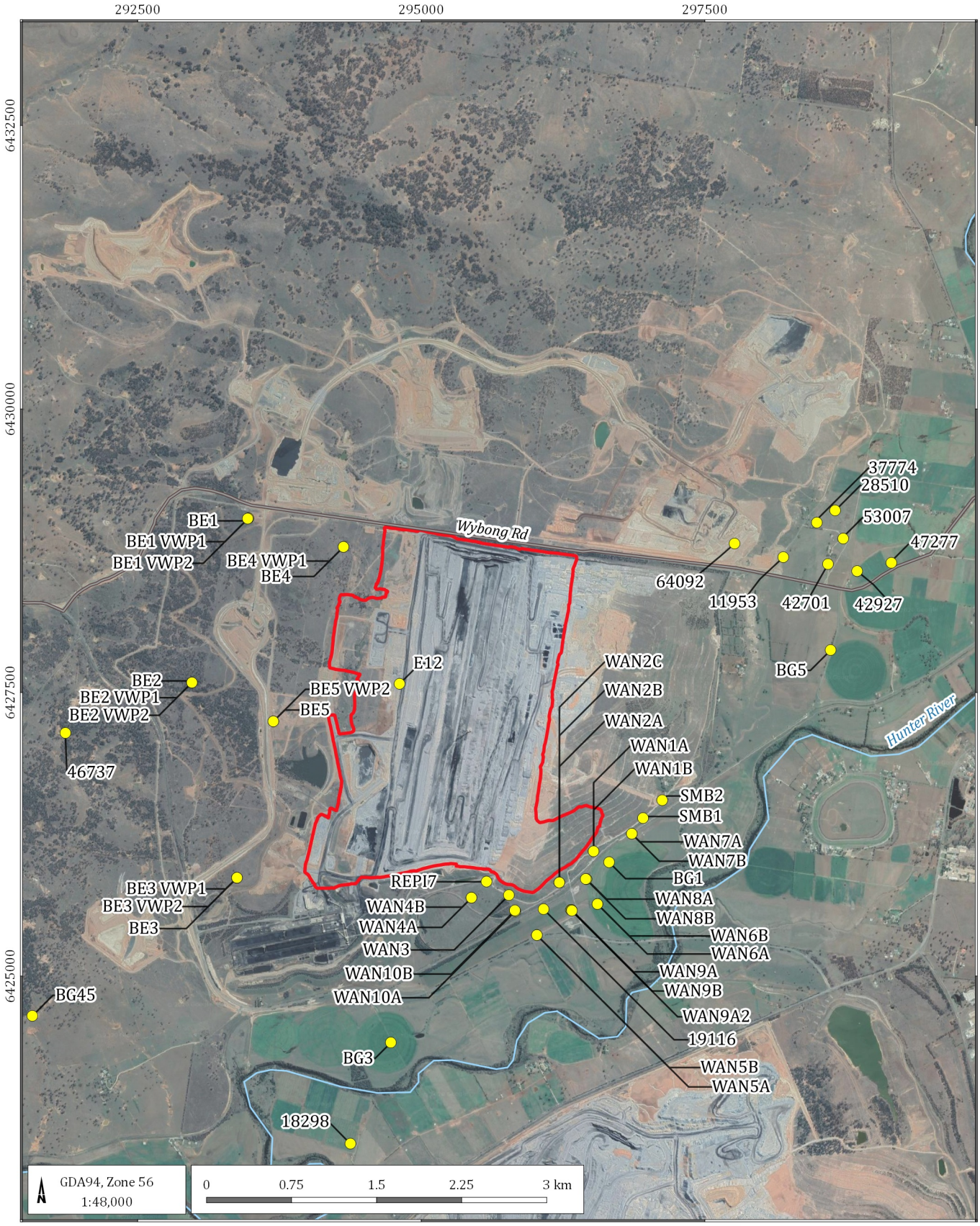
Bore ID	Easting MGA94 z56	Northing MGA94 z56	Ground level (mAHD)	Top of casing (mAHD)	Stick-up (m)	Screen (mbGL)	Total depth (mBGL)	Bore base elevation (mAHD)	Geology/ Target Seam
WAN9A2	296326	6425582	136.88	137.98	1.1	8.5-10.5	10.5	126.38	Alluvium
WAN9B	296328	6425576	136.93	137.88	0.95	21-24	24	112.93	Wynn Seam
BE1 (VWP)	293475	6429036	241.48	-	-	120	120	121.48	Warkworth/Mt Arthur
BE1 (VWP)	293475	6429036	241.48	-	-	264.5	264.5	-23.02	Edderton Seam
BE2 (VWP)	293374	6425866	204.22	-	-	97.8	97.8	106.42	Warkworth/Mt Arthur
BE2 (VWP)	293374	6425866	204.22	-	-	212.5	212.5	-8.28	Edderton Seam
BE3 (VWP)	292977	6427587	175.21	-	-	80.6	80.6	94.61	Warkworth/Mt Arthur
BE3 (VWP)	292977	6427587	175.21	-	-	154.6	154.6	20.61	Edderton Seam
BE4 (VWP)	294313	6428784	191.4	-	-	82	228.2	-36.8	Mt Arthur
BE4 (VWP)	294313	6428784	191.4	-	-	213	228.2	-36.8	Edderton Seam
BE5 (VWP)	293696	6427245	181.3	-	-	74	210.15	-28.85	Mt Arthur
BE5 (VWP)	293696	6427245	181.3	-	-	197.5	210.15	-28.85	Edderton Seam
GW01A	298190	6428409	TBC	TBC	TBC	TBC	TBC	TBC	Alluvium
GW01B	298190	6428409	TBC	TBC	TBC	TBC	TBC	TBC	Shallow Permian
WAN11A	296649	6424875	135.4	136.44	1.05	9-12	123.4	12	Alluvium
WAN11B	296645	6424876	135.5	136.45	0.95	24-27	108.5	27	Shallow Permian
WAN12	295491	6424725	135.3	136.06	0.76	11-14	121.3	14	Alluvium

Notes:

a *depth to bottom 35.1m - bore may have collapsed – WAN*

b *3. resurvey suggested.*

c *bore base should be tagged to confirm depth.*



LEGEND

- Monitoring locations
- Drainage
- Roads
- Void boundary

Bengalla annual review 2019 (G1543W)

Monitoring bore network

DATE 21/02/2020

FIGURE No: **4.1**

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5 Water management plan

Bengalla manages its water resources as per the Bengalla Water Management Plan (WMP) version 7, which was approved February 2019.

The current WMP (i.e. version 7) groundwater quality triggers are summarised in Table 5.1 and the water level triggers are summarised in Table 5.2. The 2019 monitoring data are compared to these triggers.

Table 5.1 Bengalla WMP water quality triggers (Version 7 - February 2019)

Site	Easting	Northing	WMP Version 6 (Aug 2017) Triggers				Target aquifer
			Min pH trigger	Max pH trigger	Stage 1 EC Trigger - 95th Percentile	Stage 2 EC Trigger - Maximum EC	
18298	294375	6423521	6.0	8.5	1,484	1,990	Alluvium
19116	296078	6425589	6.0	8.5	2,297	2,650	Alluvium
SMB1	296955	6426392	6.0	8.5	2,159	2,790	Alluvium
SMB2	297125	6426550	6.0	8.5	2,439	2,460	Alluvium
WAN1A	296519	6426099	6.0	8.5	2,099	2,280	Alluvium/Wynn Seam
WAN2A	296217	6425824	6.0	8.5	1,389	1,780	Alluvium
WAN4A	295442	6425690	6.0	8.5	3,965	4,170	Alluvium
WAN5A	296019	6425360	6.0	8.5	6,001	6,180	Alluvium
WAN6A	296553	6425634	6.0	8.5	1,055	1,280	Alluvium
WAN7A	296856	6426254	6.0	8.5	2,258	2,300	Alluvium
WAN8A	296457	6425855	6.0	8.5	-	7,720	Alluvium
WAN9A2	296320	6425583	6.0	8.5	936	937	Alluvium
WAN10A	295828	6425571	6.0	8.5	1,253	1,367	Alluvium
42927	298843	6428570	6.0	8.5	1,260	1,380	Alluvial Aquifer
47277	299145	6428643	6.0	8.5	1,325	1,340	Alluvial Aquifer
BG1	296656	6426003	6.0	8.5	1,021	1,580	Alluvial Aquifer
BG3	294731	6424413	6.0	8.5	3,540	4,850	Alluvial Aquifer
BG5	298609	6427874	6.0	8.5	1,330	1,670	Alluvial Aquifer
46737	291862	6427143	6.0	8.5	9,092	9,290	Shallow Permian
BE1	293469	6429033	6.0	8.5	7,186	7,190	Permian Sandstone
BE2	293375	6425866	6.0	8.5	8,335	8,370	Permian Sandstone
BE3	292977	6427587	6.0	8.5	8,738	8,740	Permian Sandstone
WAN5B	296019	6425360	6.0	8.5	1,641	1,900	Deep Permian
28510	298649	6429105	6.0	8.5	1,479	1,480	Deep Permian

Site	Easting	Northing	WMP Version 6 (Aug 2017) Triggers				Target aquifer
			Min pH trigger	Max pH trigger	Stage 1 EC Trigger - 95th Percentile	Stage 2 EC Trigger - Maximum EC	
37774	298488	6428998	6.0	8.5	2,901	3,060	Deep Permian
42701	298586	6428632	6.0	8.5	1,232	1,340	Deep Permian
53007	298720	6428857	6.0	8.5	1,240	1,350	Deep Permian
WAN3	295772	6425713	6.0	8.5	4,365	4,550	Deep Permian
WAN4B	295442	6425690	6.0	8.5	3,507	3,570	Deep Permian
REPI7	295575	6425832	6.0	8.5	4,280	4,310	Vaux Seam
WAN1B	296519	6426099	6.0	8.5	1,909	3,790	Shallow Permian
WAN2C	296217	6425824	6.0	8.5	3,619	3,840	Edderton Seam
WAN2B	296217	6425824	6.0	8.5	3,856	3,930	Edderton Seam
WAN8B	296450	6425855	6.0	8.5	2,780	2,820	Wynn Seam
WAN9B	296328	6425576	6.0	8.5	1,915	1,930	Wynn Seam
WAN6B	296553	6425634	6.0	8.5	1,297	1,461	Edderton Seam
WAN7B	296856	6426254	6.0	8.5	3,160	3,220	Edinglassie Seam
WAN10B	295825	6425578	6.0	8.5	5,068	5,090	Vaux Seam

Table 5.2 Bengalla WMP water level triggers (February 2019)

Bore ID	Geology/ target Seam	Max. Drawdown (m)	Trigger water level (mAHD)
SMB1	Alluvium	1.5	127.2
SMB2	Alluvium	1.6	127.3
WAN1A	Alluvium	4.2	117.5
WAN2A	Alluvium	6.8	118.5
WAN4A	Alluvium	5.5	121.2
WAN5A	Alluvium	2.4	124.3
WAN6A	Alluvium	1.1	126.9
WAN7A	Alluvium	1.4	125.4
WAN8A	Alluvium	2.4	123.3
WAN9A	Alluvium	2.6	123.7
WAN10A	Alluvium	4.6	122.2
18298	Alluvium	0.3	123.2
19116	Alluvium	4.2	123.2
42927	Alluvium	1.2	131.1

Bore ID	Geology/ target Seam	Max. Drawdown (m)	Trigger water level (mAHD)
47277	Alluvium	0.8	132.8
BG1	Alluvium	1.4	126.8
BG3	Alluvium	0.2	126.3
BG5	Alluvium	0.9	132.4
11953	Deep Permian	7.1	129.3
28510	Deep Permian	3.3	129.0
37774	Deep Permian	5.4	128.7
42701	Deep Permian	1.9	131.3
46737	Shallow Permian	0.7	185.3
53007	Deep Permian	1.8	131.9
BE1	Permian Sandstone	15.5	156.8
BE2	Permian Sandstone	148.9	18.8
BE3	Permian Sandstone	32.5	113.2
REPI7	Vaux Seam	39.0	63.1
WAN10B	Vaux Seam	20.9	98.3
WAN1B	Edderton Seam	15.8	100.1
WAN2B	Wynn Seam	25.4	86.4
WAN2C	Edderton Seam	25.4	75.0
WAN3	Deep Permian	26.3	100.3
WAN4B	Deep Permian	26.3	98.2
WAN5B	Deep Permian	10.7	116.0
WAN6B	Edderton Seam	4.1	123.8
WAN7B	Edinglassie Seam	2.3	126.4
WAN8B	Wynn Seam	9.5	108.5
WAN9B	Wynn Seam	8.1	111.4

6 Water levels assessment

6.1 Alluvium aquifer water levels

The hydrographs for the bores monitoring groundwater levels in the Hunter River alluvium were analysed in two sub-sets, as follows:

- bores to the immediate south of the current pit and in the approved Wantana Extension; these bores are referred to here-in as the Wantana Extension Bores; and
- bores located in the alluvium at a greater distance from Bengalla, which are unlikely to be impacted by mining; referred to as Regional Hunter River alluvial bores.

6.1.1 Wantana Extension bores

Groundwater levels in all Wantana Extension bores remained above the trigger level for all of 2019. Figure 6.1 shows the alluvial groundwater level trends in the Wantana Extension area overlain with the CRD trend and Hunter River level. The water level trends for the Wantana Extension bores were stable through 2019. Historically, these levels correlate loosely with the CRD, with water levels rising and declining similarly to the average rainfall trend (AGE 2019 – G1543U). The CRD was generally in decline throughout 2019, with drought conditions persisting across the region. The stable trends in groundwater levels in Figure 6.1 show a correlation between the Hunter River level (at Station 210002, Muswellbrook Bridge) and the water levels in the alluvium bores. This correlation with the Hunter River level is a better match to the groundwater level trends observed in the Wantana Extension bores, than the trend of the CRD. This correlation suggests the Hunter River alluvium in the vicinity of Bengalla is being recharged by the Hunter River. This mechanism is expected, particularly during drought conditions, as the river flow is maintained during the dry season by regulated discharges from Glenbawn Dam, and water levels in the river are always higher than the water level within the alluvium (Figure 6.1; note that the river level is reduced by 10 m for presentation on the axis of this chart).

Groundwater monitoring bores WAN4A and WAN1A have single readings that do not show correlation with other alluvial bores, the CRD, or Hunter River water levels. These single measurements are also approximately one meter lower than all other 2019 measurements for these bores and these measurements are considered anomalous and are likely erroneous.

None of the Wantana Extension bores fell below their respective trigger levels in 2019 (Appendix A).

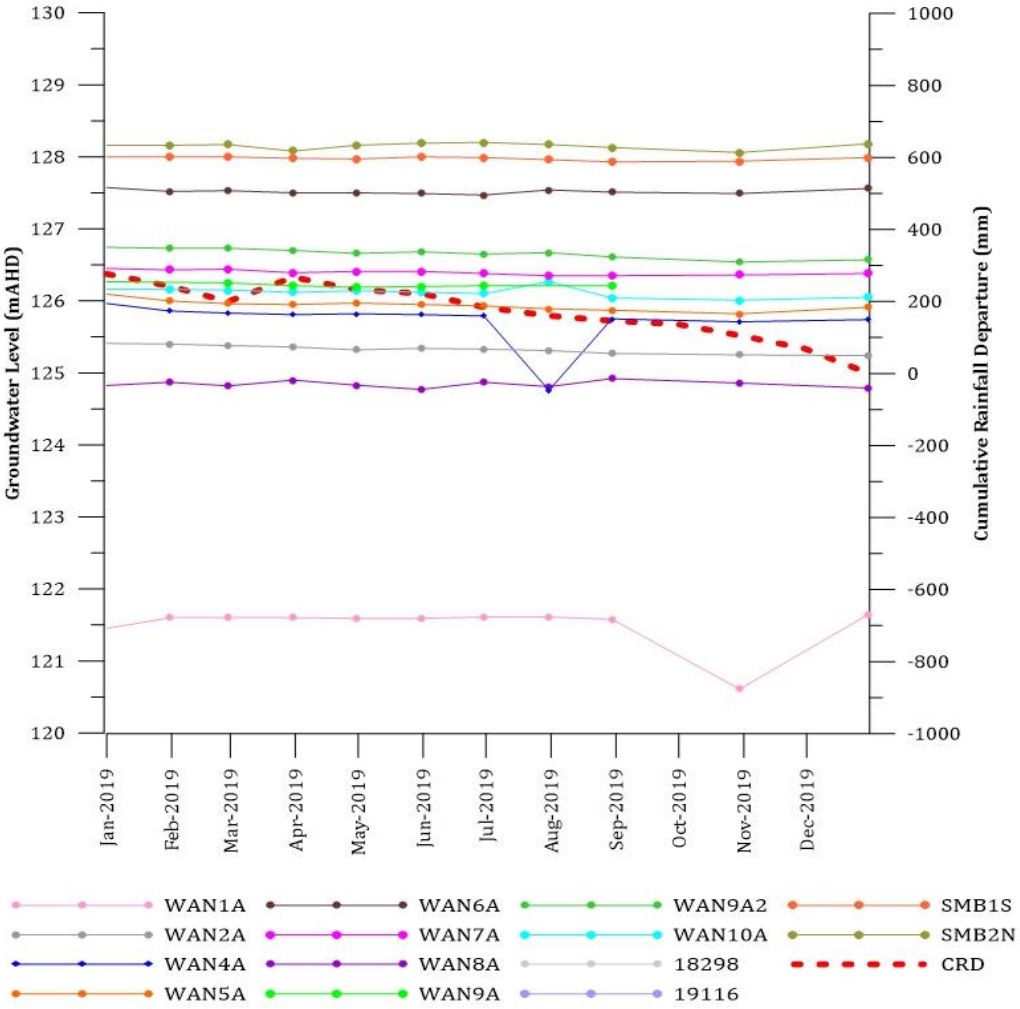


Figure 6.1 Hydrographs of alluvial bores – Wantana extension area

6.1.2 Regional Hunter River alluvial bores

Figure 6.2 shows groundwater levels measured in the Regional Hunter River alluvial monitoring bores. Groundwater levels in BG1 and BG5 remained above the trigger level for all of 2019. Groundwater levels in BG3 remained below the trigger level for all of 2019.

Groundwater levels in BG5 dropped below the trigger level in October 2017 and recovered to above the trigger level in April 2018. Groundwater elevations in BG5 remained stable and above the trigger level for all of 2019 (Figure 6.2).

BG3 groundwater levels have remained below the trigger value throughout 2019. The trend in groundwater levels from BG3 over 2019 is a gradual decrease (Figure 6.2). A separate AGE investigation report (AGE 2018 – G1543S) assessing bore BG3 and the trigger events. The study identified that the water levels were generally within historic ranges and had oscillated around baseline levels since bore installation. This indicated that there was no evidence of sudden depressurisation and concluded that change in groundwater levels did not appear to pose harm to the environment. Considering the distance between BG3 and Bengalla (> 1.5 km), these trigger events are not likely to be related to mining at Bengalla (AGE, 2018). The report recommended ongoing monitoring. The slight (<0.25 m) decrease in water level throughout 2019 is likely as result of persistent drought conditions. As such, there is no change to the conclusions of the previous investigation (AGE, 2018) and the groundwater levels measured for 2019 in this bore do not appear to pose harm to the environment.

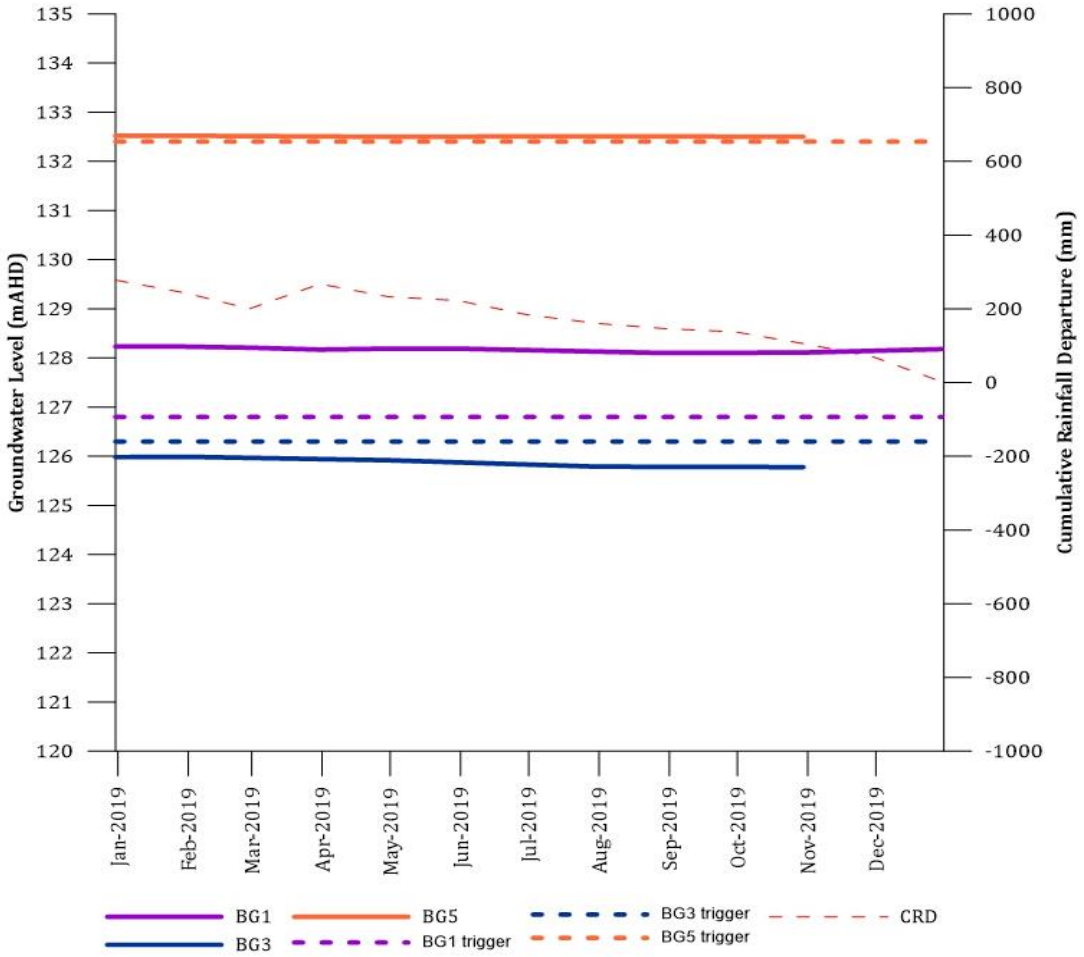


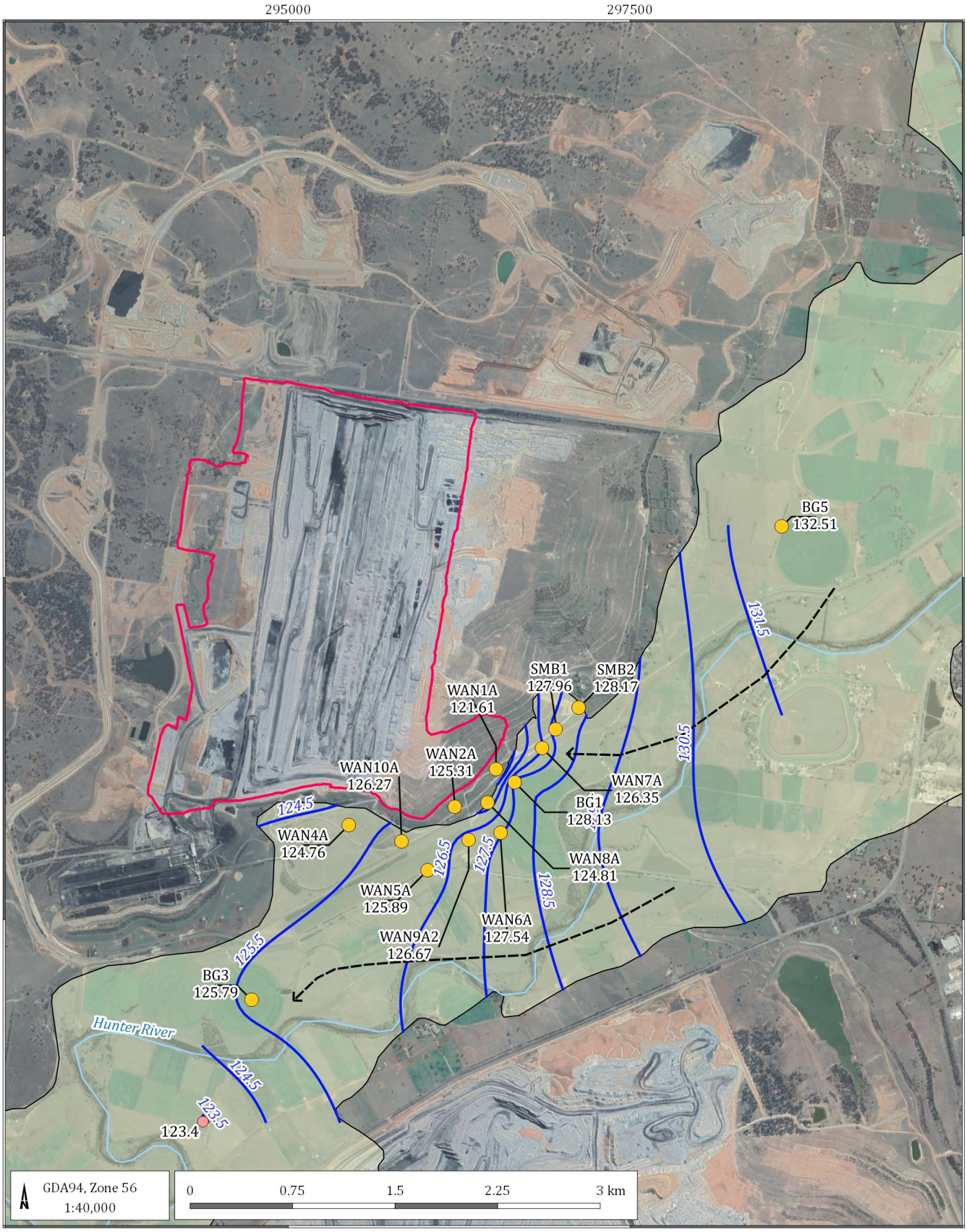
Figure 6.2 Hydrographs of Regional alluvial bores

6.1.3 Alluvial groundwater level contours

Figure 6.3 shows the water table within the Hunter River alluvium interpolated from water elevation measurements observed during July 2019. The water level contours and flow directions are consistent with that of the previous year (AGE 2019 – G1543U).

A steep hydraulic gradient is present adjacent to WAN8A and BG1 (Figure 6.3). This is likely due to a combination of the proximity of bore WAN8A to the open cut and to the edge of the alluvium (refer Figure 6.3). It is likely that mining related depressurisation of shallow Permian strata at the southern margin of the pit is causing movement of alluvial water towards Bengalla Mine. This would explain the decline of water levels to below the screened interval of the bore in WAN8B (screened in the shallow Permian/Wynn Seam; refer Section 6.2.1). Indeed, the groundwater level in WAN8A is also very close to the base of the bore, and it may be stagnant water in the bore sump. The latest 2019 groundwater elevation in WAN8A was 124.79 mAHD, whereas the base of the screened interval is 124.51 mAHD (ground level minus 11.9 m; Appendix A). Therefore, there was only 28 cm of screened casing below the water level. Regardless of the degree of saturation at WAN8, any loss of water to the pit from the alluvium fringe is likely to be masked by both the regulated nature of the Hunter River and the Hunter River recharge to the alluvium (the river is considered a losing stream at this point).

The mechanisms behind the consistently elevated groundwater level seen in BG1 are less clear. A range of explanations are possible for the higher groundwater level in BG1, including mass loading effects associated with nearby spoil emplacement and enhanced surface water infiltration due to the less consolidated nature of the spoil. In any event, the groundwater levels recorded within this bore have remained relatively consistent over 2019.



LEGEND

- Alluvium monitoring bores
- Alluvium bore - average past SWL
- Drainage
- Void boundary
- Alluvium contours (1 m) - July 2019
- Groundwater flow direction
- Alluvium boundary

Bengalla annual review 2019 (G1543W)

Alluvial groundwater levels (July 2019)

DATE 25/02/2020

FIGURE No: 6.3

Source: Hunter Coalfield Regional 1:100 000 Geology Map*
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6.2 Coal seam/interburden water levels

6.2.1 Permian monitoring bore hydrographs

Groundwater levels in all Permian monitoring bores remained above the trigger level for all of 2019. Figure 6.4 shows long-term shallow Permian groundwater levels monitored in the Wantana Extension area to the south of Bengalla. Key observations are outlined below:

- The mined seams have been depressurised to a varying extent, depending on their stratigraphic position and the proximity of the bore to the pit.
- The Edinglassie Seam is not mined at Bengalla and therefore the water elevation in this seam is considered most representative of the pre-mining potentiometric surface in the area of the Wantana Extension. Monitoring bore WAN7B screens the Edinglassie Seam and shows observed groundwater elevations to be consistently around 128 mAHD.
- The measured water level in WAN8B has been below the base of the screened interval in this bore since 2016, indicating that the bore is dry. The downhole camera survey showed that this bore has a 1 m sump at the base of the bore.
- Levels in bore WAN1A have shown almost no change since 2007. In the case of WAN1A, screened in the Wynn Coal seam, the observed water level is at, or close to, the base of the casing.
- Monitoring bore WAN2C was blocked prior to October 2018. Measurements for 2019 show groundwater levels of approximately 100 mAHD.
- Monitoring bore WAN2B has shown a gradual but steady recovery in water level since mid-2013 and has remained stable across 2019. As with WAN1B, the monitoring bore WAN2B is located adjacent to the pit end wall. The recovery noted in WAN2B may represent a gradual recovery in pressure as mining operations move further away from this bore.
- In 2019, bores WAN10B, and to a lesser extent WAN4B, have declined slightly. This decline can be attributed to the depressurisation of the coal seams as a result of mining. Depressurisation of the coal seams in this area is predicted by the numerical modelling (AGE 2013a).
- Monitoring bore REPI7 has previously shown fluctuations that correlated to the CRD; however, groundwater levels within this bore have slightly increased in 2019, in contrast to a falling CRD. The reasons for these fluctuations remain unclear, however are likely due in part to mining operations moving away from this bore, allowing for a slight recovery in groundwater levels.

Figure 6.5 and Figure 6.6 show the groundwater levels for the Permian monitoring bores (WAN4B, WAN5A, and WAN1B. Key observations can be summarised as follows:

- Groundwater levels in WAN4B and WAN5A have remained relatively stable in 2019, despite below average rainfall.

Figure 6.6 shows a coal seam (Edderton Seam) monitoring bore (WAN1B) plotted against the CRD. Groundwater levels have risen slightly in 2019, despite below average rainfall. WAN1B is located adjacent to the pit end wall. Groundwater level recovery in WAN1B is likely due to the westward progression of mining operations (i.e. away from WAN1B).

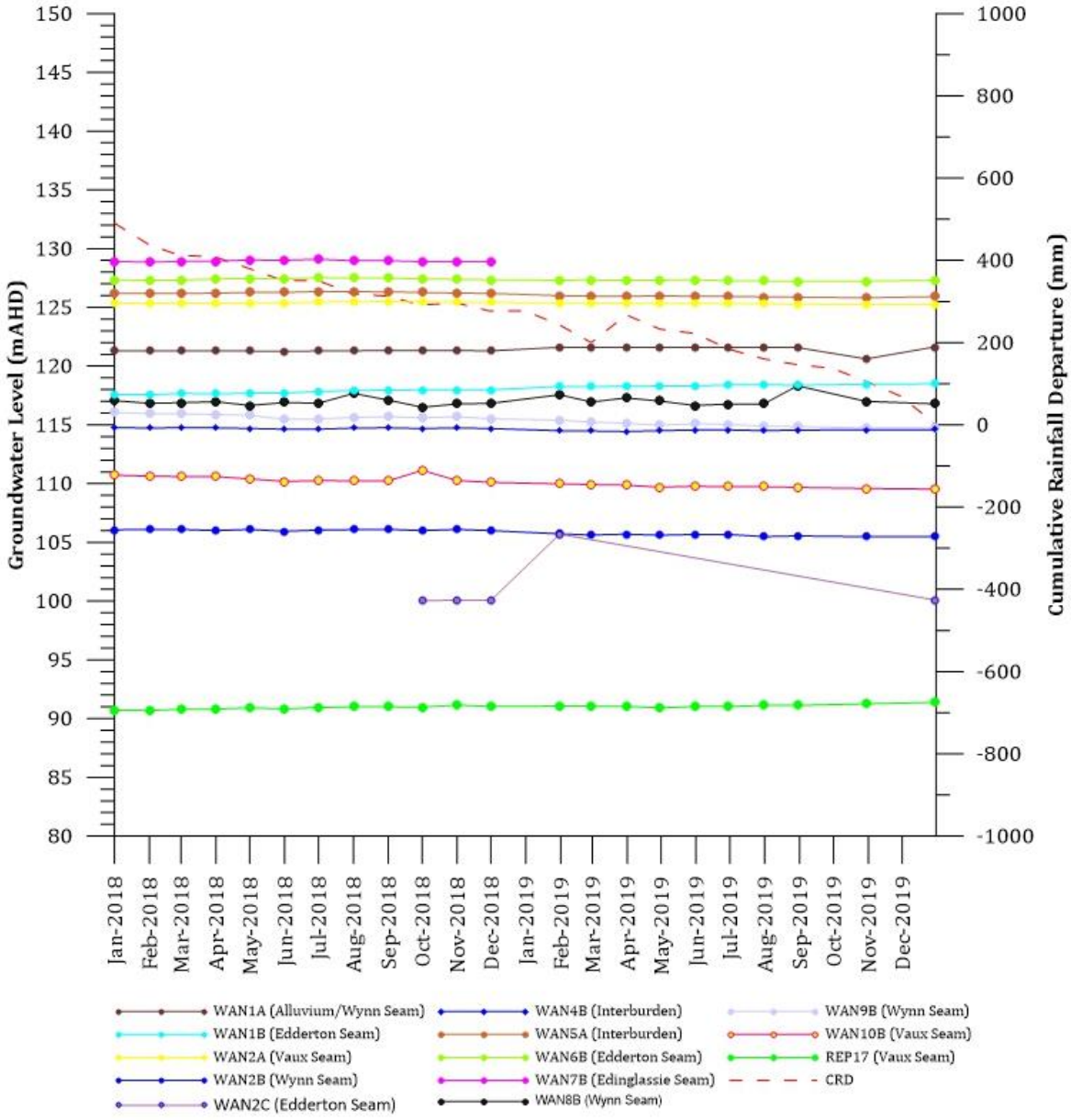


Figure 6.4 Hydrographs of coal seam/interburden bores – Wantana extension area

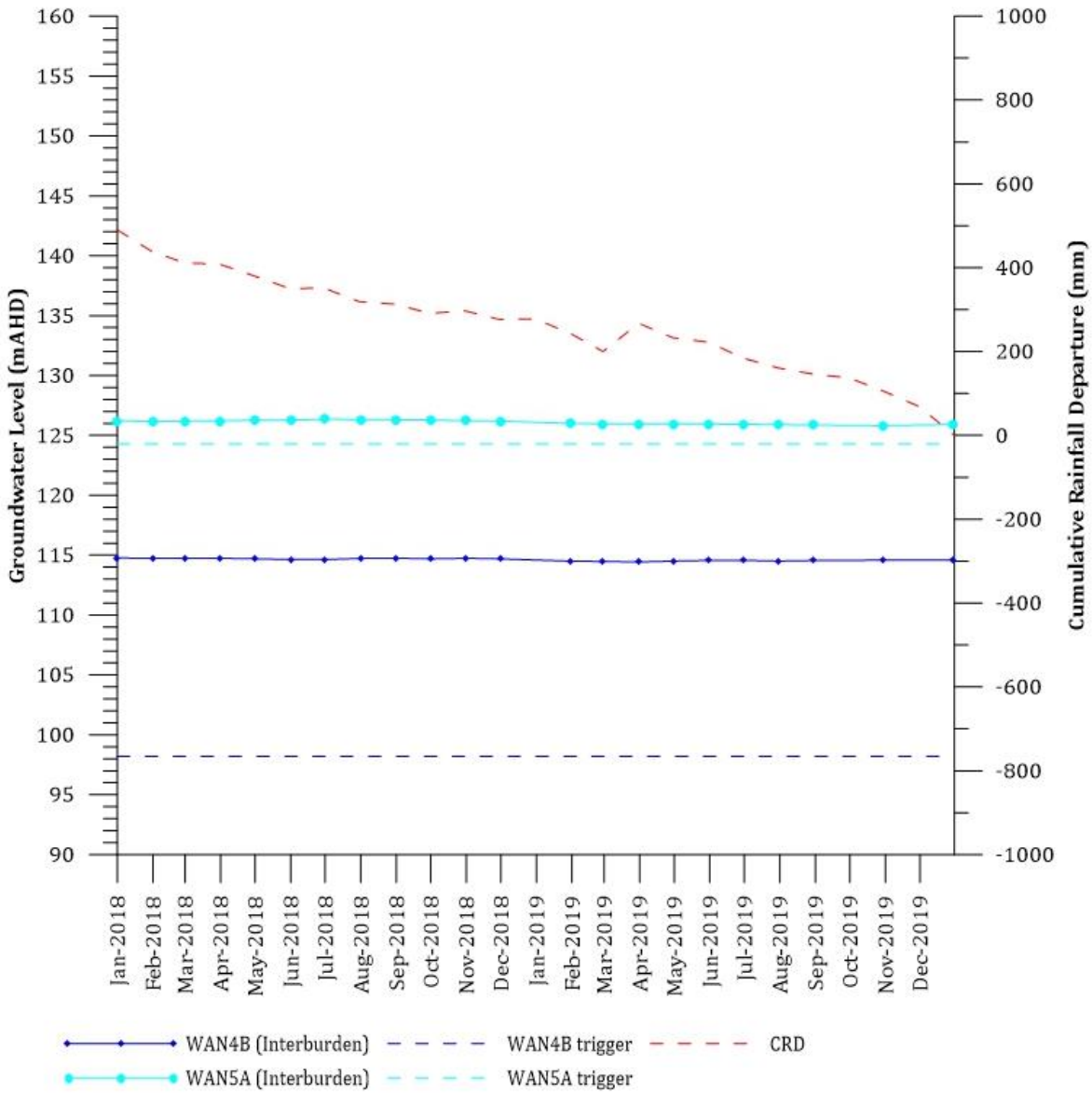


Figure 6.5 Hydrographs of deep Permian monitoring bores

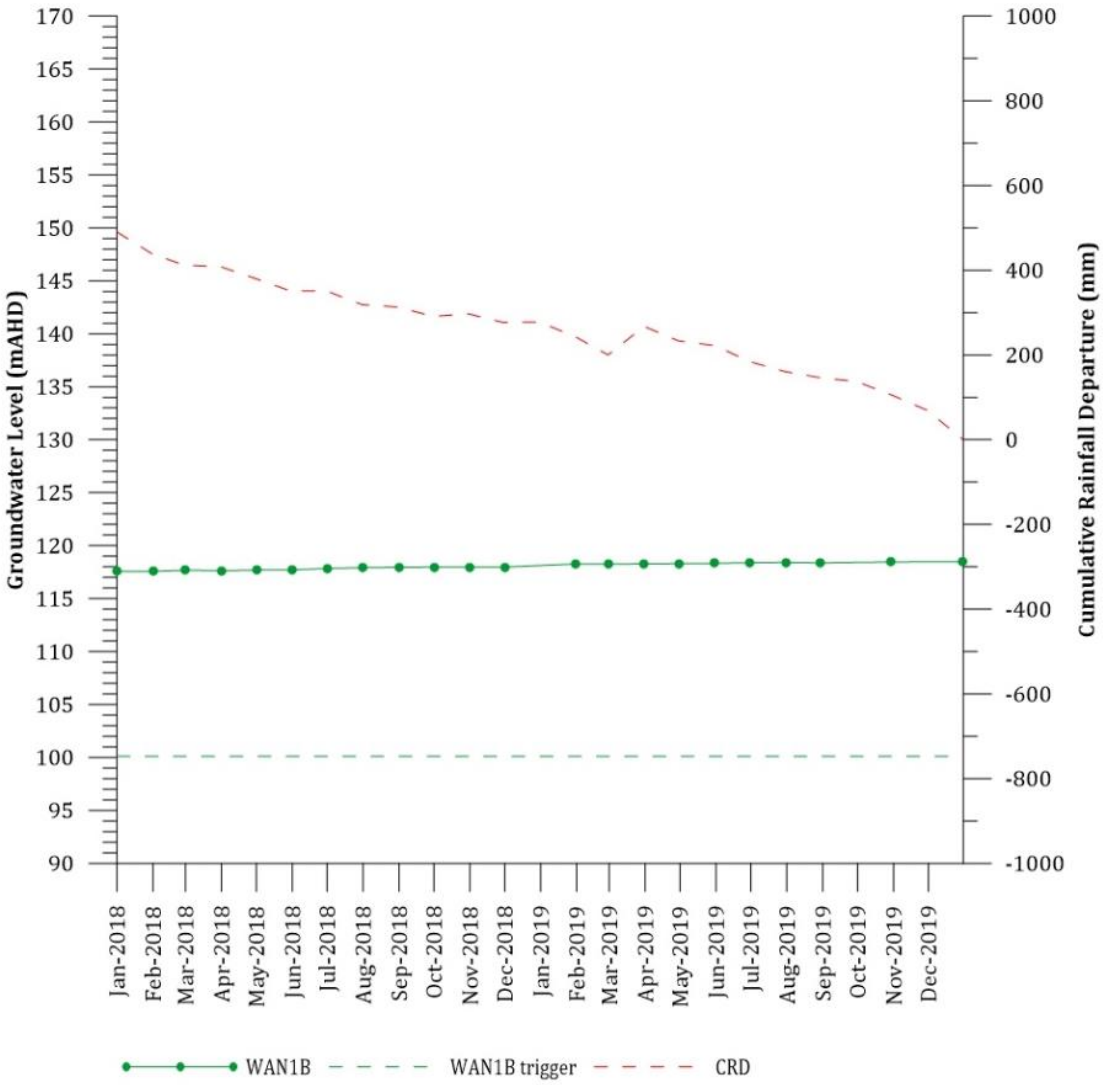


Figure 6.6 Hydrograph of shallow Permian monitoring bores

6.2.2 Nested monitoring bore hydrographs

Nested/clustered monitoring bore installations in the Wantana Extension are used to monitor water levels in several aquifers at the one location. Each nested installation generally comprises one alluvium bore and one (or more) coal seam bore(s). Groundwater levels in all nested monitoring bores remained above the trigger level for all of 2019. The hydrographs of the clustered bores (Figure 6.9 to Figure 6.15) are discussed in the following sections. WMP trigger levels for the Wantana bores are summarised in Section 5, and are based on groundwater modelling for Bengalla (AGE 2013b – G1505). The trigger values are also displayed in the hydrographs.

Figure 6.7 shows the WAN1 nested site water levels. Both WAN1 bores retained levels above the trigger levels throughout 2019. WAN1A is screened in the Wynn seam and possibly also over part of the alluvium. At this location, the Wynn seam subcrops close to the base of the alluvium. Historically, the WAN1A water level has been close to the base of the bore; hence the alluvium and Wynn seam are now dry at this location. WAN1B (Edderton seam), on the other hand, has shown mining-induced depressurisation from mid-2010 to late-2011 and subsequent water level recovery is ongoing (0.22 m in 2019). The water level (118.49 mAHD in December 2019) appears to have recovered to above the pre-mining level (115.87 mAHD). This demonstrates that water levels in depressurised coal seams can recover in a post-mining phase.

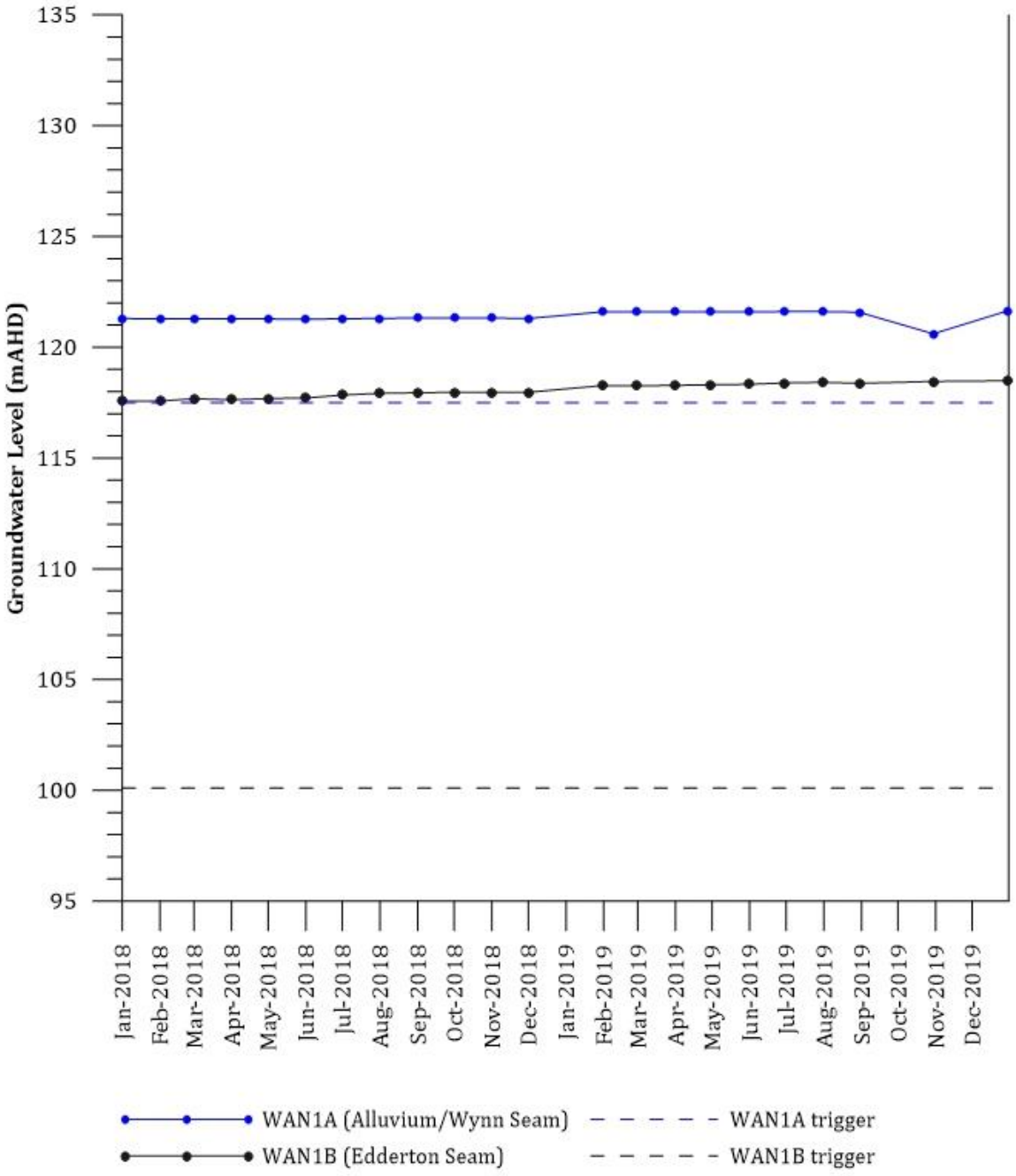


Figure 6.7 Alluvium and coal seam hydrographs – WAN1

Figure 6.8 shows the WAN2 nested site water levels. All WAN2 bores retained levels above the trigger levels throughout 2019. During the 2019 monitoring period, water levels in WAN2A (Vaux Seam) showed a stable groundwater level trend. Levels in WAN2B (Wynn Seam) steadily declined from 2005 to December 2013 as a result of mining, then remained relatively stable to December 2019. Up to 2016, WAN2C showed almost no change since 2006, with a prior decline of approximately 6 m between September 2005 and December 2006. In 2016, the static levels indicated that it was likely that the head in the Edderton seam had dropped below the base of the bore. The bore was blocked with an obstruction in September 2016 and was subsequently cleared in September 2018. When the bailer was recovered, the bailer assembly was not full, indicating that the water level was close to, or below, the base of the bore screen; only 2 level measurements were possible for this bore in 2019 and the February measurement is anomalous for this bore.

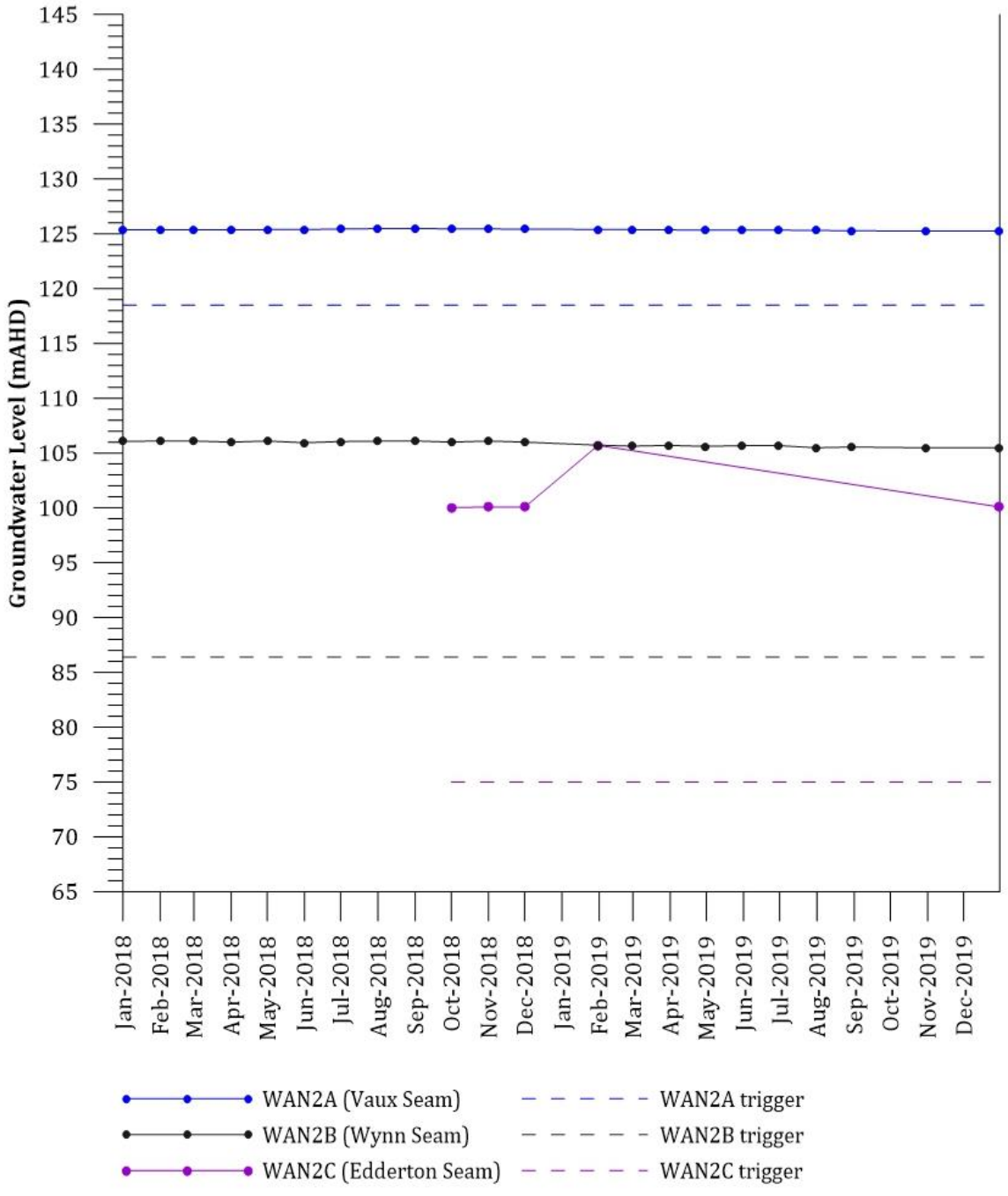


Figure 6.8 Alluvium and coal seam hydrographs – WAN2

Both WAN4 bores retained levels above the trigger levels throughout 2019 (Figure 6.9). At WAN4B, the groundwater level in the interburden prior to 2011 was 2 m lower than the water level observed in the alluvium (WAN4A). Since December 2011, the water level in the interburden bore – WAN4B – dropped 9.01 m, to an elevation of 114.59 mAHD in December 2019. However, over 2019 this water level decrease was just 0.10 m. WAN4A water level in the alluvium has maintained a relatively consistent level at approximately 126 mAHD (the base of the bore is 120.6 mAHD). This may reflect continued depressurisation in the interburden, with no or little local connection between the alluvium and the interburden, or the alluvium is constantly recharged by the Hunter River.

WAN4A/B is located closer to the pit wall compared to WAN5A/B and WAN6A/B (Figure 4.1). WAN5A/B and WAN6A/B have coal seam/interburden and alluvium water levels at similar elevations to each other (Figure 6.10 and Figure 6.11), whereas those from WAN4A/B are separated by >10 m (Figure 6.9). This suggests that either the water levels in the interburden and Edderton Seam at WAN5A/B and WAN6A/B show minimal response to mining (refer Figure 6.10 and Figure 6.11), or that the rate of recharge from the alluvium to the interburden is greater than the rate of seepage to the pit.

Data from WAN7B was not available for 2019 (refer Figure 6.12), but historic trends show the groundwater level in the Edinglassie Seam is approximately 2 m above the groundwater level in the alluvium, indicating that the Edinglassie Seam is pressurised. The Edinglassie Seam is not mined at Bengalla and hence has not been impacted by drawdown related to mining. The water levels in WAN7A show consistent trends over 2019, above the trigger level (Figure 6.12)

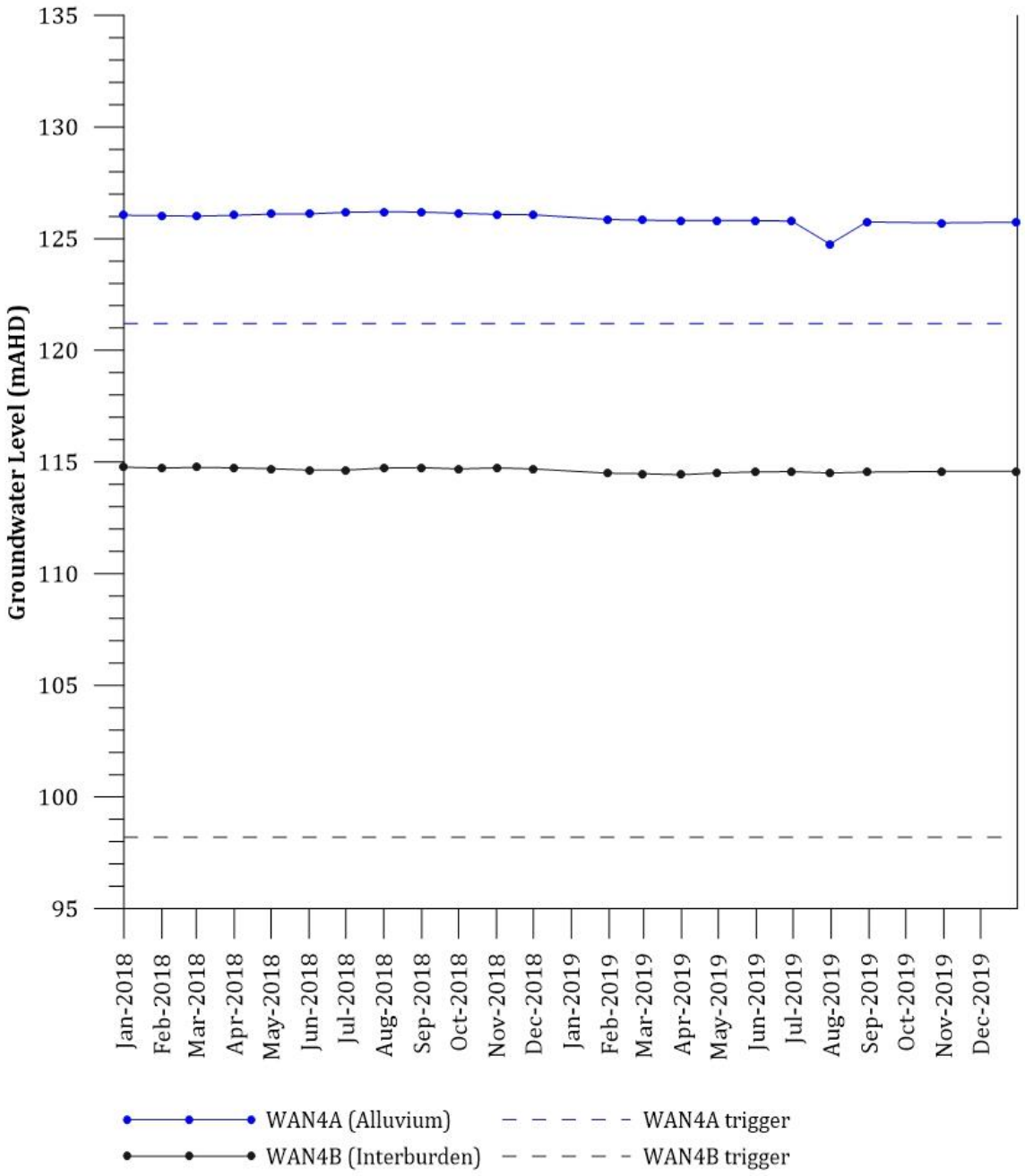


Figure 6.9 Alluvium and interburden hydrographs – WAN4

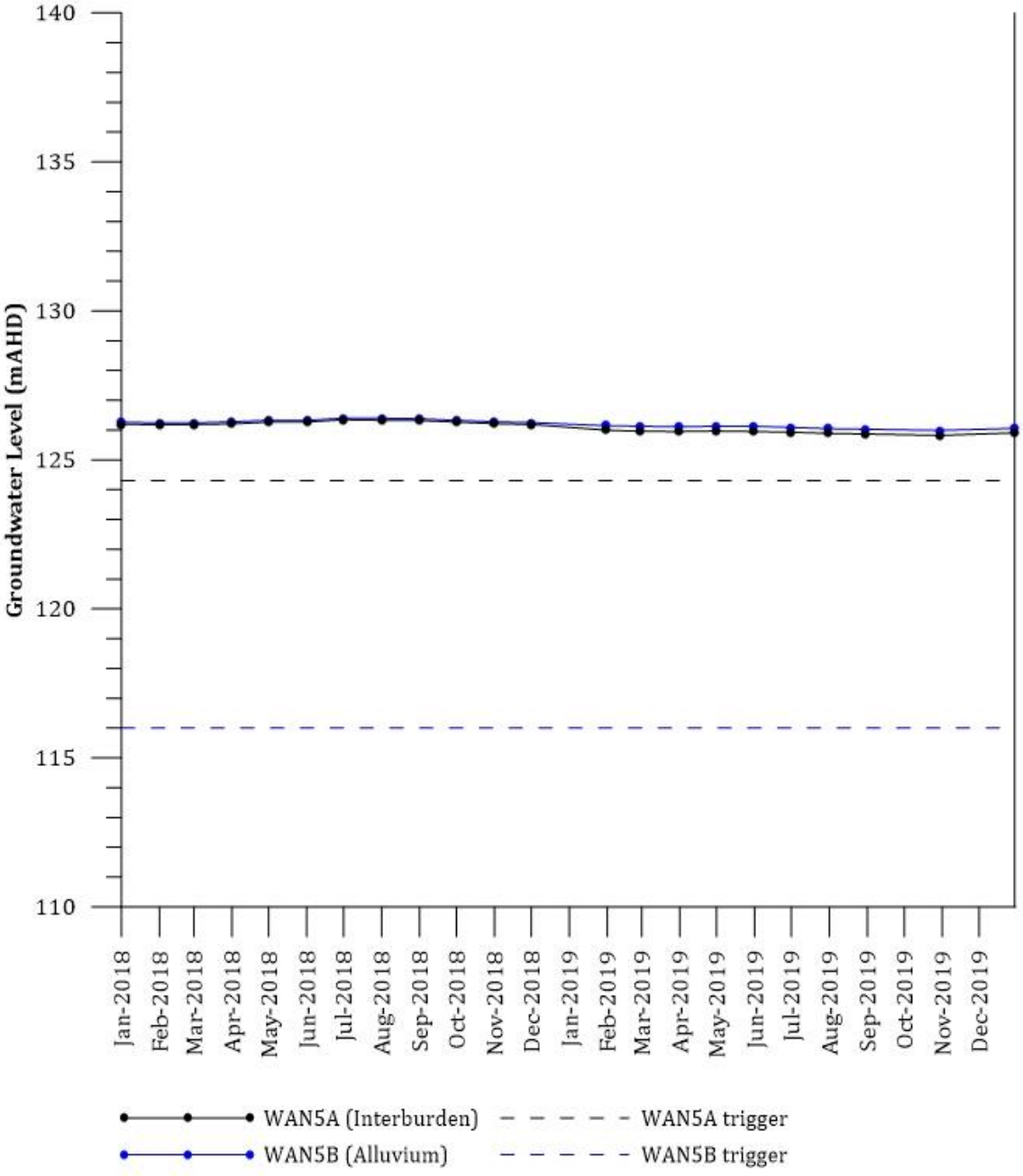


Figure 6.10 Alluvium and interburden hydrographs – WAN5

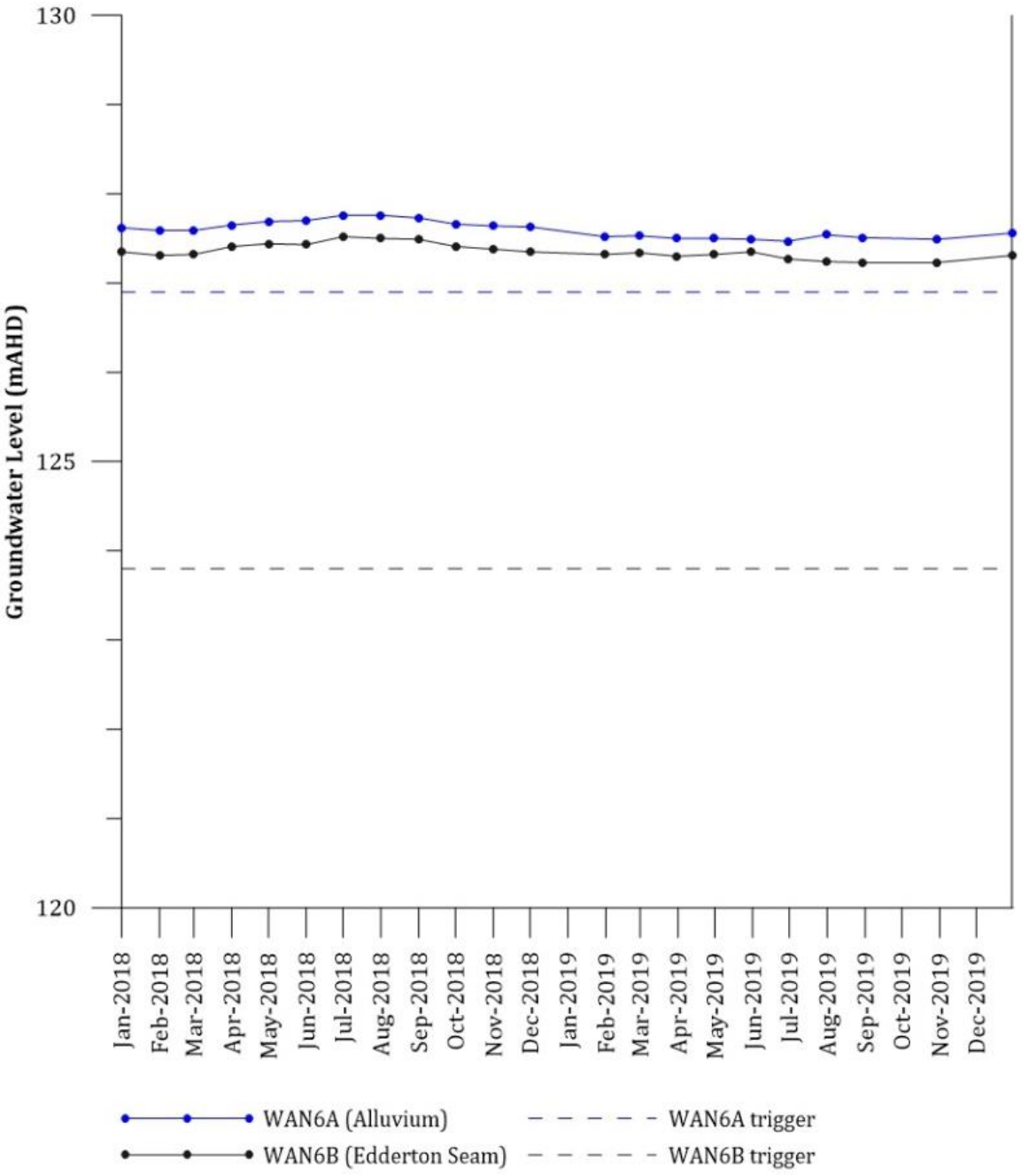


Figure 6.11 Alluvium and coal seam hydrographs – WAN6

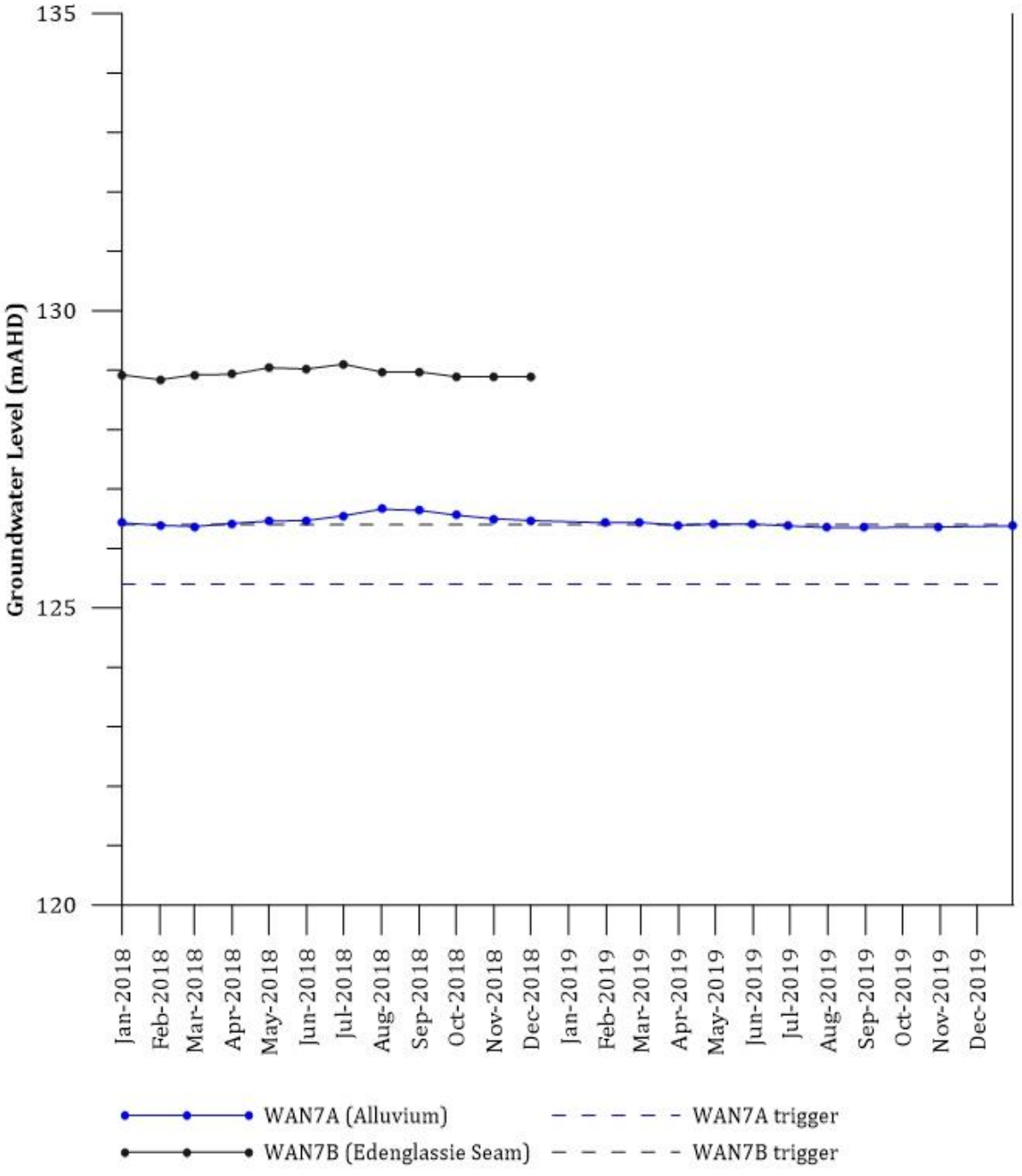


Figure 6.12 Alluvium and coal seam hydrographs – WAN7

Figure 6.13, Figure 6.14 and Figure 6.15 show groundwater levels at nested sites WAN8, WAN9 and WAN10. Monitoring bore WAN9A2 has replaced the previously dry WAN9A bore.

Figure 6.13 shows the water levels at the nested site WAN8. The water levels are approximately 125 mAHD and 117 mAHD for the alluvium and the Wynn seam, respectively. The alluvium is approximately 8 m higher than the Wynn seam head, potentially demonstrating a separation of the aquifers. The heads trends are relatively constant for the monitoring period, indicating that there has been no mining induced change to the water levels through 2019.

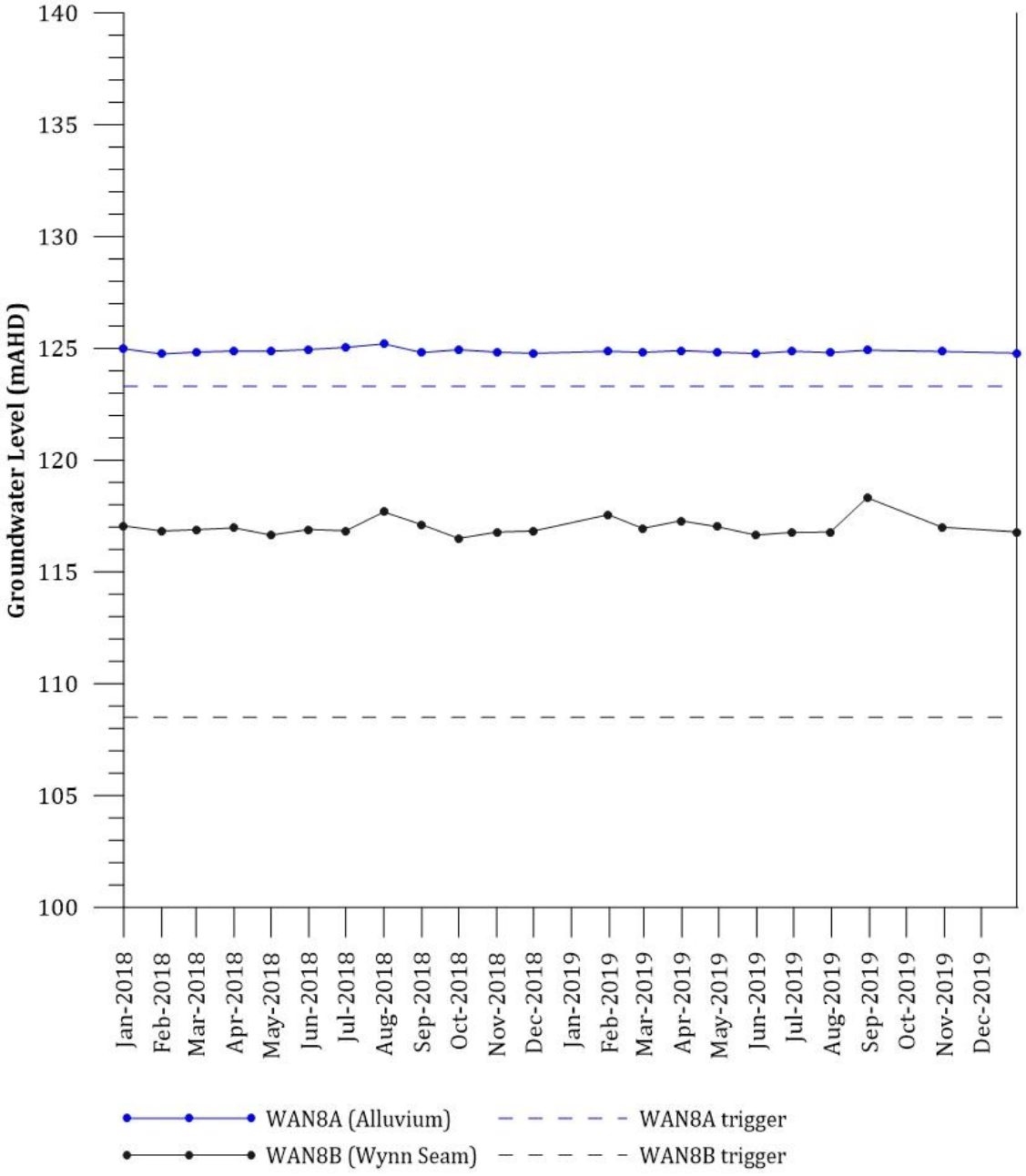


Figure 6.13 Alluvium and coal seam hydrographs – WAN8

Water levels in WAN9A2 (refer Figure 6.14) have been relatively stable since the commencement of record keeping in May 2017, as have those in WAN10A (Figure 6.15). In contrast, bores WAN9B and WAN10B (Figure 6.15) have experienced groundwater level decline over 2019.

WAN10B shows the groundwater level in the Vaux Seam declining by 0.45 m over 2019, whilst WAN10A alluvial water levels remained stable. Since September 2012, the water level in the Vaux Seam (WAN10B) has declined by approximately 7.5 m. The head differential between the bores at WAN10 has now increased to approximately 16.5 m, indicating potential for alluvial groundwater to leak to the coal seams, where they subcrop below the alluvium.

The initial groundwater level at WAN10B (119.12 mAHD, May 2009) has declined to 109.53 mAHD by December 2019 (a change of 8.79 m). This represents a decline in groundwater level of approximately 40% of the range above the adopted trigger level (Figure 6.15). Despite this, the decline is still within the limits of predicted impacts.

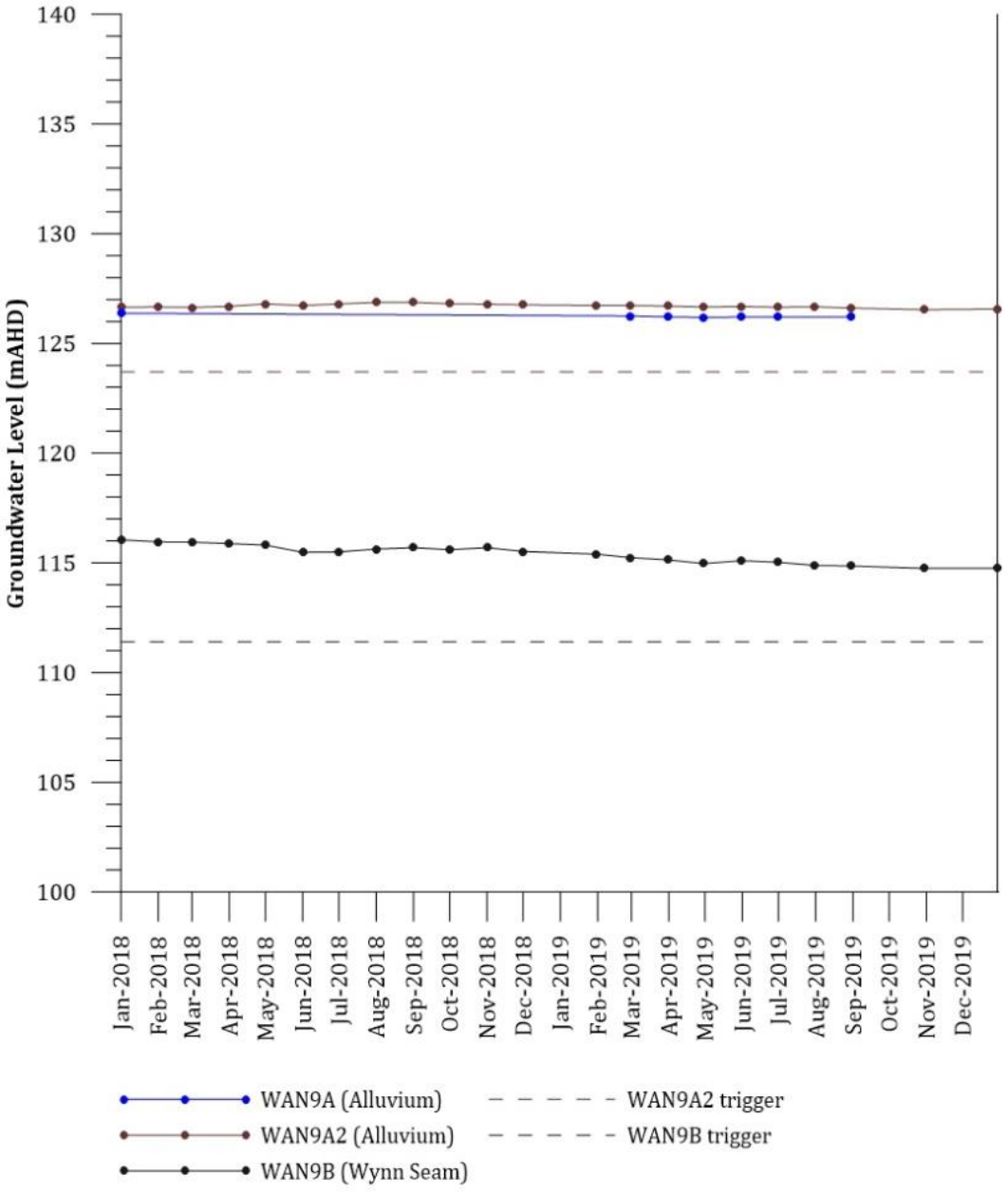


Figure 6.14 Alluvium and coal seam hydrographs – WAN9

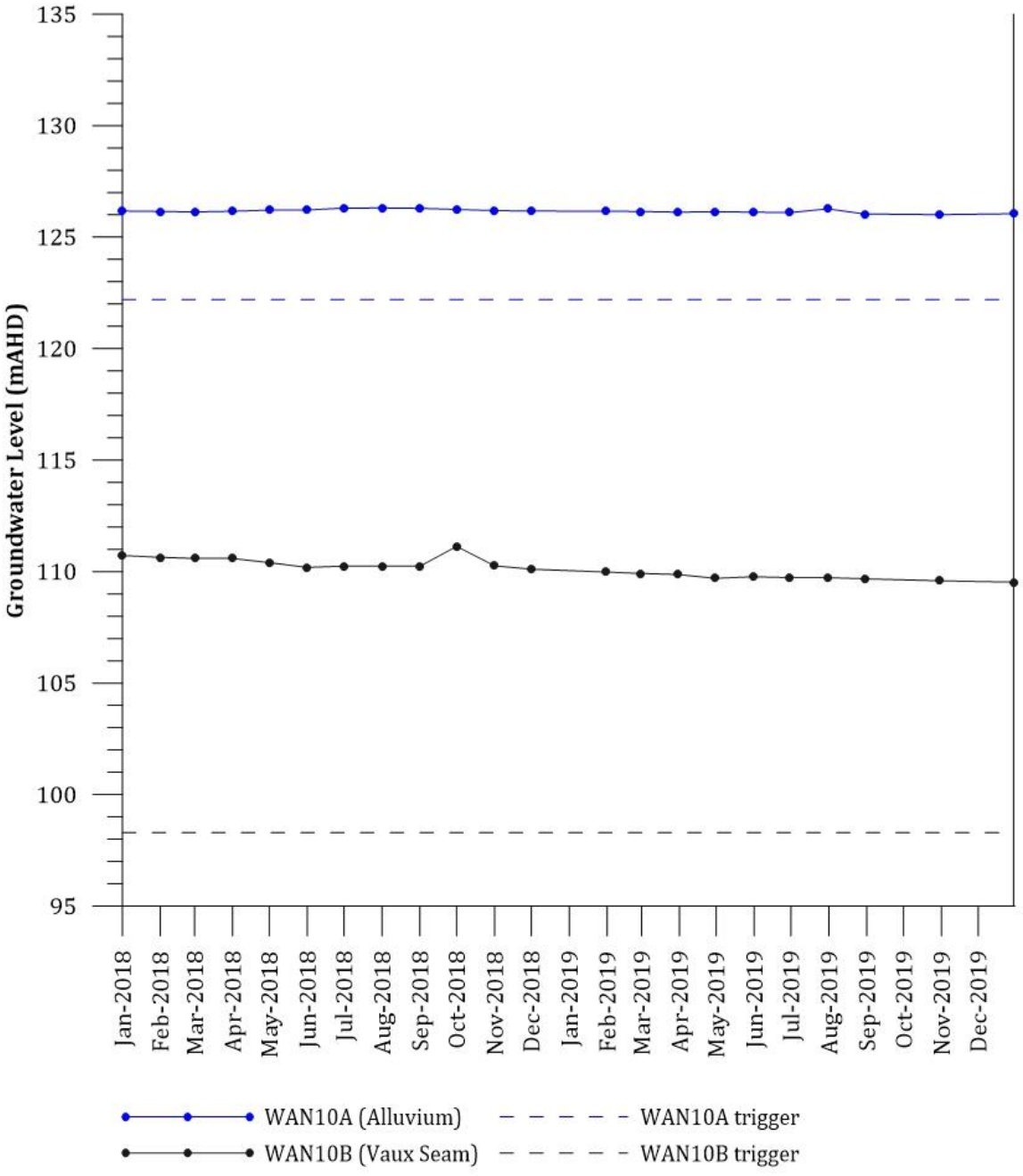
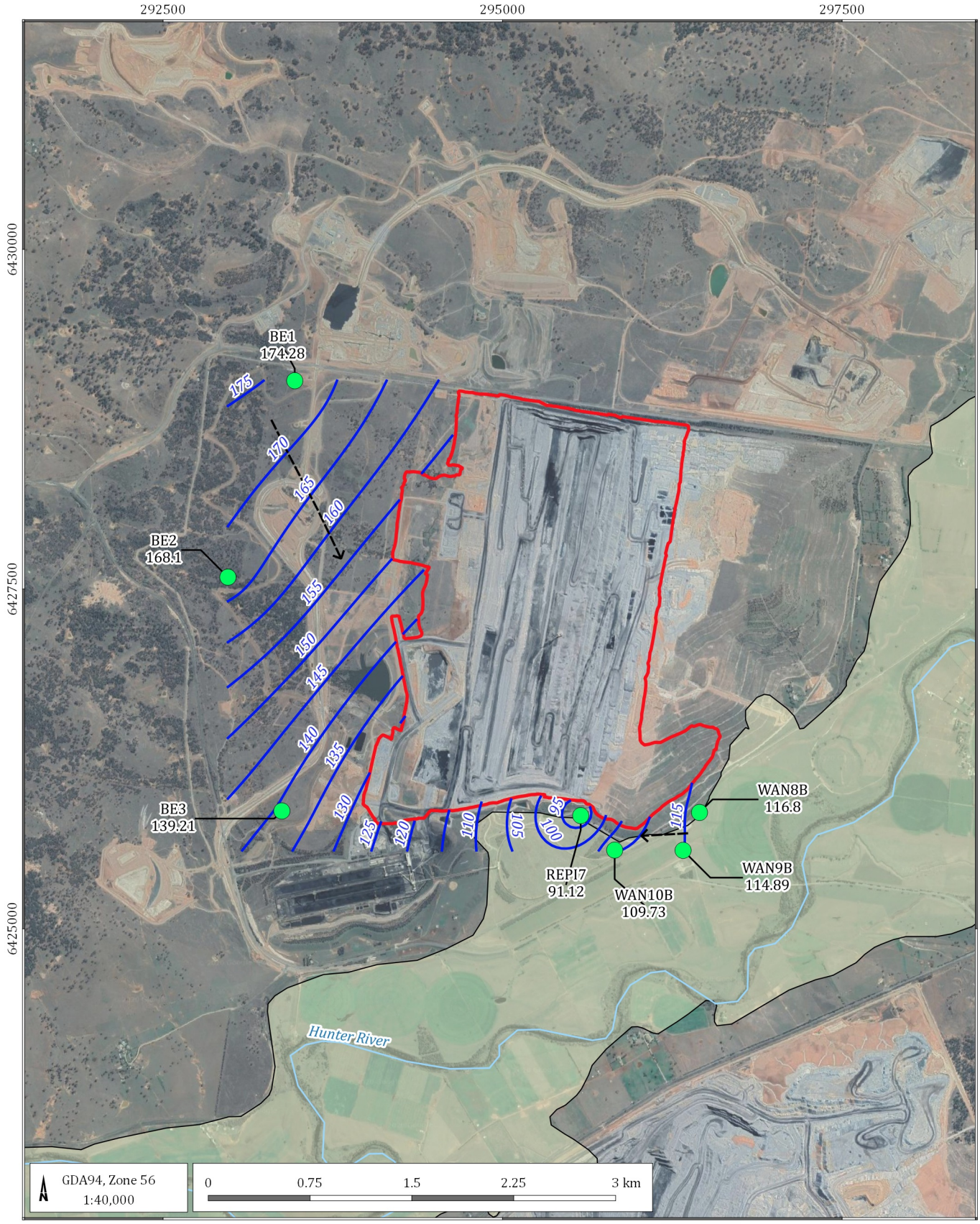


Figure 6.15 Alluvium and coal seam hydrographs – WAN10

6.2.3 Permian groundwater level contours

Figure 6.16 and Figure 6.17 show the interpreted groundwater flow contours for the shallow Permian units (Wynn and Vaux Seams and interburden) and deeper Permian units (Edderton and Edinglassie Seams and interburden), respectively. The depressurisation of the coal seams by the open cut mining and the hydraulic gradient towards the mine is evident in the water level contours of both layers. Whilst the impact of the coal seam depressurisation is evident in the Permian units, the impact to the alluvial aquifer is minimal (refer Figure 6.3 and Section 6.1.3).The water level contours and flow directions are consistent with historic data (AGE, 2019) and the drawdown is within predicted and approved ranges.



LEGEND

- Shallow Permian monitoring bores
- Drainage
- Void boundary
- Shallow Permian groundwater contours (5m) - July 2019
- Estimated groundwater flow direction
- Alluvium boundary

Bengalla annual review 2019 (G1543W)

Shallow Permian groundwater levels (July 2019)

DATE
25/02/2020

FIGURE No:
6.16

Source: Hunter Coalfield Regional 1:100 000 Geology Map*
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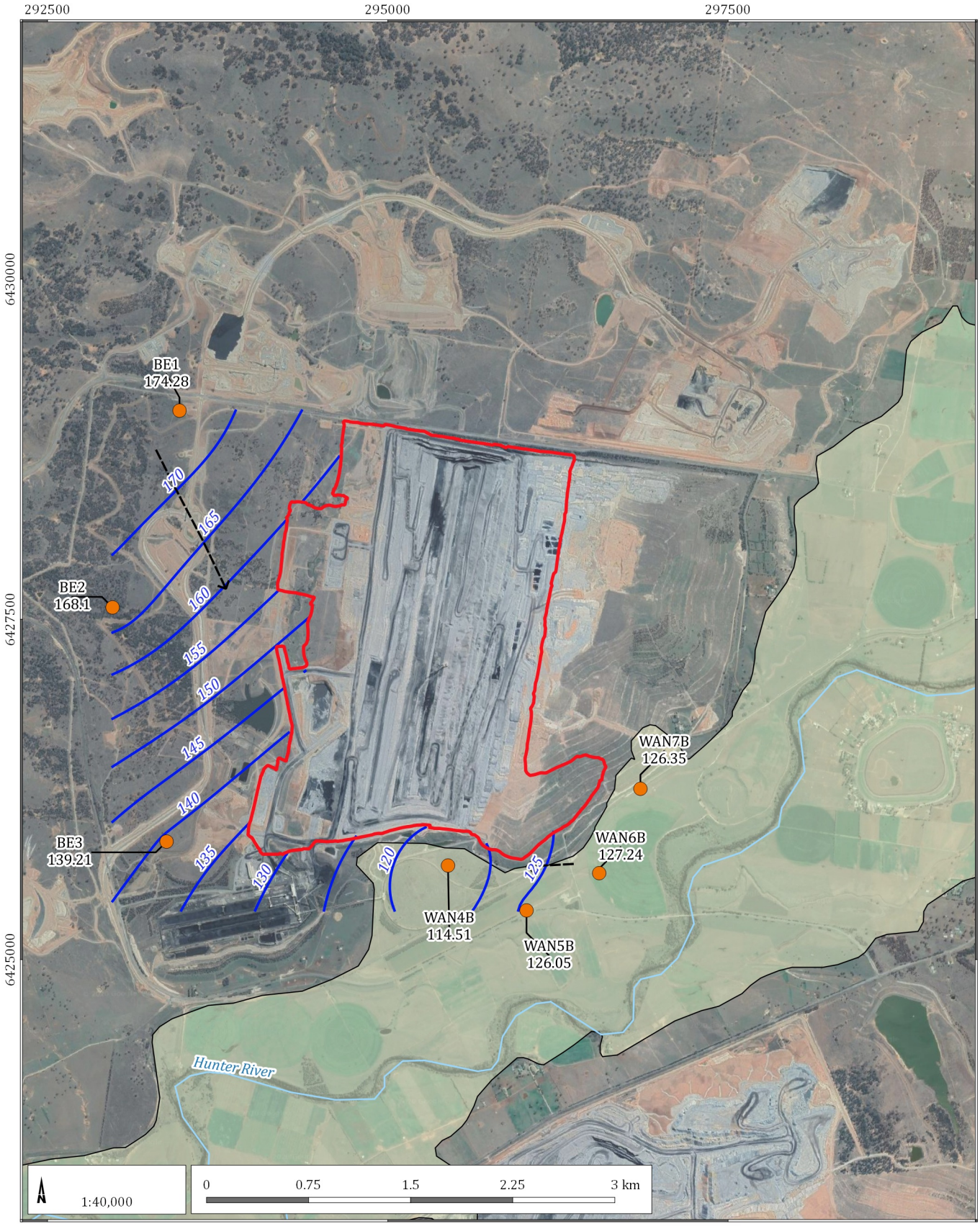

LEGEND

- Deep Permian groundwater monitoring bores
- Drainage
- Deep Permian groundwater contours (5m)- July 2019
- Void boundary
- Groundwater flow direction
- Alluvium boundary

Bengalla annual review 2019 (G1543W)

Deep Permian groundwater levels (July 2019)

DATE 25/02/2020

FIGURE No: **6.17**

Source: Hunter Coalfield Regional 1:100 000 Geology Map*
G:\Projects\G1543W.Bengalla Annual Review 2019\3_GIS\Workspaces\001_Deliverable1\06.17_G1543W_Deep Permian groundwater levels (July 2019).qgs

6.3 Permian groundwater level – northwest of active mining

Figure 6.18 to Figure 6.23 below show the groundwater level hydrographs for those bores and VWPs located to the northwest of the active mining area, including:

- 46737;
- BE1 (overburden monitoring bore);
- BE2 (overburden monitoring bore);
- BE3 (overburden monitoring bore);
- BE1 (Mt Arthur Seam VWP);
- BE1 (Edderton Seam VWP);
- BE2 (Mt Arthur Seam VWP);
- BE2 (Edderton Seam VWP);
- BE3 (Mt Arthur Seam VWP);
- BE3 (Edderton Seam VWP);
- BE4 (Mt Arthur Seam VWP);
- BE4 (Edderton Seam VWP);
- BE5 (Mt Arthur Seam VWP); and
- BE5 (Edderton Seam VWP).

Little change is evident in the groundwater level in the sites to the northwest of the active mining area over 2019 (BE1, BE2 and BE3).

During the 2019 monitoring period, bore 46737 was not accessible. BE1 displayed an increased water level of 0.78 m, BE2 increased by 0.14 m, while BE3 has declined 0.21 m. These bores are all above their relative water level triggers.

Figure 6.19 to Figure 6.23 show the potentiometric heads measured in VWP installations at BE1, BE2, BE3, BE4 and BE5. Each of these installations has one VWP sensor in the Mt Arthur Seam, and another sensor in the Edderton Seam. The water levels from monitoring bores BE1 through BE3 have also been plotted for comparison. Observations include:

- VWPs and bore at BE1 (Figure 6.19):
    - both the Mt Arthur Seam and the Edderton Seam VWP sensors appear to register a similar decline in head pressure which is analogous with groundwater elevation.
- VWPs and bore at BE2 (Figure 6.20):
    - the Mt Arthur Seam VWP sensor registered a large decline from early to mid-2018 and has stabilised thereafter; and
    - the head in the Edderton Seam VWP has continued to decline.
- VWPs and bore at BE3 (Figure 6.21):
    - the Mt Arthur Seam VWP sensor has registered declining water levels; and
    - the Edderton Seam VWP, which registered a slightly declining water level in 2018, has registered increasing water levels in 2019, thereby switching the vertical hydraulic gradient between the two coal seams.

- VWPs at BE4 (Figure 6.22):
    - the Mt Arthur Seam VWP sensor water levels have remained relatively steady over 2019; and
    - the Edderton Seam VWP sensor registered declining water levels.
- VWPs at BE5 (Figure 6.23):
    - both the Mt Arthur Seam and Edderton Seam VWP sensors have registered declining water levels. The largest decline was recorded in the Edderton Seam.

The declining water levels are most likely attributable to the advancing mine highwall and coal seams are expected to depressurise ahead of the mine highwall.

The reason for the discrepancy in groundwater level trends between the VWP sensors and the monitoring bores is that pressure dissipation is greatest in the deeper coal seams, as they are more permeable than the shallow coal overburden. Additionally, the 'BE' series monitoring bores are screened in Permian sandstone/overburden, which may not yet be intersected by the pit, and is continuing to receive recharge via seepage from overlying strata and lateral groundwater flow from the north and west.

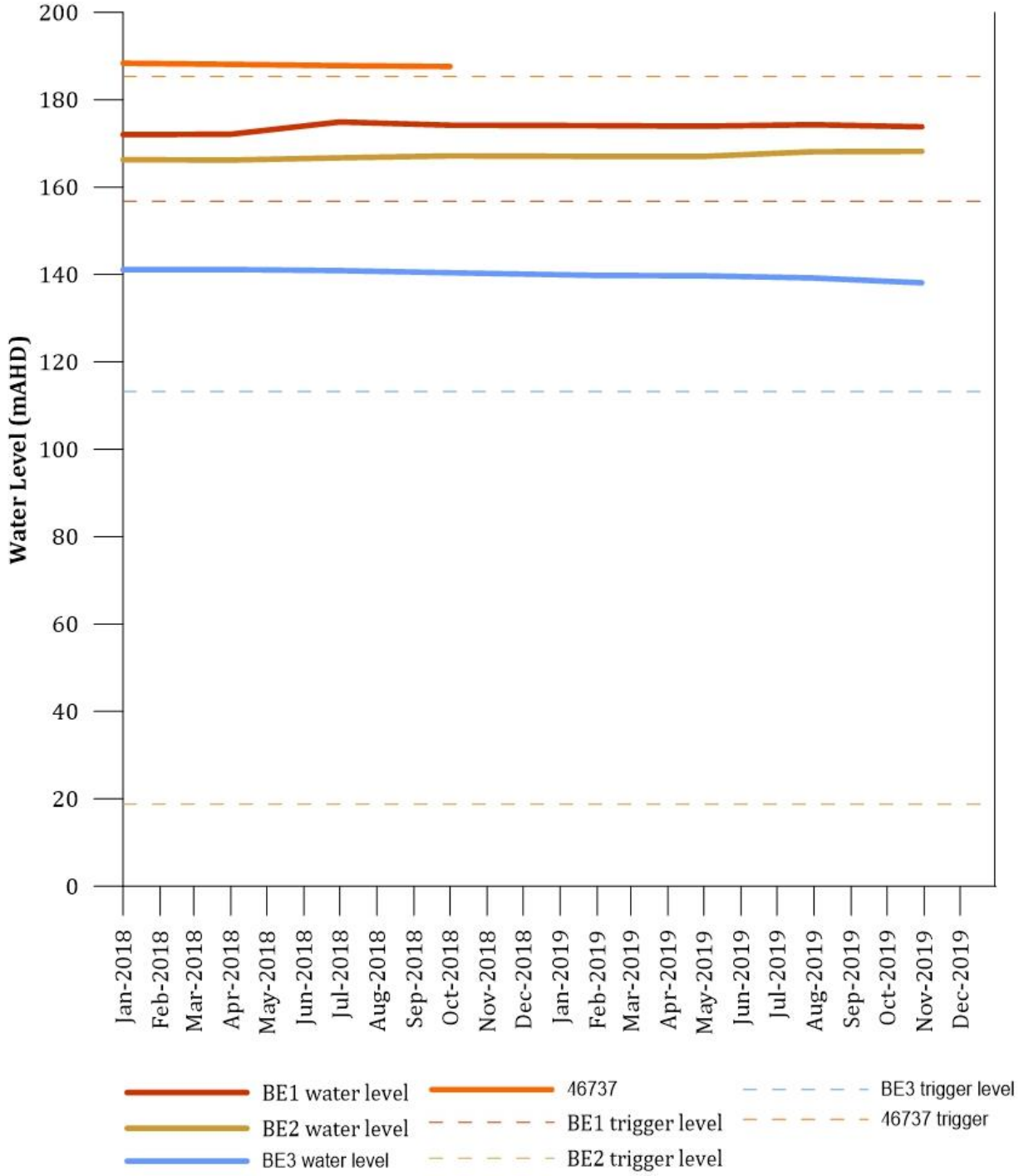

Figure 6.18 Northwest Permian monitoring bore groundwater levels

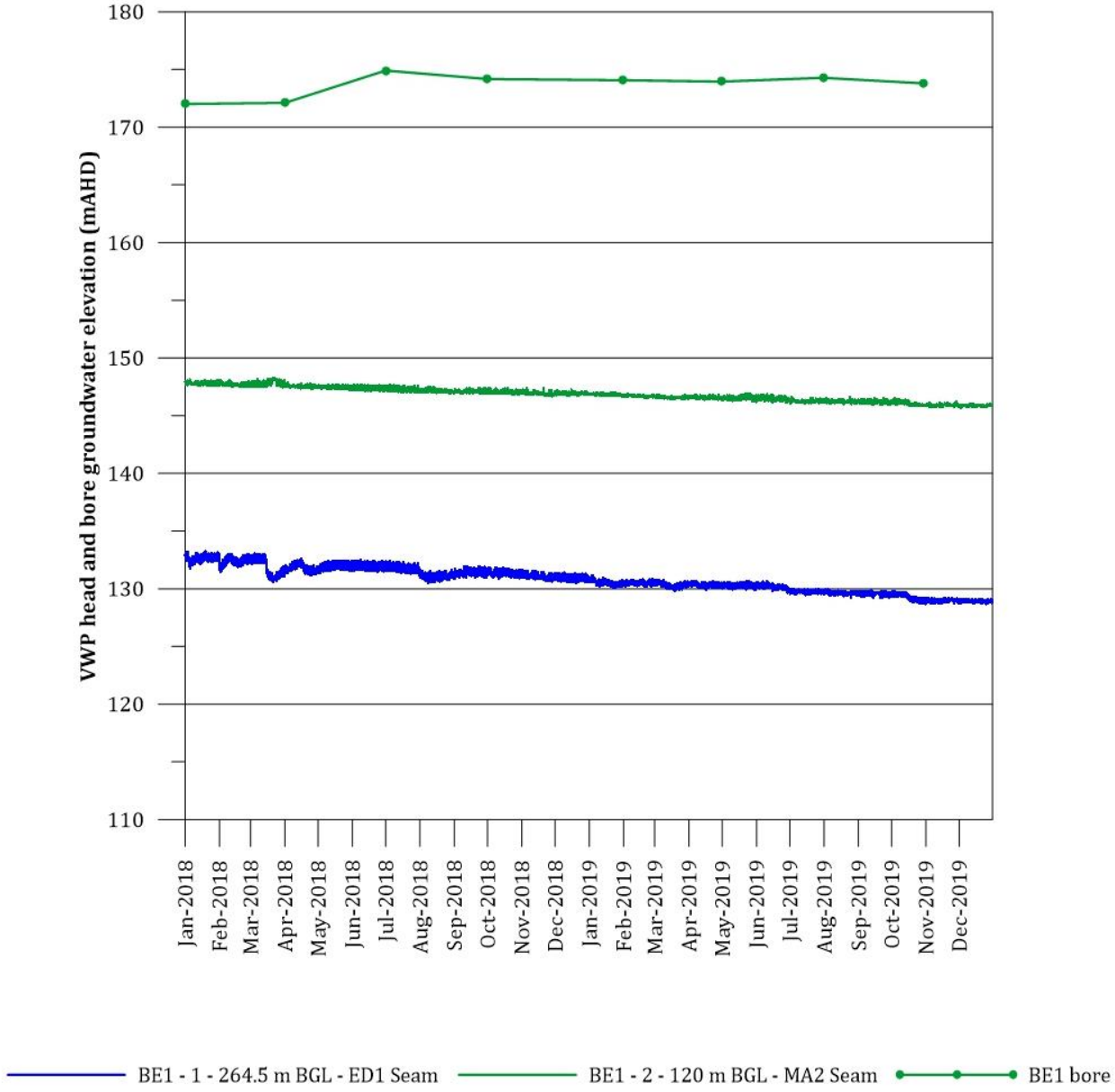

Figure 6.19 Northwest Permian VWP potentiometric heads – BE1

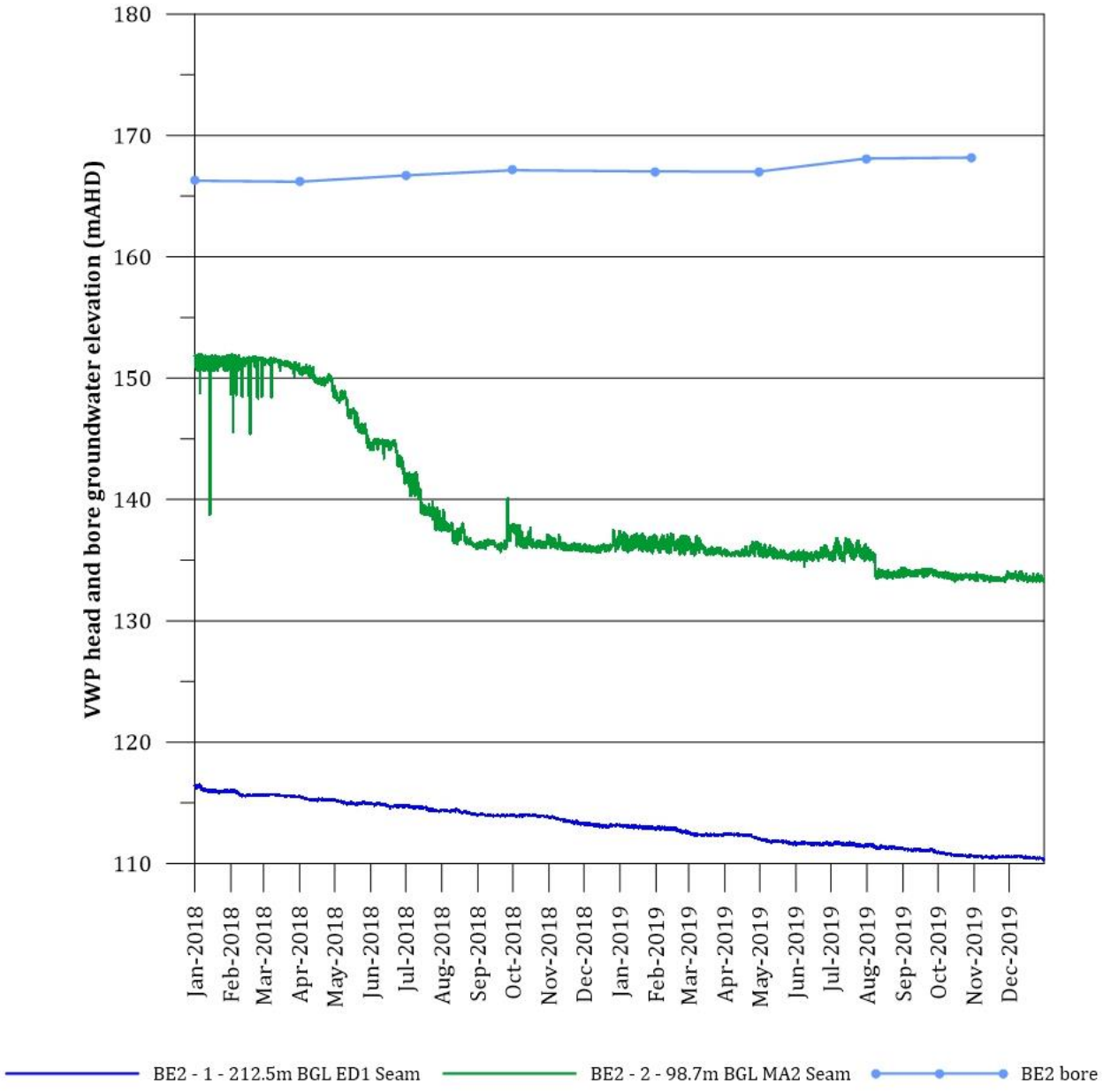

Figure 6.20 Northwest Permian VWP potentiometric heads – BE2

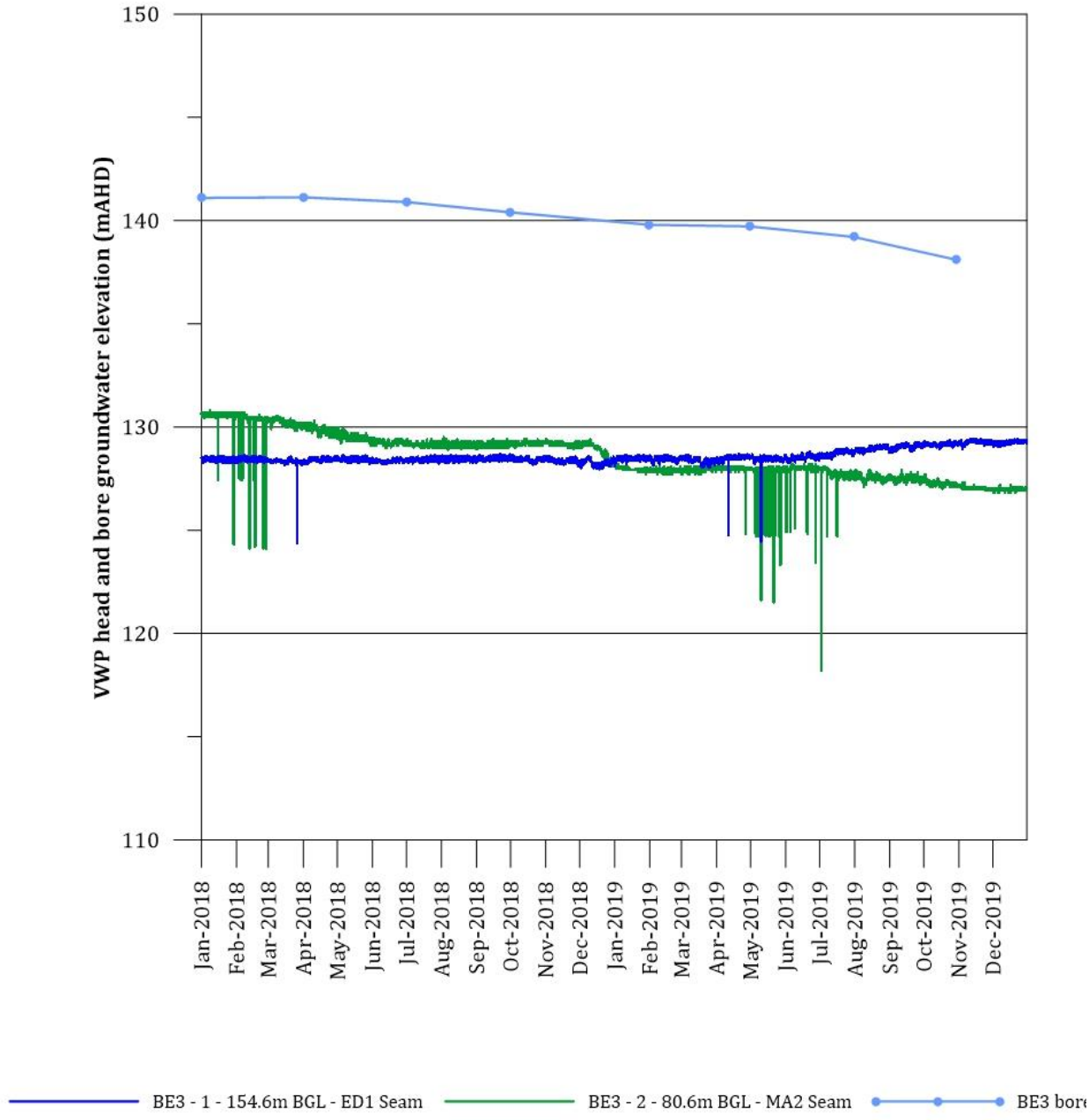

Figure 6.21 Northwest Permian VWP potentiometric heads – BE3

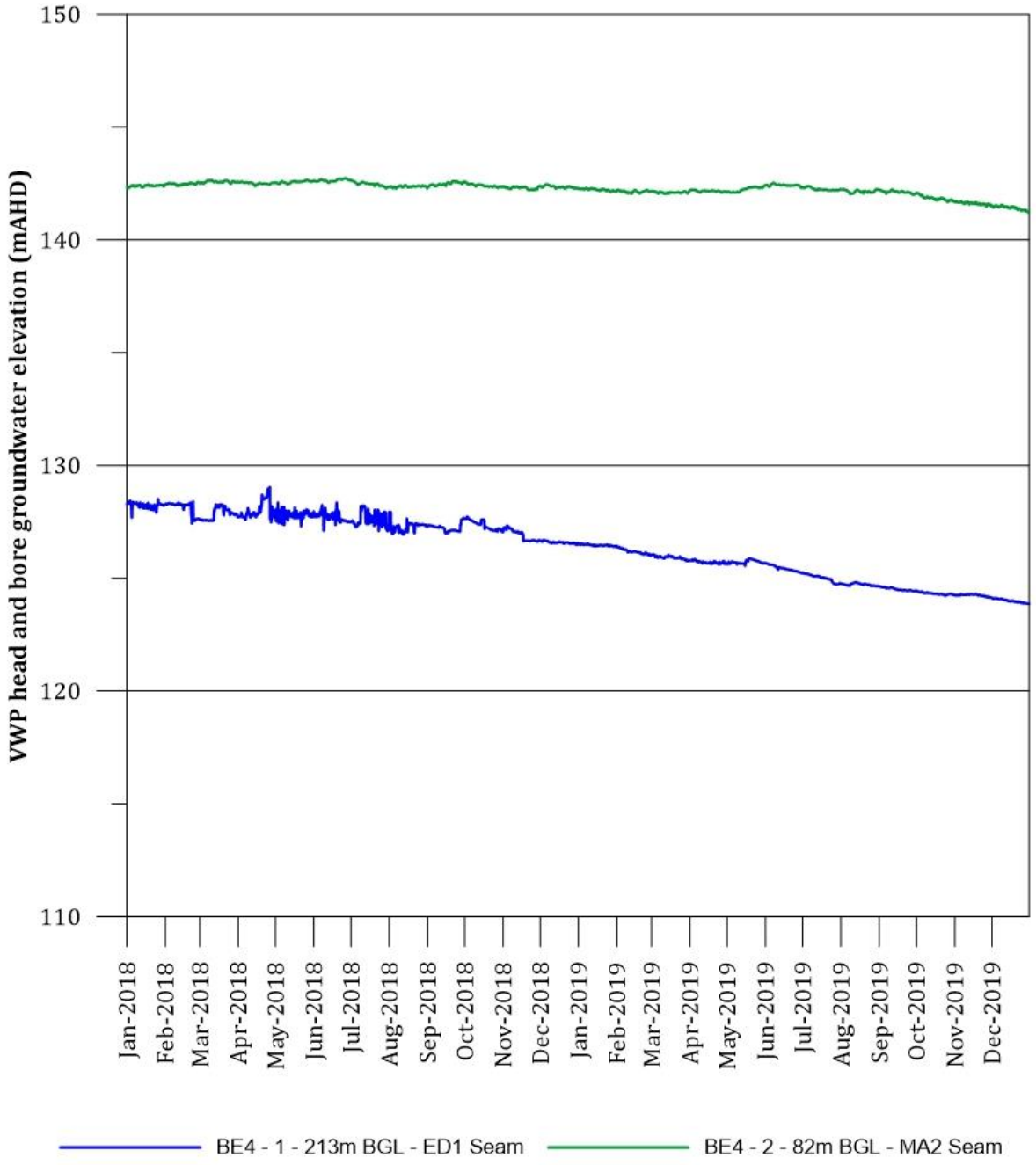

Figure 6.22 Northwest Permian VWP potentiometric heads – BE4

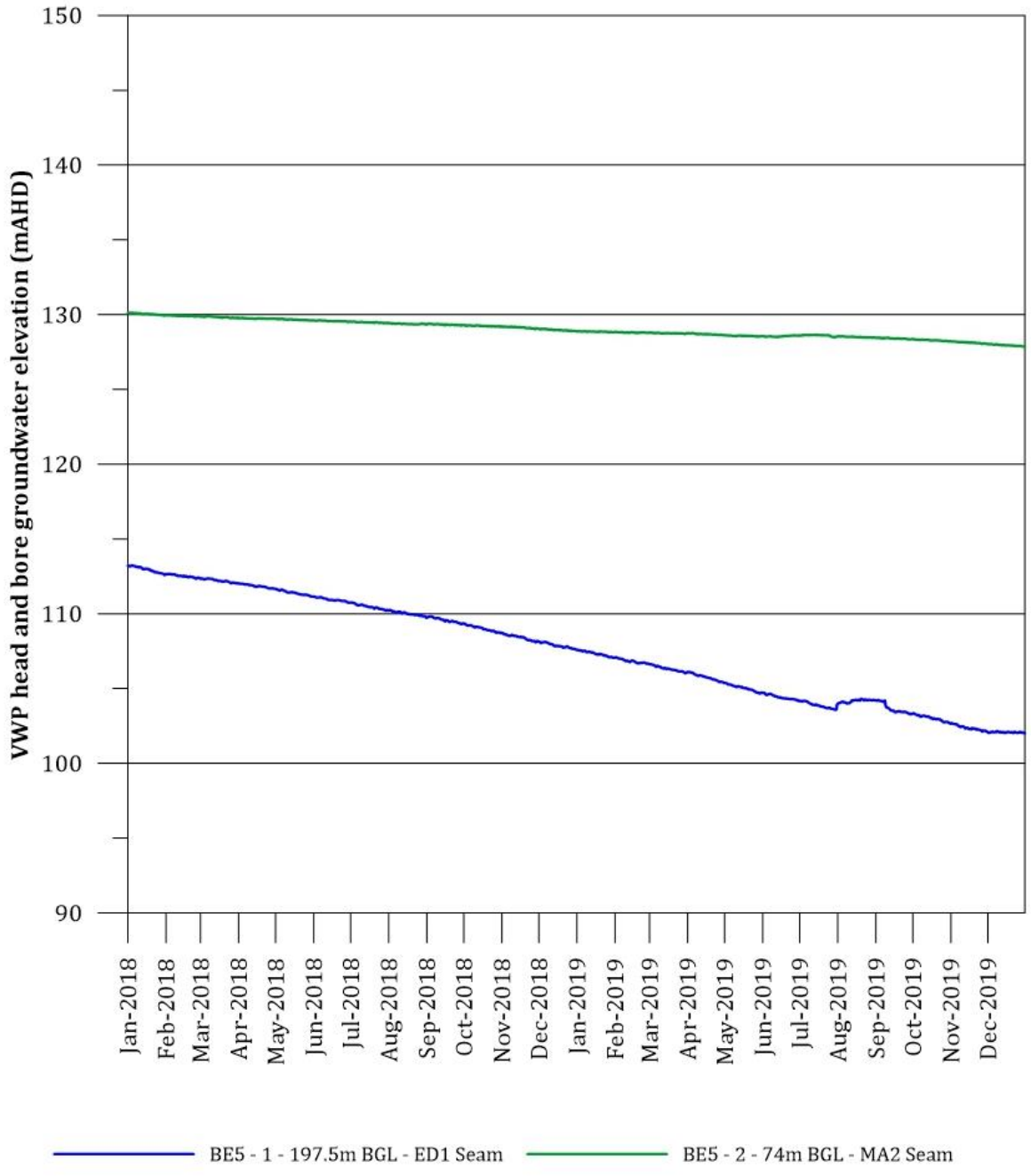

Figure 6.23 Northwest Permian VWP potentiometric heads – BE5

6.4 Groundwater level assessment against baseline data

Groundwater level data recorded over the 2019 reporting period has been compared against baseline data. Maximum predicted drawdown (trigger level) data is also reviewed, as set out in the Bengalla WMP (February 2019). A summary of the data is presented in Appendix A.

6.4.1 Baseline assessment

Appendix A shows the difference between the last measured groundwater level for the 2019 reporting period and the baseline data for each monitoring bore.

During the 2019 reporting period, monitoring bores BE3, BG3, BG1, BG3, BG5, REP17, SMB1, SMB2, WAN10A, WAN10B, WAN2B, WAN2C, WAN4A, WAN4B, WAN5A, WAN5B, WAN6A, WAN6B, WAN7A, WAN7B, WAN8B, and WAN9A2 had groundwater levels below their respective baseline water levels, see Appendix A – column 'Difference baseline vs. 2019 groundwater level'. Of the bores with groundwater levels below their respective baselines BE3, REP17, WAN10B, WAN2B, WAN4B, WAN7B, WAN8B, and WAN9B had groundwater levels of more than one meter below their respective baseline water level, due to drawdown from the mine. Monitoring bore REP17 showed the greatest negative difference (-10.71 m) compared to its baseline, whereas WAN1B showed the greatest positive difference (2.62 m).

6.4.2 Trigger level assessment

Groundwater trigger levels have been developed based on the maximum drawdown from the groundwater model. The trigger level is equal to: the most applicable pre-mining groundwater level (sourced from historic data), minus the predicted drawdown.

Appendix A shows the difference between the last measured groundwater level for the 2019 reporting period and the trigger level for each monitoring bore. One bore, BG3, (screened in alluvium and located in the irrigation area) had a groundwater level below the maximum expected drawdown in 2019.

Water level triggers are considered to have triggered a response when either:

- one bore exceeds its trigger for three consecutive measurements; or
- when three monitoring bores exceed their respective triggers during one round of monitoring.

BG3 had 4 groundwater level trigger events in 2019 (see Table 6.1); the trends and latest trigger events are presented graphically in Figure 6.24.

BG3 triggered the response protocol for all four consecutive 2019 measurements; however, it has been below its trigger value since February 2015, and the water levels are within historic ranges (Figure 6.24). The water level in BG3 has oscillated around its baseline level since its installation and the 2019 level is within historic ranges. Considering the distance between BG3 and Bengalla (> 1.5 km), these trigger events are not likely to be related to mining at Bengalla (AGE, 2018). It is concluded that the groundwater levels measured for BG3 in 2019 do not pose harm to the environment.

The groundwater level for bore BG5 has also fluctuated around its trigger level and had water level trigger exceedances in 2018 (Figure 6.24). However, there were no exceedances for this bore in 2019.

Table 6.1 Water level trigger events against approved WMP

Site	BG3	
	Alluvial aquifer	
Sample Date	Depth to water (mTOC)	Depth (mAHD)
Trigger value	126.3 mAHD	
Oct-18	7.84	**125.96**
Jan-19	7.81	**125.99**
Apr-19	7.88	**125.92**
Jul-19	8.01	**125.79**
Oct-19	8.02	**125.78**

Notes: *Red text indicates water elevation exceeds trigger level*
TOC: top of casing

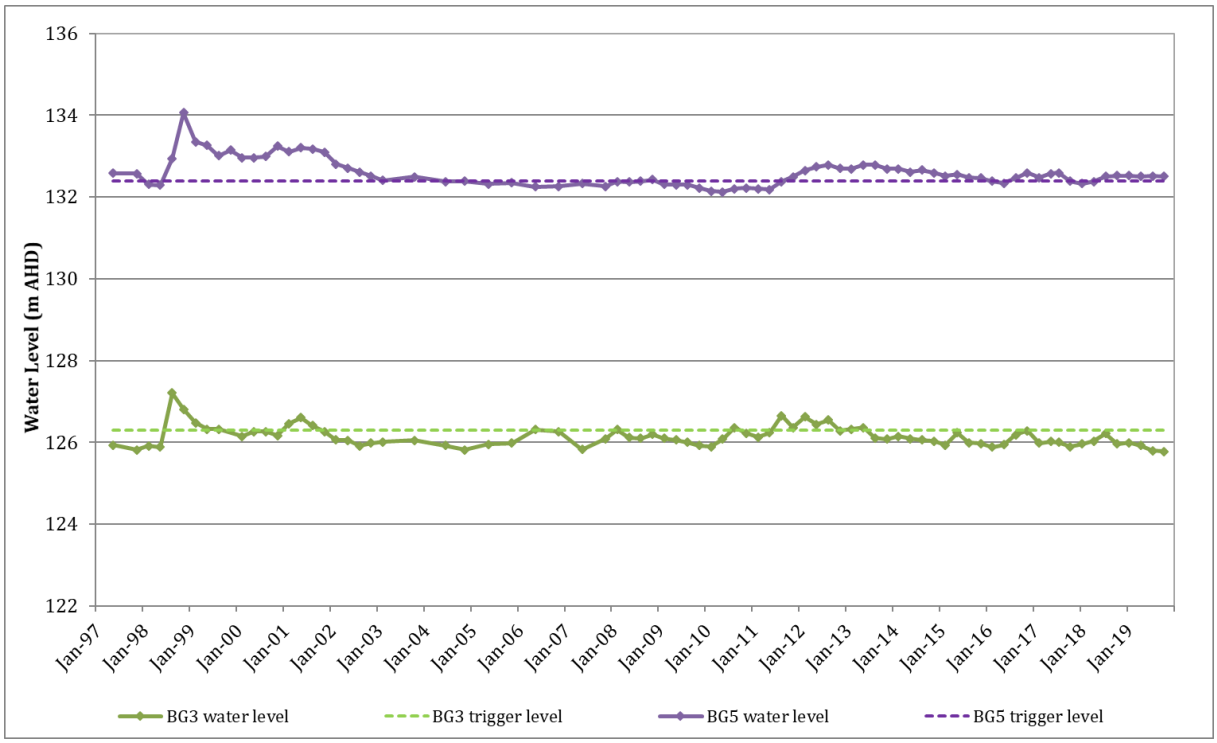

Figure 6.24 Hydrograph of bores with groundwater levels near maximum predicted drawdown

7 Groundwater quality and monitoring

7.1 Quality monitoring overview

Groundwater quality monitoring at Bengalla has included the following analyses:

- electrical conductivity (EC);
- total dissolved solids (TDS);
- pH;
- sulfate; and
- dissolved metals (Al, As, Be, B, Cd, Cr, Co, Cu, F, Fe, Pb, Li, Hg, Mo, Ni, Se, V, and Zn).

EC, TDS and pH have been monitored in the Wantana Extension sites – WAN1, WAN2, WAN3, WAN4, WAN5, WAN6 and WAN7 since September 2005, and in the Regional bores since 1999. SMB1 and SMB2 were added to the monitoring program in 2010.

Sulfate and metals have been monitored in the Wantana Extension bores WAN8, WAN9 and WAN10 since May 2009, and in all Wantana bores from August 2009. Monitoring of sulfate and metals commenced in eleven of the Regional monitoring bores in 2003, and in the remaining eight Regional monitoring bores in August 2009.

7.2 Alluvial water quality

7.2.1 pH

Figure 7.1, Figure 7.2 and Figure 7.3 show pH trends in alluvial bores. Groundwater pH trends for Hunter River alluvial bores have remained consistent across 2019 with some minor fluctuations evident.

WAN8A had two consecutive pH values above trigger level pH 8.5 in 2019, and the pH values are anomalously high. However, only two results are recorded for the year due to the bore containing insufficient water to sample. At the latest reading for 2019, there was only 28 cm of water column within the screened interval. These observations of water level and water quality together indicate that the water being sampled from WAN8A is stagnant water from the bore column, rather than in situ groundwater. The monitoring procedure for this bore should be redressed to exclude sampling if there is insufficient water to provide a representative sample. The high pH values at this site do not pose an environmental risk.

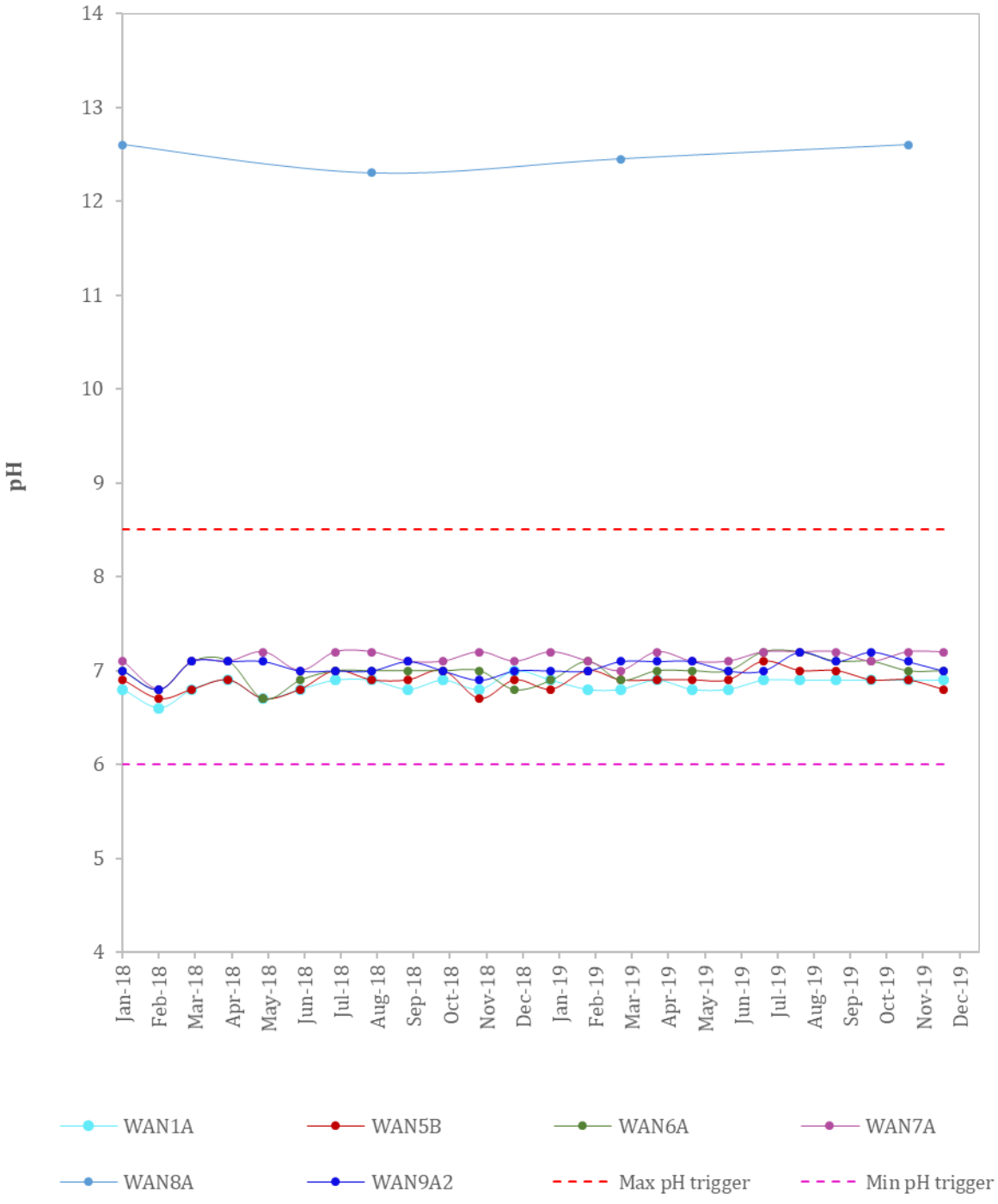

Figure 7.1 pH trends – Hunter River alluvial bores

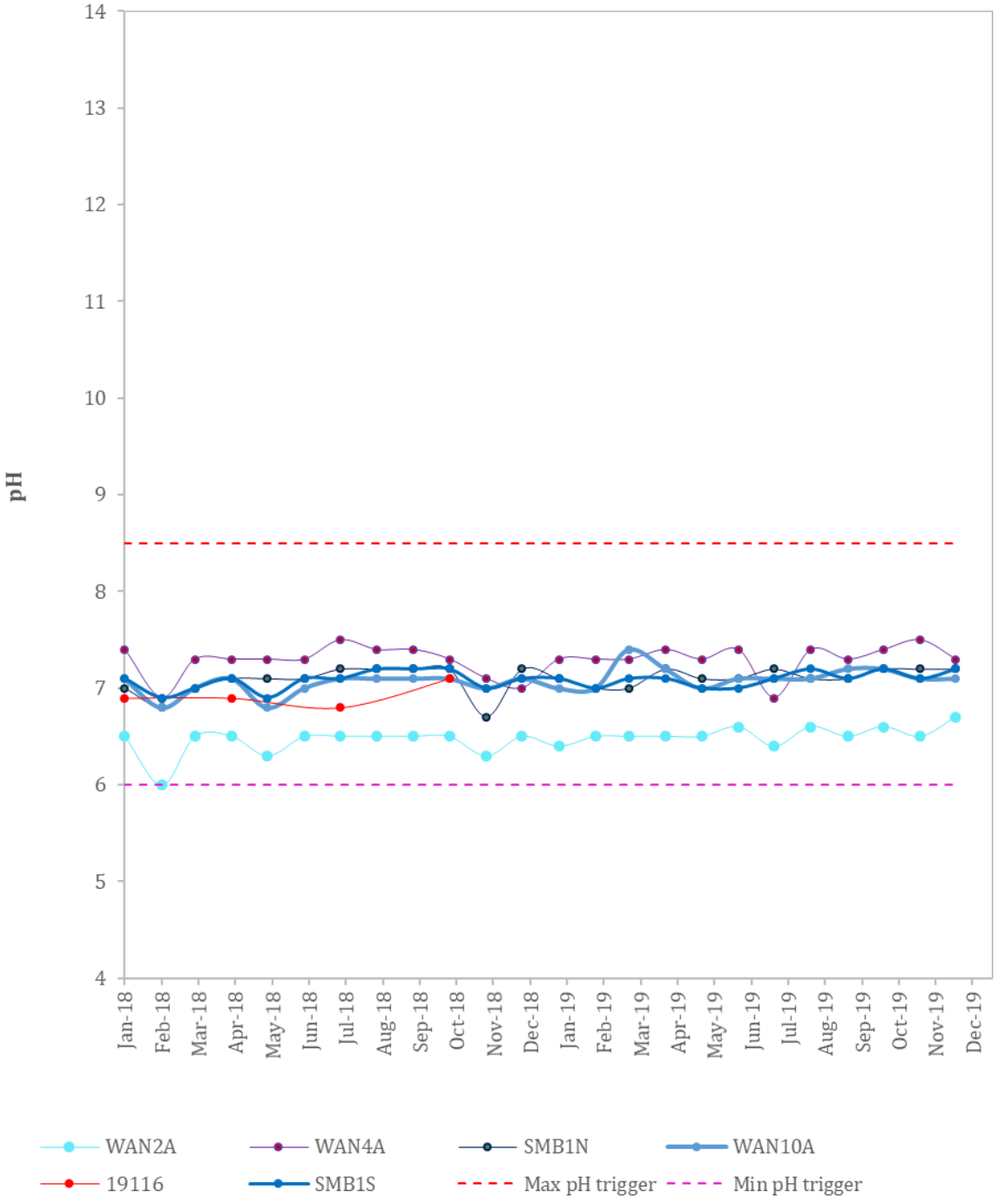

Figure 7.2 pH trends – other alluvial bores

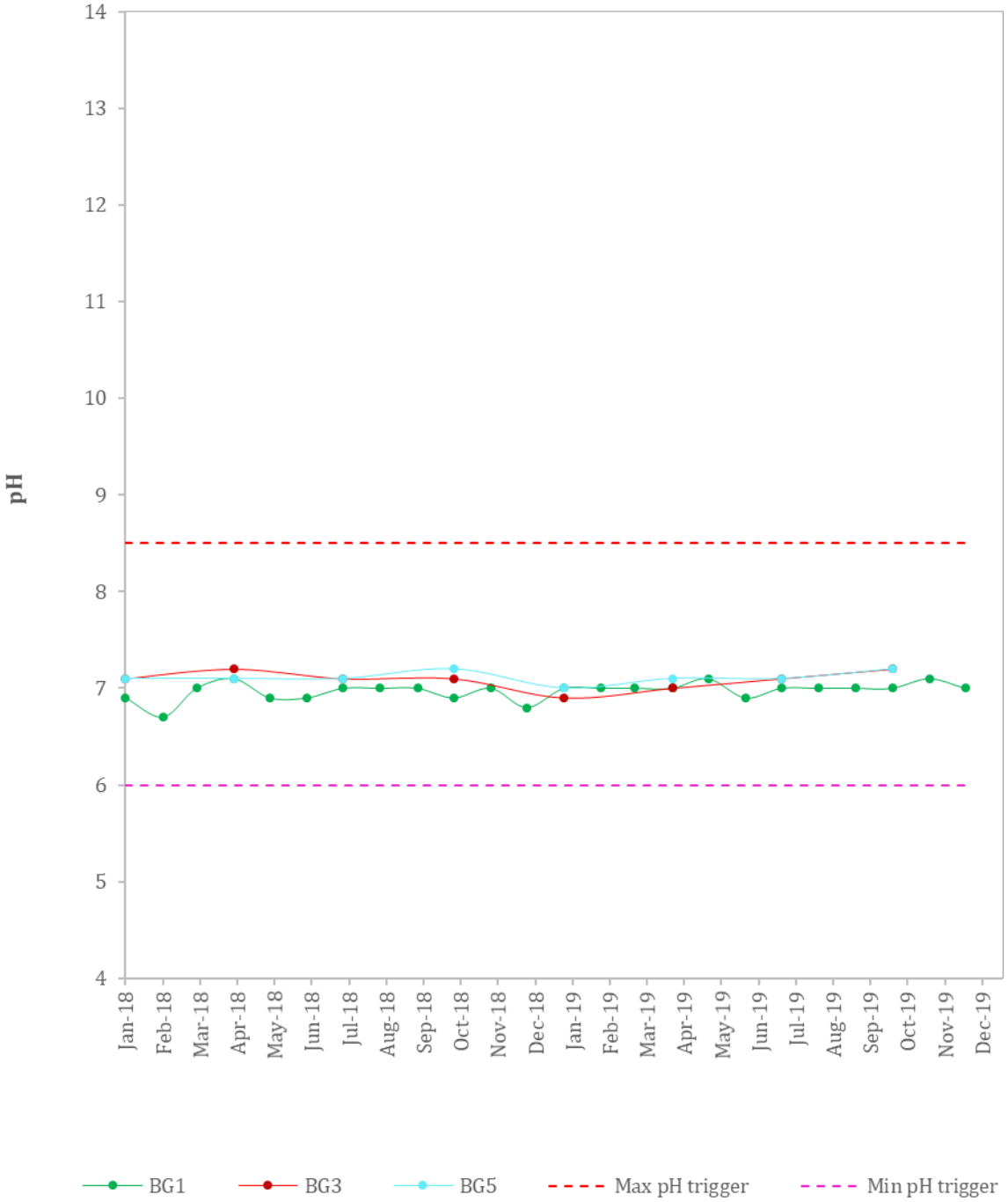

Figure 7.3 pH trends – regional alluvial bores

7.2.2 EC

Figure 7.4 and Figure 7.5 show EC trends in alluvial bores in the Wantana Extension Area and Regional alluvial monitoring bores, respectively.

Generally, the EC in the alluvium is less than 1,500 µS/cm, indicating that the alluvial groundwater in the Wantana Extension area is similar to groundwater in the regional alluvial bores. Five bores are shown to have EC exceeding 1,500 µS/cm, including:

- BG3;
- WAN7A;
- WAN8A;
- SMB1-South; and
- SMB2-North.

Water quality trigger events in 2019 are described in Section 7.5.

WAN4A has been recording a gentle decline in EC since early 2015 with the last recorded value 1,086 µS/cm (December 2019). WAN4A is on a "spur" of alluvium to the south of Bengalla's southern endwall. The coal seams in this area are likely depressurising due to mining and the decrease in pressure has allowed local infiltration of less saline river water in the alluvium, causing a decrease in EC. The water level in this bore does not appear to be impacted. The EC values in this bore should continue to be monitored.

The EC values for WAN8A, which is screened in the alluvium, have historically ranged between 1,282 µS/cm (Nov 2007) and 8,870 µS/cm (May 2010). Measurements from January and August 2019 were 7,730 µS/cm and 8,000 µS/cm, respectively. However, the high EC currently observed probably represents stagnant water accumulated in the sump of WAN8A, rather than in situ groundwater. Groundwater levels (6.1.3) and pH (7.2.1) also support this conclusion.

Throughout 2019, monitoring bores, WAN7A, SMB1-South, SMB2-North were presenting EC values between 1,500 µS/cm and 2,500 µS/cm. Although these results are above 1,500 µS/cm, these bores have generally remained consistent throughout 2019 and historically (Figure 7.4).

Regional monitoring bore BG3 is situated along strike to seams currently being mined at Bengalla (and north of Mt Arthur where the same geological profile is mined), and has historically shown significant variation in EC. Recently, EC values in this bore have declined from 1,511 µS/cm in January 2018 to 1,067 µS/cm in October 2019 (Figure 7.5). It is not clear why this decrease in EC has occurred over this period. Coal seam depressurisation may have allowed for localised infiltration of less saline river water into the alluvium, thereby causing a decrease in EC. Ongoing monitoring will continue and further assessment may in future establish the possible cause.

With respect to water levels and EC trends, WAN6A, SMB1-South and SMB2-North water level and EC trends appear to match, with increases in EC corresponding to declines in water levels, thus evaporation, or lack of rainfall infiltration is the cause of EC rise. It does not appear that there are mine related impacts on groundwater EC within these bores.

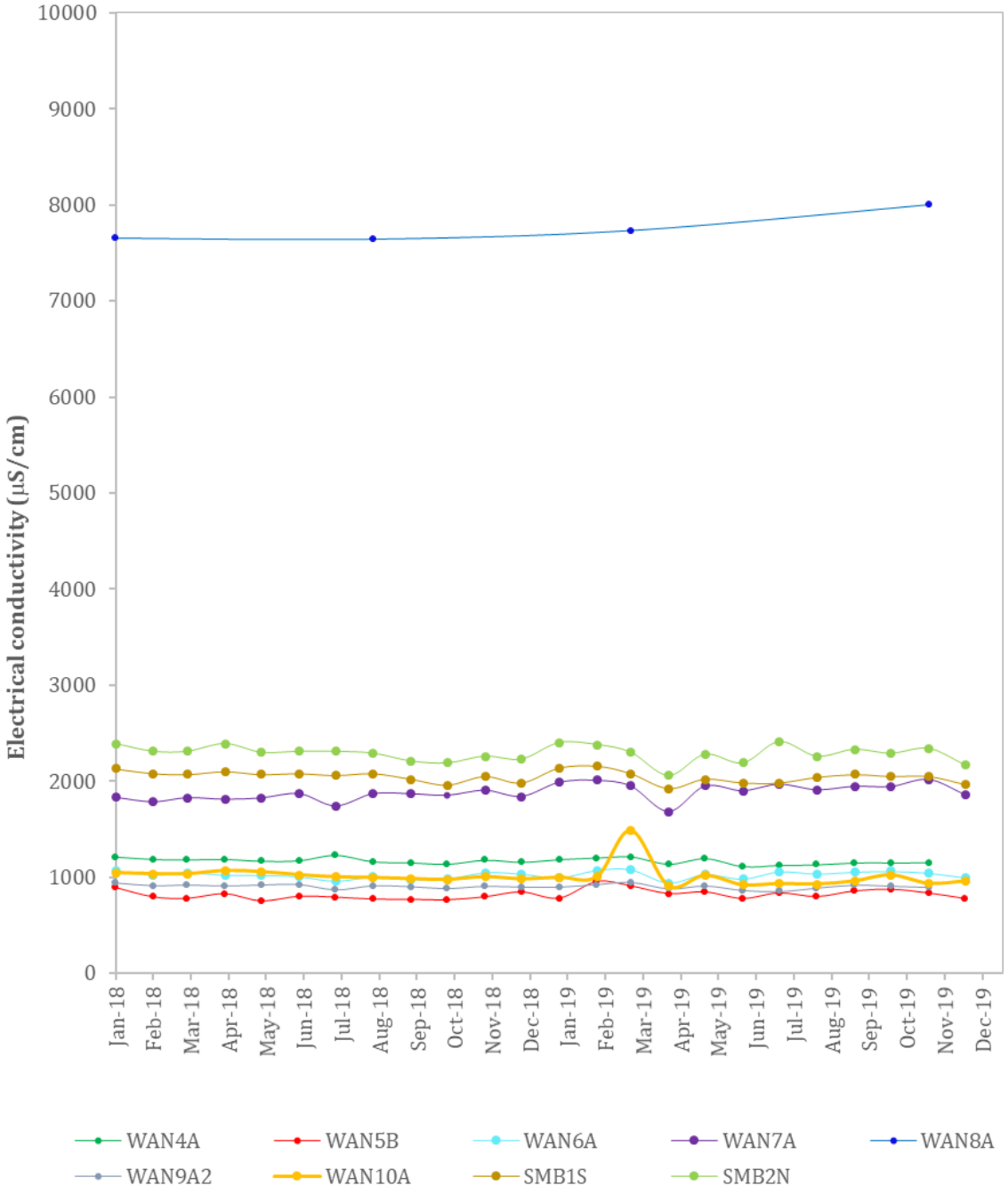

Figure 7.4 EC trends – Hunter River Alluvium (Wantana Extension)

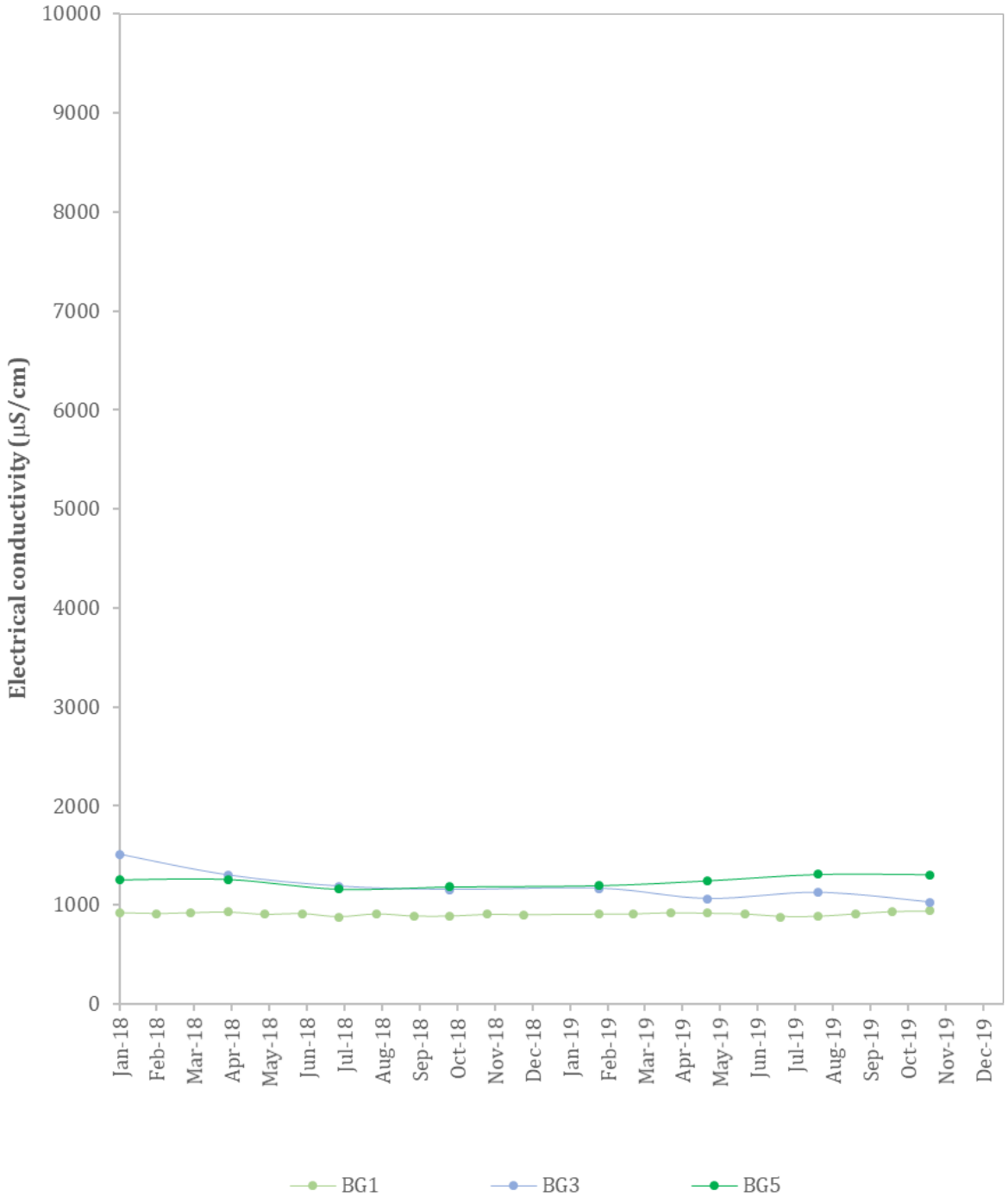

Figure 7.5 EC trends – Hunter River Alluvium (Regional)

7.3 Coal seam and interburden water quality

7.3.1 pH

Figure 7.6 and Figure 7.7 show pH trends for coal seam units, and interburden bores in the Wantana area, respectively. Groundwater pH trends in coal seam and interburden have remained circum-neutral and stable, and generally share the same trends over 2019. No coal seam/interburden bores have exceeded pH trigger values throughout 2019.

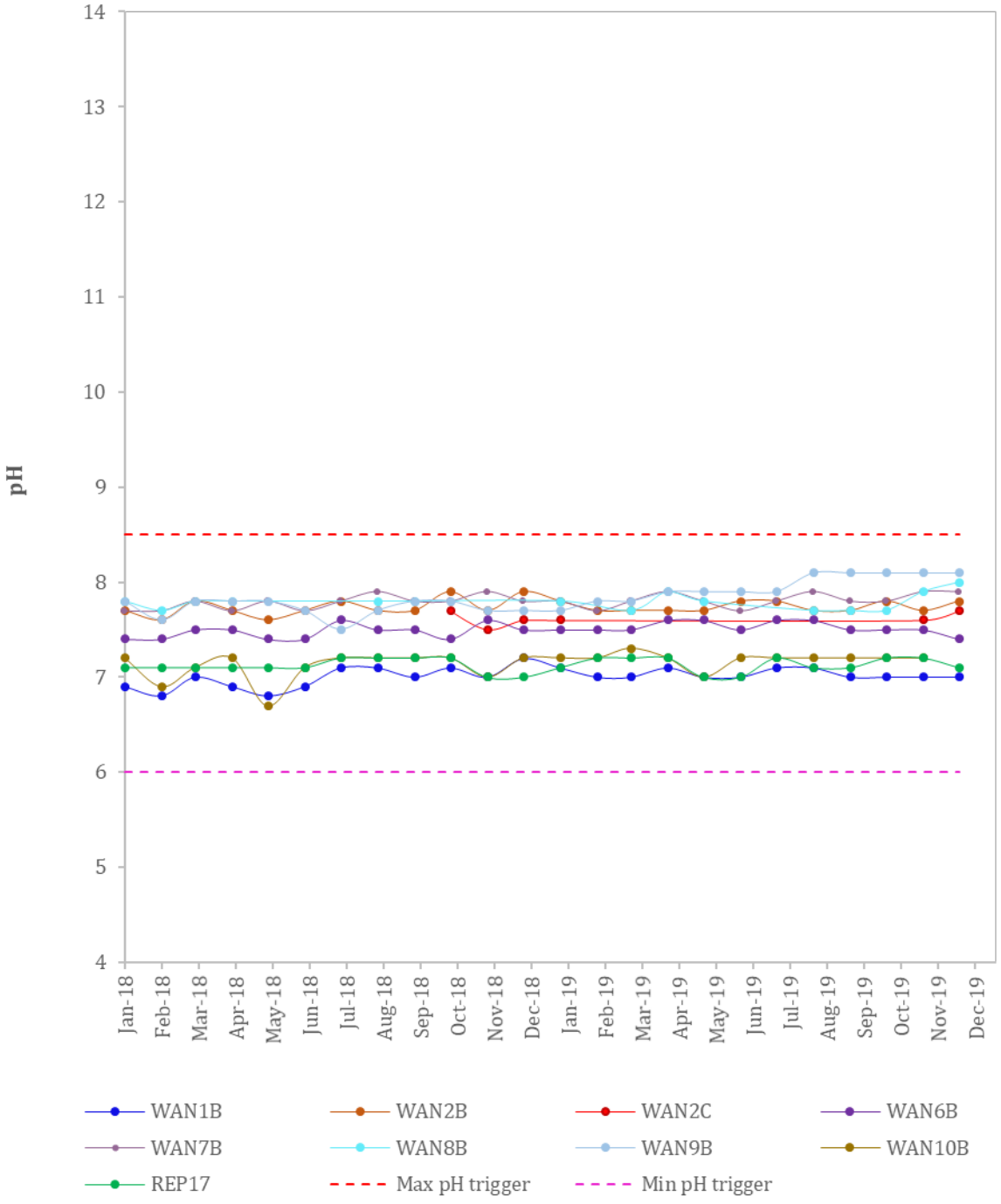

Figure 7.6 pH trends – coal seam aquifers

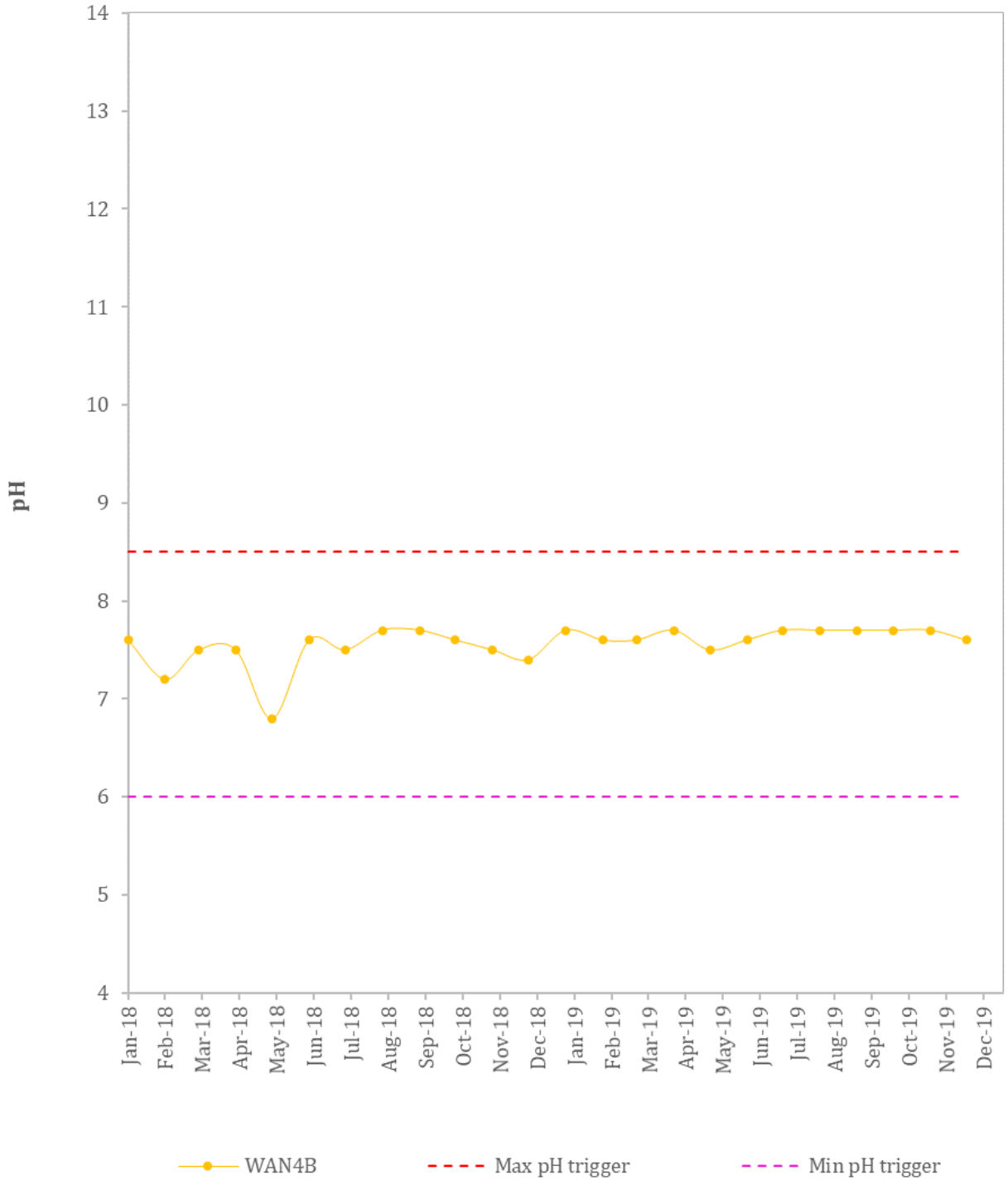

Figure 7.7 pH trends – coal seam aquifers (Wantana Area)

7.3.2 EC

Figure 7.8 and Figure 7.9 show EC trends for coal seam units and interburden bores in the Wantana area and regional monitoring bores, respectively. Water quality trigger events in 2019 are described in Section 7.5.

The coal seam and interburden bores can be separated into three distinct groups by groundwater EC:

- bores that have EC measurements less than 2,000 µS/cm, including WAN1A, WAN1B, WAN2A, WAN6B, and WAN9B (lower EC group; Figure 7.8);
- bores that have EC measurements between 2,000 µS/cm and 3,000 µS/cm, including WAN8A,WAN7B, and WAN2B;and,
- bores that have EC measurements between 3,000 µS/cm and 9,000 µS/cm, including WAN2B, WAN2C, WAN5A and WAN7B, that are within the expected range for coal seam bores (Figure 7.8 and Figure 7.9).

The lower EC group may reflect seepage from the alluvium.

As discussed in Section 6.2.2, WAN2C was cleared of a blockage as of October 2018. Subsequent EC results are variable but similar to those recorded prior to the blockage in August 2016, averaging 3, 900µS/cm in 2019.

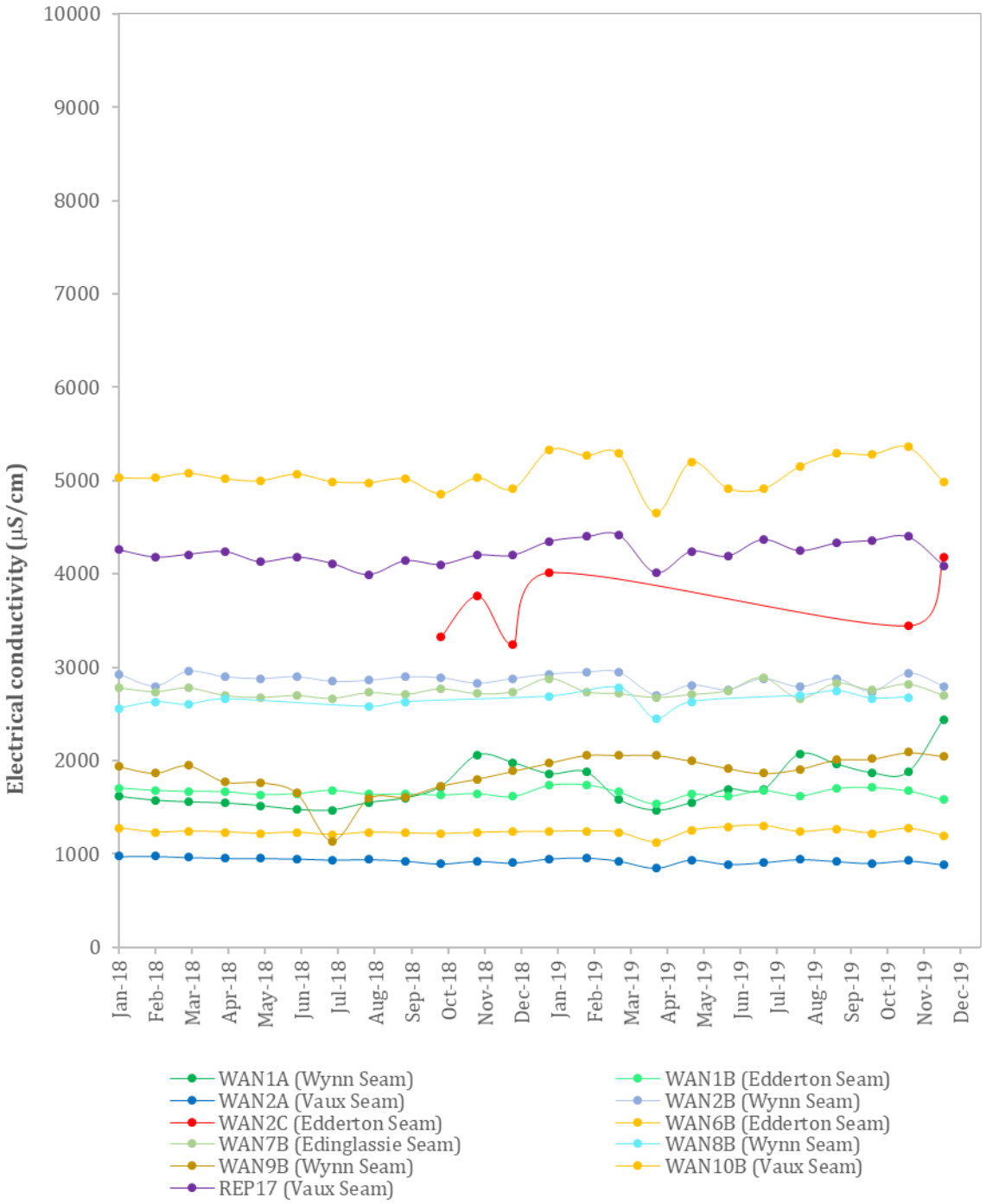

Figure 7.8 Electrical conductivity trends – coal seam aquifers (Wantana Area)

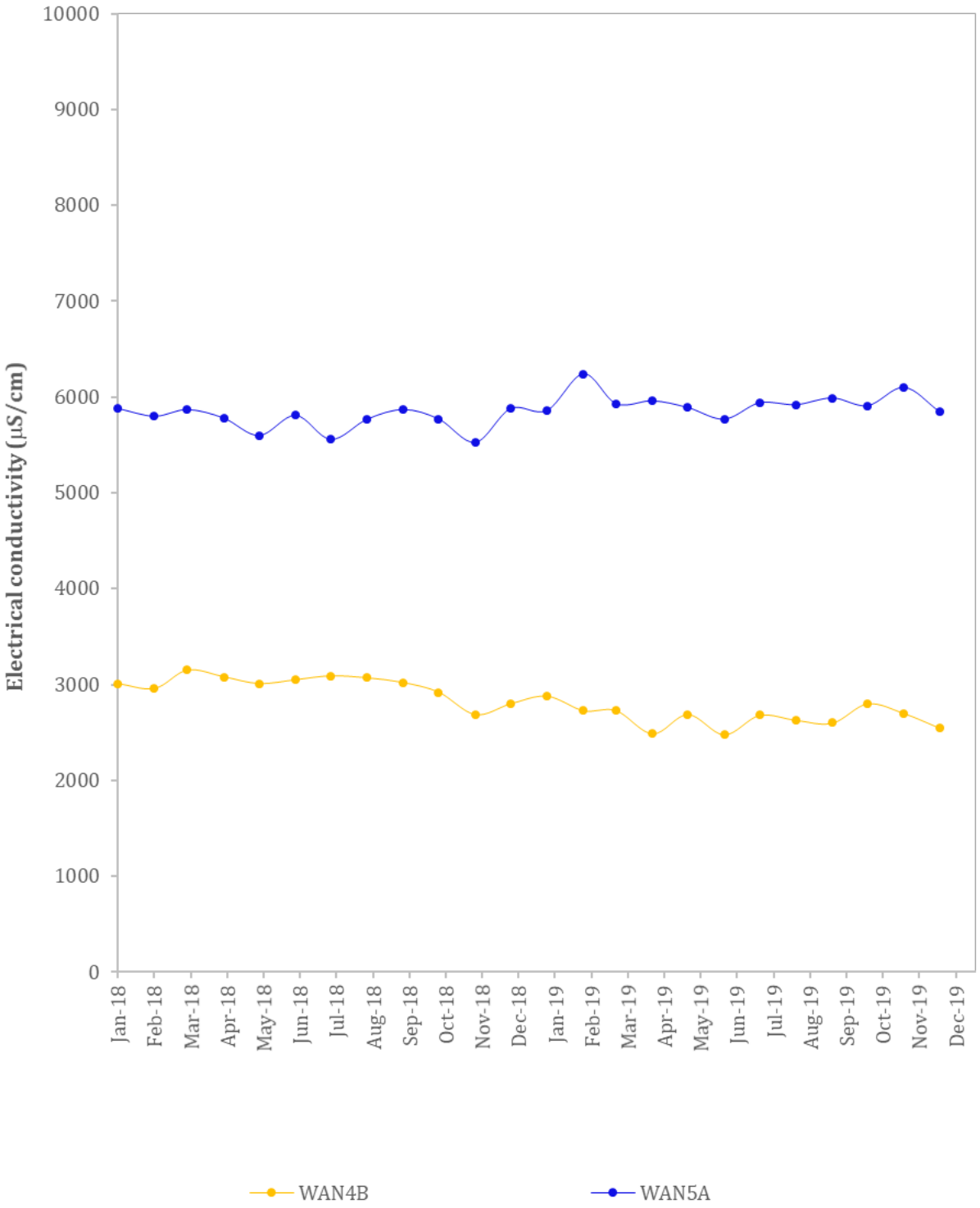

Figure 7.9 Electrical conductivity trends – Deep Permian bores

7.4 Permian groundwater quality – northwest of active mining

Figure 7.10 and Figure 7.11 show the EC and pH, respectively, for bores to the northwest of active mining. These bores include:

- BE1;
- BE2; and
- BE3.

Figure 7.10 shows EC has remained relatively consistent for bores BE1, BE2 and BE3. The water levels in these bores have remained steady over the reporting period. These bores are ahead of the mine highwall and there is no apparent depressurisation. The changes in EC, which is naturally elevated, are likely due to changes in recharge.

Figure 7.11 shows pH values have remained circum-neutral and stable in 2019. Groundwater pH values for all monitoring bores are within historic ranges.

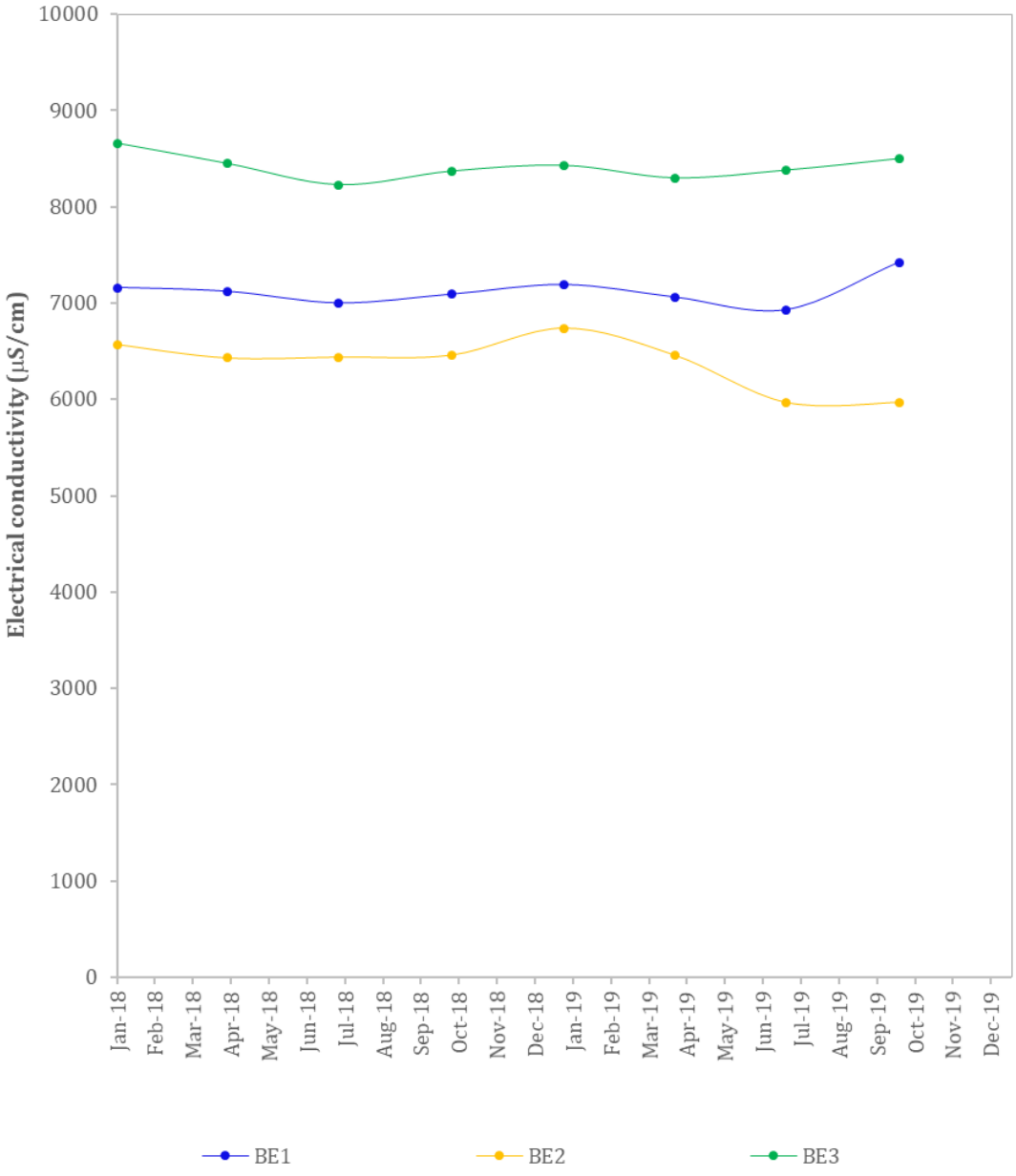

Figure 7.10 Electrical conductivity of Permian bores to the northwest of active mining

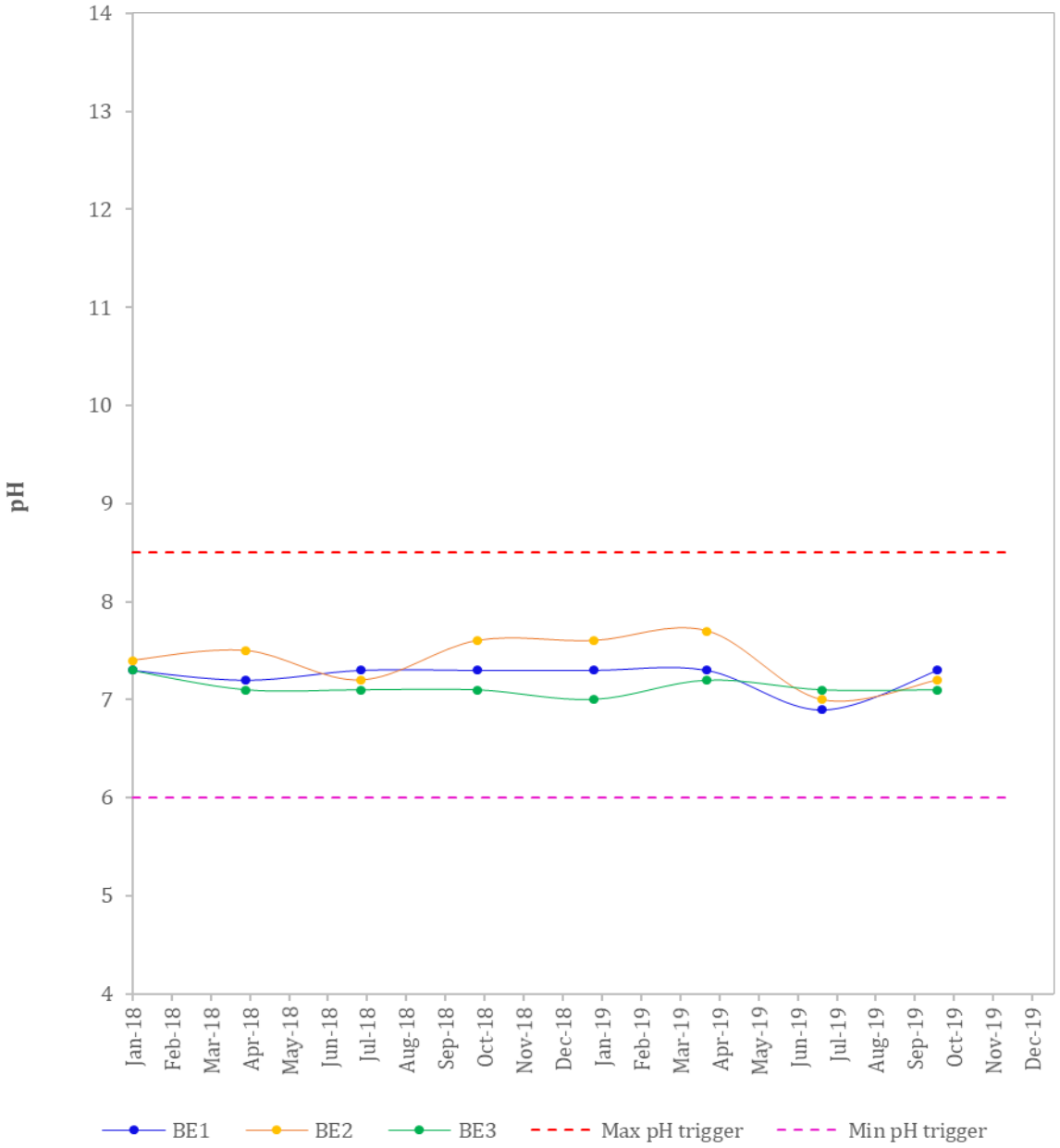

Figure 7.11 pH of Permian bores to the northwest of active mining

7.5 Water quality trigger events

Water quality monitoring data was compared to trigger values in the current approved WMP. Nine sites had groundwater quality trigger events in 2019.

7.5.1 pH

With the exception of WAN8A, which recorded four consecutive exceedances for pH in 2018 and 2019, all groundwater monitoring bores in the network have recorded values within the assigned trigger values. Elevated pH values for WAN8A were investigated in 2017 and were found to be not mining related (refer Section 7.2.1). Results from this reporting period indicate that the water in this bore is stagnant, and not connected to the environment.

7.5.2 EC

A comparison of monitoring results to EC triggers revealed that eight monitoring bores exceeded their respective EC triggers (Table 5.1) during the monitoring period. The relevant monitoring data and trigger events are summarised in Table 7.1.

Changes in rainfall recharge are likely to be the main influencing factor in the variability of the measured EC values, and therefore influence some of the trigger events. Additionally, depressurisation of coal seams that are subcropping beneath the Hunter River alluvium is also an influencing factor in some bores (as discussed above). This is consistent with the 2013 EIS (AGE, 2013a) prediction that changes to the groundwater quality would be associated with the depressurisation of the Permian units.

WAN9B and WAN10B have a history of exceeding trigger values for EC and displayed variable EC changes in 2019; WAN9B displayed a slight increase, whereas WAN10B displayed an oscillating trend. Continued monitoring is required to understand the causes of fluctuating EC in these bores.

Table 7.1 Summary of EC trigger events for 2019

Site	WAN6A (alluvium)	WAN9B (Wynn Seam)	WAN10B (Vaux Seam)	SMB1 South (alluvium)	SMB2 North (alluvium)	BE1 (Permian Sandstone overburden)	BE2 (Permian Sandstone overburden)	BE3 (Permian Sandstone overburden)
Stage 1 EC Trigger - 95th Percentile	*999*	*1,915*	*4,727*	*2,040*	*2,369*	-	-	-
Stage 2 EC Trigger - Maximum EC	**1,280**	**1,930**	**4,740**	**2,120**	**2,370**	**6,580**	**6,070**	**8,420**
Jan-19	995	**1,977**	**5,330**	**2,140**	2,400	**7,190**	**6,740**	**8,430**
Feb-19	1,074	**2,060**	**5,270**	**2,160**	**2,380**			
Mar-19	1,080	**2,060**	**5,290**	2,080	2,300			
Apr-19	941	**2,060**	4,650	1,920	2,060	**7,060**	**6,460**	8,300
May-19	1,030	**2,000**	**5,200**	2,020	2,280			
Jun-19	982	**1,920**	**4,920**	1,980	2,190			
Jul-19	1,058	**1,865**	**4,910**	1,980	**2,410**	**6,930**	5,970	8,380
Aug-19	1,037	1,910	**5,150**	2,040	2,260			
Sep-19	1,055	**2,010**	**5,290**	2,070	2,330			
Oct-19	1,063	**2,020**	**5,280**	2,050	2,290	**7,420**	5,970	**8,500**
Nov-19	1,044	**2,090**	**5,360**	2,050	2,340			
Dec-19	995	**2,050**	**4,990**	1,964	2,170			

Note: ***underscore*** *signifies that notification should be undertaken.*

8 Comparison to ANZECC guidelines

Groundwater is used for livestock watering on properties in the region as well as for irrigation purposes. Guidelines exist for the protection of these environmental values and are outlined in the Australian and New Zealand Environment and Conservation Council (ANZECC, 2000) guidelines.

Annual speciation results as required by the WMP have been compared to the ANZECC guidelines and are shown in Table 8.1. No data is available from bores 64092, A10 and E12 as these bores have been mined though. There was no access to BG45 and 11953 in 2019, and bores A5, WAN3, WAN4B, WAN8A, and WAN8B were dry or had insufficient water to sample. The only recorded exceedances of guideline values in 2019 were for iron, fluoride and TDS. Several bores were not sampled due to restricted access, insufficient water, or being mined through (Table 8.1).

Table 8.1 2019 ANZECC Exceedances

Site	Short term irrigation	Long term irrigation	Stock water	Stock water - pigs and poultry	Stock water - sheep	Stock water - cows
Analyte in exceedance	none	Iron	Fluoride	TDS	TDS	none
Exceedance value		0.20 mg/L	2.0 mg/L	3000 mg/L	4000 mg/L	
19116	No exceedances					
46737	none	none	none	3380 mg/L TDS	none	none
BE1	none	none	Fluoride (4.4 mg/L)	4310 mg/L TDS	4310 mg/L TDS	none
BE2	none	iron (5.46 mg/L)	fluoride (2.6 mg/L)	3970mg/L TDS	none	none
BE3	none	iron (1.39 mg/L)	fluoride (2.6 mg/L)	5040 mg/L TDS	5040 mg/L TDS	none
WAN1A	none	iron (0.80 mg/L)	none	none	none	none
WAN1B	none	iron (0.50 mg/L)	none	none	none	none
WAN2A	none	iron (1.15 mg/L)	none	none	none	none
WAN2B	none	iron (0.54 mg/L)	fluoride (3.5 mg/L)	none	none	none
WAN5B	No exceedances					
WAN6A	none	iron (2.45 mg/L)	none	none	none	none
WAN9B	none	none	fluoride (6.2 mg/L)	none	none	none
28510	No exceedances					
37774	No exceedances					
53007	No exceedances					

9 Summary

9.1 Groundwater levels

A review of groundwater level trends indicates the following:

- Alluvium water level contours and flow directions are consistent with previous years.
- Groundwater level fluctuations in the Hunter River Alluvium correlate with levels in the Hunter River despite drought conditions. Recharge to the alluvium may therefore be predominantly due to leakage from the river.
- On a regional scale, groundwater in the alluvium flows south-west, generally parallel to the flow of the Hunter River. However, close to the Wantana Extension, alluvial groundwater flows towards the pit, possibly due to the depressurisation of coal seams subcropping beneath the alluvium. This is consistent with the 2013 EIS (AGE, 2013a) that states "The groundwater model predicts that mining associated with the Project will induce flow from the alluvium to the Permian. This is a reversal of the flow direction under pre-mining conditions", and "The model predicts mining will continue to depressurise and lower groundwater levels in the Permian sequence, but this will not result in drawdown extending a significant degree into the alluvial aquifer system, with model drawdown calculated to be less than 1 m."
- The coal seams and interburden in the Wantana Extension appear to have been depressurised as a result of mining, and there is potential in this area for leakage from the alluvium to the coal seams. A pressure head differential of up to 16 m (WAN4, WAN9 and WAN10) is evident between the alluvium and the coal seams. This is in line with the EIS groundwater model predictions that state "*The* water *level in the deep aquifer is expected to fall reducing the availability of water in this aquifer*". Bengalla's target coal seams are included in the "*deep aquifer*" layer of the groundwater model.
- WAN1A is screened at the Wynn Seam and possibly over part of the alluvium. At the WAN1 location, the Wynn seam subcrops close to the base of the alluvium. Historically, the water level in WAN1A has been close to the base of the bore; hence, the alluvium and Wynn Seam are dry at this location. WAN1B (Edderton seam), on the other hand, has shown mining induced depressurisation from mid-2010 to late-2011 and subsequent water level recovery. The water level appears to have recovered to above the pre-mining level. This demonstrates that water levels in depressurised coal seams can recover in a post-mining phase.
- WAN2C declined approximately 6 m between September 2005 and December 2006 but has remained relatively unchanged thereafter. It is likely that the head in the Edderton Seam has dropped below the base of the bore. The bore was blocked with an obstruction in September 2016, which was cleared in September 2018, and has since recorded groundwater levels of approximately 100 mAHD.
- Two bores, WAN8A and WAN9A have historically not shown a good correlation to the other alluvial bores nor the CRD. The recharge/discharge mechanism of these bores is different to the other WAN bores indicating that these are likely to be mining impacted. Additionally, a steep hydraulic gradient exists nearby to WAN8A and BG1. It appears likely that water is flowing from the alluvium, which is recharged via the regulated Hunter River, into the depressurised Wynn Seam in this location.
- One regional alluvium bore, BG3, triggered the Trigger Event Response Protocol due to low water levels in 2019. However, BG3 has remained below its trigger value since February 2015, and no risk of environmental harm is identified.

- Bores to the northwest of the active mining area (i.e. future mining area) showed very little change in groundwater level across the monitoring period. This is in line with the EIS groundwater model predictions. The eventual removal of those seams and overburden will completely depressurise the whole profile at that location and an area outside of the highwall location.
- The Edderton Seam at VWP installations BE1, BE2, BE3, BE4 and BE5 shows signs of seam depressurisation.
- The Mt Arthur Seam at VWP installations BE1, BE2, BE3 and BE5 also shows signs of seam depressurisation.

9.2 Groundwater quality

A review of pH monitoring data indicates the following:

- Most monitoring bores record groundwater pH values within triggers and share similar pH trends.
- WAN8A has historically presented elevated pH measurements and triggered in August 2017. Two exceedances for pH were recorded in 2019 at this bore; however, only two samples were analysed due to the bore containing insufficient water to sample. WAN8A likely contains stagnant water and should not be sampled in future unless water levels are adequate to allow suitable purging.

A review of EC monitoring data indicates the following:

- EC values in alluvium monitoring bores are less than 1,500 µS/cm, except for BG3, WAN7A, WAN8A, SMB1-South and SMB2-North. This is likely to be a natural phenomenon associated with proximity to coal seam subcrop and their influence on the water quality locally.
- WAN4A may be impacted by underlying coal seam depressurisation due to mining. The decrease in pressure has allowed local infiltration of less saline river water into the alluvium, causing a decrease in EC. The water level in this bore does not appear to be impacted. The water quality appears to be returning to a level in line with the pre-2008 water quality in this bore. The EC values in this bore should continue to be monitored.
- The EC values for WAN8A have historically ranged between 1,282 µS/cm (Nov 2007) and 8,870 µS/cm (May 2010). Whilst 2019 measurements were within historic ranges, this bore is suspected to contain stagnant water.
- SMB1-South and SMB2-North present EC values that have generally remained consistent throughout 2019 and historically. It is unlikely that these bores have been impacted by mining.
- BG3 displayed a strong decline in EC during 2018 and 2019. This bore is situated to the south of Bengalla (and north of Mt Arthur where the same geological profile is mined), along strike from actively mined coal seams which are known to be depressurising. Similar to the case with WAN4A, this decrease in pressure may have allowed for localised infiltration of less saline alluvial water.
- EC data within the coal measures and interburden are between 2,500 µS/cm and 9,000 µS/cm, which is the expected EC for coal measures and interburden.
- Four bores in the coal seams (WAN1A, WAN1B, WAN2A, WAN6B, and WAN9B) show EC less than 2,000 µS/cm, suggesting leakage from the alluvium due to depressurisation of the coal seams. This freshening of the alluvium, coal measures and interburden was predicted in the EIS groundwater model, which states "Water quality in the alluvial sediments will improve as a result of decreased discharge of water from hardrock aquifers to the alluvial aquifer due to aquifer depressurisation."

- WAN10B has historically presented elevated EC values between 3,790 µS/cm and 5,140 µS/cm, and generally above the Stage 2 EC trigger. The EC trigger events in 2018 (to month ending October 2018) were investigated as per the Trigger Event Response Protocol. The investigation found that changes in rainfall/recharge are likely to be the main influencing factor in these trigger events. EC values and trend for WAN10B for 2019 are consistent with the conclusions of the 2018 investigation (AGE, 2018).
- Groundwater quality within the bores to the northwest of the active mining area (future mining area) showed little change in pH (7.0 – 7.7) and moderate change in EC (range: 5,970 µS/cm – 8,430 µS/cm) over the reporting period.
- When speciation results are compared to the ANZECC guidelines, certain locations exceed the ANZECC guidelines for iron (irrigation), fluoride (stock water) and TDS (stock water).

10 Recommendations

Recommendations based on the information provided in this report include:

- Continue to monitor water levels in bores where access allows. The water levels should be investigated if the respective water levels drop below the trigger criteria.
- Continue to closely monitor water levels and water quality in BG3. Should water level and quality continue their present trend, an additional nested site (i.e. 1 x alluvial and 1 x Permian bore) should be drilled to the south of Bengalla, along strike to the actively mined seams in the region nearby to BG3 (i.e. < 1 km). The purpose of these bores would be to provide a control point that enables a comparison of the two sites.
- Continue to monitor the water levels and water quality in bores WAN8A and WAN8B, with an awareness that very low water levels are likely linked to stagnant water, which should not be sampled.
- The EC values and water levels of WAN4 nested bores are still declining. The trend should continue to be monitored.
- No data were recorded in 2019 for several monitoring bores due to mining operations at the Mt Pleasant mine. We understand that GW01A and GW01B have replaced these bores and should be incorporated into the Water Management Plan.

11 References

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Hansen Bailey (2014) "Development Consent Modification Environmental Assessment, Bengalla Mine", June 2014.

Appendix A Monitoring bore summary data

Bore ID	Easting MGA94 z56	Northing MGA94 z56	Ground level (mAHD)	Top of casing (mAHD)	Stick- up (m)	Screen (mbGL)	Total depth (mBGL)	Bore base elevation (mAHD)	Geology/ Target Seam	Standard WQ/SWL	Installation date	Full suite WQ	Data since	Baseline water level (mAHD)	Baseline measure-ment date	Max predicted drawdown (mAHD)	Maximum predicted drawdown (m)	WMP bore	Trigger levels (mAHD)	2019 GWL (mAHD)	Measured date	Difference baseline vs. 2019 GWL (m)	Max drawdown vs. 2019 GWL (m) [Available drawdown]	Trigger vs. 2019 GWL (m)
11953cd	298192	6428693	147	147.97	0.97	-	-	-	Deep Permian	Quarterly	Jan-97	Annually	Oct-03	136.46	1-Feb-00	129.33	7.13	Yes	129.3	-		-	-	-
18298c	294375	6423521	132.86	133.47	0.61	-	-	-	Alluvium	Quarterly	Jan-97	Annually	Sep-09	123.53	1-Feb-11	123.19	0.34	Yes	123.2					
19116c	296078	6425589	135.6	136.43	0.82	-	-	-	Alluvium	Quarterly	Jan-97	Annually	Oct-03	127.46	1-May-97	123.24	4.22	Yes	129					
28510cd	298649	6429105	142.7	144	1.3	-	-	-	Deep Permian	Quarterly	Jan-97	Annually	Aug-09	132.22	1-Feb-00	128.97	3.25	Yes	129	-	-	-	-	-
37774cd	298488	6428998	145.6	146	0.4	-	-	-	Deep Permian	Quarterly	Jan-97	Annually	Aug-09	134.14	1-Feb-00	128.74	5.4	Yes	128.7	-	-	-	-	-
42701c	298586	6428632	144	144.91	0.97	-	-	-	Deep Permian	Quarterly	Jan-97	Annually	Oct-03	133.18	1-Feb-00	131.26	1.92	Yes	131.3					
42927c	298843	6428570	144.26	145.36	1.1	-	-	-	Alluvium	Quarterly	Jan-97	Annually	Oct-03	132.29	1-Feb-00	131.11	1.18	Yes	131.1					
46737c	291862	6427143	227.69	227.9	0.21	-	-	-	Shallow Permian	Quarterly	Jan-97	Annually	Sep-09	186.05	1-Feb-01	185.31	0.74	Yes	185.3					
47277cb	299145	6428643	143.54	144.59	1.06	-	-	-	Alluvium	Quarterly	Jan-97	Annually	Aug-09	133.65	1-Aug-02	132.81	0.84	Yes	132.8					
53007cd	298720	6428857	143.97	144.01	0.04	-	-	-	Deep Permian	Quarterly	Jan-97	Annually	Aug-09	133.67	1-Feb-01	131.91	1.76	Yes	125	-	-	-	-	-
64092cd	297762	6428813	151.27	151.35	0.09	-	-	-	Shallow Permian	Quarterly	Jan-97	Annually	Oct-03	143.98	1-Feb-99	124.96	19.02	Yes	125	-	-	-	-	-
A10c	295445	6428834	199.33	199.33	0	-	-	-	Shallow Permian	Quarterly	Jan-97	Annually	Oct-03	184.45	1-Feb-99	151.94	32.51	No	-	-	-	-	-	-
BE1 (bore)	293469	6429033	241.48	242.67	1.19	69-75	75	166.48	Permian Sandstone	Quarterly	Jun-12	Annually	Jun-12	172.04	1-Sep-12	156.83	15.21	Yes	156.8	173.8	Oct-19	1.76	16.97	17
BE2 (bore)	293374	6425866	204.22	205.38	1.16	45-48	48	156.22	Permian Sandstone	Quarterly	Jun-12	Annually	Jun-12	167.67	1-Sep-12	18.81	148.86	Yes	18.8	168.18	Oct-19	0.51	149.37	149.38
BE3 (bore)	292977	6427587	175.21	176.39	1.18	48-54	54	121.21	Permian Sandstone	Quarterly	Jun-12	Annually	Jun-12	145.69	1-Sep-12	113.18	32.51	Yes	113.2	138.1	Oct-19	-7.59	24.92	24.9
BG1c	296656	6426003	138.2	138.78	0.58	-	-	-	Alluvium	Quarterly SWL 8hr logger	Jan-97	Annually	Oct-03	128.24	1-Nov-00	126.84	1.4	Yes	126.8	128.18	Dec-19	-0.06	1.34	1.38
BG3cb	294731	6424413	133.60	133.76	0.16	-	-	-	Alluvium	Quarterly SWL 8hr logger	Jan-97	Annually	Oct-03	126.48	1-Feb-99	126.25	0.23	Yes	126.3	125.78	Oct-19	-0.7	-0.47	-0.52
BG45c	291570	6424648	166.04	166.36	0.32	-	-	-	Shallow Permian	Quarterly SWL 8hr logger	Jan-97	Annually	Sep-09	152.74	1-May-01	149.92	2.82	No	-	-	-			
BG5c	298609	6427874	142.2	142.51	0.31	-	-	-	Alluvium	Quarterly	Jan-97	Annually	Oct-03	133.35	1-Feb-99	132.4	0.95	Yes	-	132.5	Oct-19	-0.85	0.1	
E12cb	294808	6427576	197.06	197.17	0.11	-	-	-	Shallow Permian	Quarterly	Jan-97	Annually	Oct-03	157.4	1-Feb-99	-6.57	163.97	Yes	-	-	-	!		!
REPI7	295575	6425832	135.47	136.38	0.91	49-52	52	83.47	Vaux Seam	Quarterly	Jan-97	Annually	Jan-97	102.09	1-Jun-10	63.07	39.02	Yes	63.1	91.38	Dec-19	-10.71	28.31	28.28
SMB1	296955	6426391	141.2	142.47	1.27	13-19	19	122.2	Alluvium	Monthly	Jun-10	Biannually	Aug-10	128.66	1-Aug-11	127.17	1.49	Yes	127.2	127.99	Dec-19	-0.67	0.82	0.79
SMB2	297124	6426549	141.69	142.61	0.92	15-21	21	120.69	Alluvium	Monthly	Jun-10	Biannually	Aug-10	128.83	1-Aug-11	127.28	1.55	Yes	117.5	128.18	Dec-19	-0.65	0.9	10.68
WAN10A	295828	6425571	135.07	136.13	1.06	Aug-13	13.83	121.24	Alluvium	Monthly	May-09	Biannually	Apr-09	126.74	1-May-09	122.16	4.58	Yes	122.2	126.05	Dec-19	-0.69	3.89	3.85
WAN10B	295825	6425578	135.04	136.1	1.06	44-47	47	88.04	Vaux Seam	Monthly	May-09	Biannually	Apr-09	119.2	1-May-09	98.32	20.88	Yes	98.3	109.53	Dec-19	-9.67	11.21	11.23
WAN1A	296519	6426099	140.6	141.35	0.75	16-20	20	120.6	Alluvium/Wynn seam	Monthly	Sep-05	Annually	Aug-09	121.72	1-Sep-05	117.53	4.19	Yes	117.5	121.64	Dec-19	-0.08	4.11	4.14
WAN1B	296519	6426099	140.6	141.35	0.75	29-33	33	107.6	Edderton Seam	Monthly	Sep-05	Annually	Aug-09	115.87	1-Sep-05	100.09	15.78	Yes	100.1	118.49	Dec-19	2.62	18.4	18.39
WAN2A	296217	6425824	137.7	138.4	0.7	13-16	16	121.7	Alluvium/Vaux seam	Monthly	Sep-05	Annually	Aug-09	125.23	1-Feb-07	118.47	6.76	Yes	118.5	125.24	Dec-19	0.01	6.77	6.74
WAN2B	296217	6425824	137.7	138.44	0.74	36-39	39	98.7	Wynn Seam	Monthly	Sep-05	Annually	Aug-09	111.8	1-Feb-07	86.38	25.42	Yes	86.4	105.48	Dec-19	-6.32	19.1	19.08
WAN2C	296217	6425824	137.7	138.43	0.73	51-54	55	83.7	Edderton Seam	Monthly	Sep-05	Annually	Aug-09	100.44	1-Feb-07	75.02	25.42	Yes	75	100.1	Dec-19	-0.34	25.08	25.1
WAN3a	295772	6425713	136.4	136.7	0.3	2.5-87	87	49.4	Deep Permian	Monthly	Sep-05	Annually	Aug-09	126.64	1-Sep-05	100.32	26.32	Yes	100.3	-	-			
WAN4A	295442	6425690	135.1	135.93	0.83	11.5-14.5	14.5	120.6	Alluvium	Monthly	Sep-05	Annually	Aug-09	126.64	1-Sep-05	121.16	5.48	Yes	121.2	125.74	Dec-19	-0.9	4.58	4.54
WAN4B	295442	6425690	135.1	135.89	0.79	21-24	24	111.1	Deep Permian	Monthly	Sep-05	Annually	Aug-09	124.51	1-Sep-05	98.19	26.32	Yes	98.2	114.59	Dec-19	-9.92	16.4	16.39

Bore ID	Easting MGA94 z56	Northing MGA94 z56	Ground level (mAHD)	Top of casing (mAHD)	Stick- up (m)	Screen (mbGL)	Total depth (mBGL)	Bore base elevation (mAHD)	Geology/ Target Seam	Standard WQ/SWL	Installation date	Full suite WQ	Data since	Baseline water level (mAHD)	Baseline measure-ment date	Max predicted drawdown (mAHD)	Maximum predicted drawdown (m)	WMP bore	Trigger levels (mAHD)	2019 GWL (mAHD)	Measured date	Difference baseline vs. 2019 GWL (m)	Max drawdown vs. 2019 GWL (m) [Available drawdown]	Trigger vs. 2019 GWL (m)
WAN5A	296019	6425360	135.9	136.74	0.84	10.5-13.5	15.57	121.17	Alluvium	Monthly	Sep-05	Annually	Aug-09	126.74	1-Sep-05	124.31	2.43	Yes	124.3	125.91	Dec-19	-0.83	1.6	1.61
WAN5B	296019	6425360	135.9	136.78	0.88	26-29	28.98	107.8	Deep Permian	Monthly	Sep-05	Annually	Aug-09	126.74	1-Sep-05	116.03	10.71	Yes	116	126.06	Dec-19	-0.68	10.03	10.06
WAN6A	296553	6425634	136.9	137.67	0.77	7.5-10.5	10.5	126.4	Alluvium	Monthly	Sep-05	Annually	Aug-09	128	1-Aug-07	126.9	1.1	Yes	126.9	127.56	Dec-19	-0.44	0.66	0.66
WAN6B	296553	6425634	136.9	137.66	0.76	30-33	33	103.9	Edderton Seam	Monthly	Sep-05	Annually	Aug-09	127.92	1-Aug-07	123.82	4.1	Yes	123.8	127.31	Dec-19	-0.61	3.49	3.51
WAN7A	296856	6426254	138.1	138.86	0.76	12.0-15.0	15	123.1	Alluvium	Monthly	Sep-05	Annually	Aug-09	126.8	1-Feb-09	125.4	1.4	Yes	125.4	126.38	Dec-19	-0.42	0.98	0.98
WAN7B	296856	6426254	138.1	138.89	0.79	80-83	83	55.1	Edinglassie Seam	Monthly	Sep-05	Annually	Aug-09	128.7	1-Feb-08	126.41	2.29	Yes	126.4	126.38	Dec-19	-2.32	-0.03	-0.02
WAN8A	296457	6425854	136.41	137.47	1.07	10.7-11.9	12.94	124.53	Alluvium	Monthly	May-09	One off sample	Apr-09	125.64	1-Sep-09	123.29	2.35	Yes	123.3	124.79	Dec-19	-0.85	1.5	1.49
WAN8B	296450	6425855	136.33	137.42	1.09	15-18.6	19.6	117.82	Wynn Seam	Monthly	May-09	One off sample	Apr-09	118.03	1-Oct-09	108.51	9.52	Yes	108.5	116.79	Dec-19	-1.24	8.28	8.29
WAN9A2	296326	6425582	136.88	137.98	1.1	8.5-10.5	10.5	126.38	Alluvium	Monthly	May-09	One off sample	Apr-09	126.25	1-Sep-09	123.68	2.57	Yes	123.7	126.57	Dec-19	0.32	2.89	2.87
WAN9B	296328	6425576	136.93	137.88	0.95	21-24	24	112.93	Wynn Seam	Monthly	May-09	Biannually	Apr-09	119.44	1-Sep-09	111.39	8.05	Yes	111.4	114.76	Dec-19	-4.68	3.37	3.36
BE1 (VWP)	293475	6429036	241.48	-	-	120	120	121.48	Warkworth/Mt Arthur	Quarterly	Oct-11	NA	2011	-	-	-	-	-	-	-	-	-	-	-
BE1 (VWP)	293475	6429036	241.48	-	-	264.5	264.5	-23.02	Edderton Seam	Quarterly	Nov-11	NA	2011	-	-	-	-	-	-	-	-	-	-	-
BE2 (VWP)	293374	6425866	204.22	-	-	97.8	97.8	106.42	Warkworth/Mt Arthur	Quarterly	Dec-11	NA	2011	-	-	-	-	-	-	-	-	-	-	-
BE2 (VWP)	293374	6425866	204.22	-	-	212.5	212.5	-8.28	Edderton Seam	Quarterly	Jan-12	NA	2011	-	-	-	-	-	-	-	-	-	-	-
BE3 (VWP)	292977	6427587	175.21	-	-	80.6	80.6	94.61	Warkworth/Mt Arthur	Quarterly	Feb-12	NA	2011	-	-	-	-	-	-	-	-	-	-	-
BE3 (VWP)	292977	6427587	175.21	-	-	154.6	154.6	20.61	Edderton Seam	Quarterly	Mar-12	NA	2011	-	-	-	-	-	-	-	-	-	-	-
BE4 (VWP)	294313	6428784	191.4	-	-	82	228.2	-36.8	Mt Arthur	Quarterly	Mar-17	NA	2017	-	-	-	-	-	-	-	-	-	-	-
BE4 (VWP)	294313	6428784	191.4	-	-	213	228.2	-36.8	Edderton Seam	Quarterly	Mar-17	NA	2017	-	-	-	-	-	-	-	-	-	-	-
BE5 (VWP)	293696	6427245	181.3	-	-	74	210.15	-28.85	Mt Arthur	Quarterly	Apr-17	NA	2017	-	-	-	-	-	-	-	-	-	-	-
BE5 (VWP)	293696	6427245	181.3	-	-	197.5	210.15	-28.85	Edderton Seam	Quarterly	Apr-17	NA	2017	-	-	-	-	-	-	-	-	-	-	-
GW01A	298190	6428409	TBC	TBC	TBC	TBC	TBC	TBC	Alluvium	Monthly	Dec-18	Annually	TBC	-	-	-	-	No	-	-	-	-	-	-
GW01B	298190	6428409	TBC	TBC	TBC	TBC	TBC	TBC	Shallow Permian	Monthly	Dec-18	Annually	TBC	-	-	-	-	No	-	-	-	-	-	-
WAN11A	296649	6424875	135.4	136.44	1.05	9-12	123.4	12	Alluvium	Monthly	Jan-19	Annually	Feb-2019	-	-	-	-	No	-	-	-	-	-	-
WAN11B	296645	6424876	135.5	136.45	0.95	24-27	108.5	27	Shallow Permian	Monthly	Jan-19	Annually	Feb-2019	-	-	-	-	No	-	-	-	-	-	-
WAN12	295491	6424725	135.3	136.06	0.76	11-14	121.3	14	Alluvium	Monthly	Feb-19	Annually	Feb-2019	-	-	-	-	No	-	-	-	-	-	-

Notes:

a *depth to bottom 35.1m - bore may have collapsed – WAN 3.*

b *resurvey suggested.*

c *bore base should be tagged to confirm depth.*

^ *bore will be mined out and drawdown will be to base of coal measures.*

APPENDIX H

Rehabilitation Monitoring Findings

Table H1
Summary of Rehabilitation Monitoring Observations and Actions

Type	Details	Actions	Action Priority *
Grazing	Should cattle grazing be re-introduced in the Class III pasture area, the potential implications associated with the presence of *Sorghum halepense* (Johnson's grass) should be investigated in concertation with a qualified agronomist.	No grazing intended on Class III pasture in 2020	2
Revegetation	If pasture biomass management is undertaken on Class III pasture, then increase species diversity via a maintenance program of direct seeding using a variety of desirable grass species (including C3 and C4 species, perennial and annual species) and legumes suited to the district and which are known to establish productive pastures across the Hunter region.	No actions intended on Class III pasture in 2020	2
Revegetation	If pasture biomass management is undertaken on Class III pasture, any maintenance seeding works should consider the need for fertiliser application with due consideration of the nutrient requirements suited to the establishment of legumes (particularly in relation to sulphur levels). Advice from a qualified agronomist should be sought to develop a suitable fertiliser regime.	No actions intended on Class III pasture in 2020	2
Revegetation	If pasture biomass management is undertaken on Class III pasture, any maintenance seeding is best undertaken following suitable weather conditions (i.e. high soil moisture levels).	No actions intended on Class III pasture in 2020	2
Inspections	Continue with regular inspections (i.e. during annual audits) of the identified (and deemed stabilised) erosion features, tunnel inlet features and surface	Annual rehabilitation monitoring to be continued in 2020	2

Type	Details	Actions	Action Priority *
	cracking to confirm the stability of the areas over time (i.e. contour bank and adjacent slopes).		
Weed Control	Continue the implementation of the routine weed management program, specifically targeting African boxthorn, Galenia, Bathurst burr, Pampas grass, Saffron Thistle.	Continue and intensify the systematic and ongoing control of the species. Spot spray local infestations of environmental weeds and monitor vegetative response.	2
Weed Control	Carefully monitor the evolution of the established *Acacia saligna* patches to ensure these remain contained to existing locations.	Annual rehabilitation monitoring to be continued in 2020. Acacia saligna will be targeted for additional monitoring to assess any increase in establishment prior to the development of management techniques to control A. saligna.	2
Reforestation	Increase tree densities through infill tubestock plantings of eucalypt species, targeting areas of currently insufficient tree densities as well as areas dominated by Cooba (i.e. where eucalypts are sparse).	High Density Woody Vegetation (HDWV) project to commence in 2020 - 2025.	2
Habitat Establishment	Prior to the implementation of further revegetation works across the block, ensure that artificial habitat features are incorporated. Depending on the availability of resources, this could include logs, rock piles, erection of stag trees, etc.	Additional habitat establishment will be considered in the establishment of HDWV	2
Habitat Establishment	Spread the identified stockpiled logs evenly across the slope.	Additional habitat establishment will be considered in the establishment of HDWV	2
Weed Control	Urgently control the establishing patch of Coolatai grass, and increase vigilance for further incursion of the species at the site (and immediately control when detected).	Coolatai grass has been included in the Bengalla mine Weed Action plan for 2020. Increased vigilance will continue regarding the presence of Coolatai grass.	1

Type	Details	Actions	Action Priority *
Weed Control	Treat the identified severe infestations of Galenia across the upper slopes and top of the landform.	Continue to monitor and intensify the systematic and ongoing control of the species	2
HDWV	Having regard to the relative inconclusiveness of the 2016 OEA revegetation trials, another strategy should be developed and implemented to revegetate the area with high density woody species (it is understood that broadscale planting of tubestocks is currently investigated).	A Strategy to develop the HDWV communities over the OEZ is being developed and implementation will commence in 2020.	1
Erosion Control	Repair the breached contour bank and associated severe gully erosion.	Existing contour banks will be reassessed and repaired in conjunction with the implementation of the HDWV establishment	2
Reforestation	Continue the ongoing monitoring of the area (i.e. through the annual monitoring program) to ascertain further germination and establishment of eucalypts as a viable seed load may remain in situ. If this does not occur and eucalypts densities remain at current levels, infill plantings of tubestocks will be required to increase stem densities to acceptable levels.	Rehabilitation monitoring will continue on an annual basis	2
HDWV	In view of the poor germination strike rates of eucalypts, it is recommended that a review of the current seeding rates for eucalypt species be undertaken	Will be incorporated into the HDWV strategy	2
Erosion Control	Repair the channel erosion identified along the rock-lined drains (x2 locations). This could simply involve importing and filling the eroding area with suitable rock material to provide further armouring	Erosion control will be incorporated into the annual works as detailed in the HDWV strategy	2
Erosion Control	Repair all severely eroding areas across the 2016 rehabilitation, including breached contour banks (x5) and associated gully erosion	Erosion control will be incorporated into the annual works as detailed in the HDWV strategy	2
HDWV	It is likely that a viable seed load remains in situ at most locations across Block E, which germination has been delayed by the ongoing drought (findings of this monitoring program show that a delay of several years can sometimes occur between seeding and germination). Woodland improvement works are	HDWV strategy will account for monitoring and other component of the HDWV establishment	2

Type	Details	Actions	Action Priority *
	therefore not considered required presently, and monitoring of the areas should continue for potential germination		
Habitat Establishment	Considering the good access across the block as a function of lacking woody vegetation, consider retro-fitting the areas of 2013-2015 rehabilitation with artificial habitat features such as of logs, rock-piles, coarse woody debris and/or erect habitat trees	To be incorporated into the HDWV strategy	1

Source –Koru Environmental Pty Limited (2018) Rehabilitation Monitoring and Audit 2019 Bengalla Mine

**Note: Only priority 1 and 2 actions are shown in Table H1.*


NW11
NW2
NW3
NW4
NW10
NW1
NW12
NW13
NW5
NW6
NW8
NW7
NW9
KORU ENVIRONMENTAL
Legend
Bengalla site boundary
Final land use
Grazing pasture
High density woody vegetation
Long-term Monitoring Sites
50m transect start
50m transect end
BlockNo
Block A - Class III pasture
Block B - Older rehabilitation, woody vegetation present
Block C - Older rehabilitation, woody vegetation absent
Block D - Younger rehabilitation, woody vegetation present
Block E - Younger rehabilitation, woody vegetation absent
BENGALLA MINE
Rehabilitation Monitoring 2019
FIGURE 1
Rehabilitation blocks and monitoring sites locations

APPENDIX I

Summary of Cumulative Elevated PM_{10} Monitoring Results and Bengalla Increment

APPENDIX I

Summary of Cumulative Elevated PM_{10} Dust Monitoring Results and Bengalla Increment

Date of elevated result	Result ($\mu g/m^3$)	Monitor	Date BMC received	Date DPIE notified	Description
24 HOUR EXCEEDANCES					
02/01/2019	61	PM_{10}-1	11/02/19	12/02/19	BMC engaged Environmental Resources Management (ERM) to investigate the elevated PM_{10} levels recorded at PM_{10}-1, PM_{10}-3 and PM_{10}-4. Based on the prevailing wind directions it is estimated that Bengalla's operations did not contribute to the elevated reading at PM_{10}-1. For PM_{10}-3, Bengalla's operations, wind erosion from the Bengalla dam construction and the Mt Pleasant rail corridor contributed a maximum of 20 $\mu g/m^3$. Bengalla's operations and the Mt Pleasant rail corridor contributed a maximum of 10 $\mu g/m^3$ to the elevated reading at PM_{10}-4. BMC provided DPE with the investigation report and a summary of operations undertaken at Bengalla on 02/01/19.
	81	PM_{10}-3	15/02/19	15/02/19	
	71	PM_{10}-4	11/02/19	12/02/19	
14/01/2019	54	PM_{10}-3	15/02/19	15/02/19	BMC engaged ERM to investigate the elevated PM10 levels at PM_{10}-3 and PM_{10}-4. The investigation concluded based on prevailing wind directions, Bengalla's operations and/or wind erosion from the Bengalla dam construction contributed a maximum of 14 $\mu g/m^3$ to the elevated reading at PM_{10}-3. Additionally, Bengalla's operations and the Mt Pleasant rail corridor contributed a maximum of 13 $\mu g/m^3$ to the elevated reading at PM4. BMC provided DPIE with the investigation report and a summary of operations undertaken at Bengalla on 14/01/19.
	53	PM_{10}-4	11/02/19	12/02/19	
26/01/2019	57	PM_{10}-1	11/02/19	12/02/19	BMC engaged ERM to investigate the elevated PM10 levels at PM_{10}-1 and PM_{10}-3. Based on the prevailing wind directions it is estimated that Bengalla's operations and the Mt Pleasant rail corridor contributed a maximum of 12 $\mu g/m^3$ to the elevated reading at PM_{10}-1; and Bengalla's operations and/or wind erosion from the Bengalla dam construction contributed a maximum of 3 $\mu g/m^3$ to the elevated reading at PM_{10}-3. BMC provided DPIE with the investigation report and a summary of operations undertaken at Bengalla on 26/01/19.
	60	PM_{10}-3	15/02/19	15/02/19	

Date of elevated result	Result (µg/m^3)	Monitor	Date BMC received	Date DPIE notified	Description
13/02/2019	134	PM_{10}-1	07/03/19	08/03/19	BMC engaged ERM to investigate the elevated PM_{10} levels at PM_{10}-1, PM_{10}-2, PM_{10}-3 & PM_{10}-4, and to determine Bengalla's contribution. It is considered that the predominant reason for the elevated readings at all the monitors is the regional dust storm. Bengalla operations and the adjoining mining activities contributed a maximum of 36 µg/m^3 to the elevated reading at PM_{10}-1. Bengalla operations were not the main contributors to the reading at PM_{10}-2 or PM_{10}-3 but there is inadequate information to determine a numerical contribution of Bengalla operations. Wind erosion of the exposed areas at Bengalla dam construction site contributed a maximum of 25 µg/m^3 to the reading at PM4. BMC provided DPIE with the investigation report and a summary of operations undertaken at Bengalla on 13/02/19.
	102	PM_{10}-2	07/03/19	08/03/19	
	73	PM_{10}-3	14/03/19	14/03/19	
	98	PM_{10}-4	07/03/19	08/03/19	
19/02/2019	112	PM_{10}-1	07/03/19	08/03/19	BMC engaged ERM to investigate the elevated PM_{10} levels recorded at PM_{10}-1, PM_{10}-3 and PM_{10}-4. It is estimated that Bengalla's operations and adjoining mining activities contributed a maximum of 33 µg/m^3 to the elevated reading at PM_{10}-1. At PM_{10}-2 and PM_{10}-4, it was determined Bengalla's operations were not the main contributors to the elevated readings. BMC provided DPIE with the investigation report and a summary of operations undertaken at Bengalla on 19/02/19.
	65	PM_{10}-2	07/03/19	08/03/19	
	79	PM_{10}-4	07/03/19	08/03/19	
03/03/2019	59	PM_{10}-4	10/04/19	10/04/19	BMC engaged TAS to investigate the elevated PM_{10} level at PM_{10}-4. The expert considers that based on the prevailing wind directions it is estimated that Bengalla's operations contributed a maximum of 25 µg/m^3 to PM_{10} on 03/03/19. BMC provided DPIE with the investigation report and a summary of operations undertaken at Bengalla on 03/03/19

Date of elevated result	Result ($\mu g/m^3$)	Monitor	Date BMC received	Date DPIE notified	Description
15/03/2019	52	PM_{10}-4	10/04/19	10/04/19	BMC engaged TAS to investigate the elevated PM_{10} level and to determine Bengalla's contribution. The report concluded that Bengalla did not contribute more than 50 $\mu g/m^3$ to the elevated reading at PM4 on 15/03/19. The expert considers that based on the prevailing wind directions it is estimated that Bengalla's operations contributed a maximum of 13 $\mu g/m^3$ to PM_{10}-4 on 15/03/19. BMC provided DPIE with the investigation report and a summary of operations undertaken at Bengalla on 15/03/2019.
14/04/2019	69	PM_{10}-4	08/05/19	08/05/19	BMC engaged TAS to investigate the elevated PM_{10} level at PM_{10}-4. The investigation concluded that Bengalla did not contribute more than 50 $\mu g/m^3$ to the reading. Based on the prevailing wind directions it is estimated that Bengalla's operations contributed a maximum of 18.4 $\mu g/m^3$ to PM_{10}-4 on 14/05/19. BMC provided DPIE with the investigation report and a summary of operations undertaken at Bengalla on 14/04/19.
26/04/2019	63	PM_{10}-1	08/05/19	08/05/19	BMC engaged TAS to investigate the elevated PM_{10} level at PM_{10}-1. The investigation concluded that Bengalla did not contribute more than 50 $\mu g/m^3$ to the reading on 26/04/19. Based on the prevailing wind directions, it is estimated that Bengalla's operations contributed a maximum of 39 $\mu g/m^3$ to PM_{10}-1 on 26/04/19. BMC provided DPIE with the investigation report and a summary of operations undertaken at Bengalla on 26/04/19.
02/05/2019	53	PM_{10}-4	12/06/19	12/06/19	BMC engaged TAS to investigate the elevated PM_{10} level at PM_{10}-4. The investigation concluded that Bengalla did not contribute more than 50 $\mu g/m^3$ to the reading at PM_{10}-4 on 02/05/19. The expert considers based on the prevailing wind directions, it is estimated that Bengalla's operations contributed a maximum of 14 µg/m3 to PM4 on 2/05/19. BMC provided DPIE with the investigation report and a summary of operations undertaken at Bengalla on 2/05/19.

Date of elevated result	Result (µg/m^3)	Monitor	Date BMC received	Date DPIE notified	Description
01/06/2019	57	PM_{10}-4	11/07/19	11/07/19	BMC engaged TAS to investigate the elevated PM_{10} level recorded at PM_{10}-4. The report concludes that Bengalla did not contribute more than 50 µg/m^3 to the reading at PM_{10}-1 on 1/06/19. Based on the prevailing wind directions, it is estimated that Bengalla's operations contributed a maximum of 5.1 µg/m3 to PM4 on 1/06/19. BMC provided DPIE with the investigation report and a summary of operations undertaken at Bengalla on 1/06/19.
07/06/2019	80	PM_{10}-4	11/07/19	11/07/19	BMC engaged TAS to investigate the elevated PM_{10} level at PM_{10}-4. The investigation concluded Bengalla did not contribute more than 50 µg/m^3 to the reading at PM_{10}-4 on 7/06/19. The expert considers that based on the prevailing wind directions it is estimated that Bengalla's operations contributed a maximum of 18.4 µg/m^3 to PM_{10}-4 on 7/06/19. BMC provided DPIE with the investigation report and a summary of operations undertaken at Bengalla on 7/06/19.
01/07/2019	79	PM_{10}-4	08/08/19	09/08/19	BMC engaged TAS to investigate the elevated PM_{10} level at PM_{10}-4. The report concludes that Bengalla did not contribute more than 50 µg/m^3 to the reading at PM_{10}-4 on 1/07/19. Based on the prevailing wind directions, it is estimated that Bengalla's operations contributed a maximum of 0 µg/m^3 to PM_{10}-4 on 1/07/19. BMC provided DPIE with the investigation report and a summary of operations undertaken at Bengalla on 1/07/19.
25/07/2019	65	PM_{10}-4	08/08/19	09/08/19	BMC engaged TAS to investigate the elevated PM_{10} level at PM_{10}-4. The investigation concluded that Bengalla did not contribute more than 50 µg/m^3 to the reading at PM_{10}-4 on 25/07/19. The expert considers that based on the prevailing wind directions it is estimated that Bengalla's operations contributed a maximum of 32 µg/m^3 to PM_{10}-4 on 25/07/19. BMC provided DPIE with the investigation report and a summary of operations undertaken at Bengalla on 25/07/19.

Date of elevated result	Result (µg/m^3)	Monitor	Date BMC received	Date DPIE notified	Description
18/08/2019	51	PM_{10}-4	10/09/19	10/09/19	BMC engaged TAS to investigate the elevated PM_{10} level and to determine Bengalla's contribution. The report determined that based on the prevailing wind directions it is estimated that Bengalla's operations contributed a maximum of 15.7 µg/m^3 to PM_{10}-4 on 18/08/19. BMC provided DPIE with the investigation report and a summary of operations undertaken at Bengalla on 18/08/19.
05/09/2019	73	PM_{10}-4	09/10/19	09/10/19	BMC engaged TAS to investigate the elevated PM_{10} level at PM_{10}-4. The report concluded that Bengalla did not contribute more than 50 µg/m^3 to the reading at PM_{10}-4 on 5/09/19. The expert considers that based on the prevailing wind directions it is estimated that Bengalla's operations contributed a maximum of 44 µg/m^3 to PM_{10}-4 on 5/09/19. BMC provided DPIE with the investigation report and a summary of operations undertaken at Bengalla on 5/09/19.
11/09/2019	56	PM_{10}-4	09/10/19	09/10/19	BMC engaged TAS to investigate the elevated PM_{10} level at PM_{10}-4. The investigation concluded that Bengalla did not contribute more than 50 µg/m^3 to the reading at PM_{10}-4 on 11/09/19. Based on the prevailing wind directions, it is estimated that Bengalla's operations contributed a maximum of 3.7 ug/m^3 to PM_{10}-4 on 11/09/19. BMC provided DPIE with the investigation report and a summary of operations undertaken at Bengalla on 11/09/19.
17/10/2019	130	PM_{10}-1	08/11/19	11/11/2019	BMC engaged TAS to investigate the elevated PM_{10} levels at PM_{10}-1, PM_{10}-2, PM_{10}-3 & PM_{10}-4, and to determine Bengalla's contribution to the exceedance. The report concluded that Bengalla did not contributed more than 50 µg/m^3 to the elevated reading at all monitors. Bengalla operations contributed a maximum of 9 µg/m^3 at PM_{10}-1, 7 ug/m^3 at PM_{10}-2, 1 µg/m^3 at PM_{10}-3, and was determined to have no contribution to the reading recorded at PM_{10}-4. BMC provided DPIE with the investigation report and a summary of operations undertaken at Bengalla on 17/10/2019.
	72	PM_{10}-2			
	66	PM_{10}-3			
	65	PM_{10}-4			

Date of elevated result	Result (µg/m^3)	Monitor	Date BMC received	Date DPIE notified	Description
23/10/2019	59	PM_{10}-4	08/11/19	11/11/2019	BMC engaged TAS to investigate the elevated PM_{10} reading and to determine Bengalla's contribution. The report concluded that Bengalla did not contribute more than 50 µg/m^3 to the elevated reading on 23/10/19. Based on prevailing wind direction, it is estimated that Bengalla's operations contributed a maximum of 10 µg/m^3 to PM_{10}-4. BMC provided DPIE with the investigation report and a summary of operations undertaken at Bengalla on 23/10/2019.
29/10/2019	70	PM_{10}-1	08/11/2019	-	No further investigation was required for elevated reading. The elevated reading was attributed to bushfires in the region (extraordinary event).
	75	PM_{10}-2			
	62	PM_{10}-3			
	78	PM_{10}-4			
16/11/2019	77	PM_{10}-1	10/12/2019	11/12/2019	BMC engaged TAS to investigate the elevated PM_{10} levels at PM_{10}-1, PM_{10}-2 & PM_{10}-3, and to determine Bengalla's contribution to the exceedance. The report concluded that Bengalla did not contributed more than 50 µg/m^3 to the elevated reading at all monitors on 16/11/2019. Based on the prevailing wind direction it was deemed Bengalla operations aren't a contributor to the elevated reading, with an approximate contribution of 0 µg/m^3 at PM_{10}-1, PM_{10}-2 and PM_{10}-3. The elevated levels were attributed to the regional bushfire smoke event. BMC provided DPIE with the investigation report and a summary of operations undertaken at Bengalla on 16/11/2019.
	79	PM_{10}-2			
	64	PM_{10}-4			
22/11/2019	158	PM_{10}-1	10/12/2019	11/12/2019	BMC engaged TAS to investigate the elevated PM_{10} levels at PM_{10}-1, PM_{10}-2, PM_{10}-3 and PM_{10}-4, and to determine Bengalla's contribution to the exceedance. The report concluded that Bengalla did not contributed more than 50 µg/m^3 to the elevated reading at all monitors on 16/11/2019. Based on the prevailing wind direction it was deemed
	136	PM_{10}-2			
	112	PM_{10}-3			

Date of elevated result	Result (µg/m^3)	Monitor	Date BMC received	Date DPIE notified	Description
	99	PM_{10}-4			Bengalla operations aren't a contributor to the elevated reading. The maximum contribution of PM_{10}-1 is 20.5 µg/m^3 based on wind direction, assuming dust levels stayed consistent throughout the day. At monitors PM_{10}-2, PM_{10}-3 and PM_{10}-4, the contribution of Bengalla was calculated to be 0 µg/m^3 based on the monitors location upwind of Bengalla. The elevated levels were attributed to the regional bushfire smoke event. BMC provided DPIE with the investigation report and a summary of operations undertaken at Bengalla on 22/11/2019.
28/11/2019	93	PM_{10}-1	10/12/2019	11/12/2019	BMC engaged TAS to investigate the elevated PM_{10} levels at PM_{10}-1, PM_{10}-2, PM_{10}-3 and PM_{10}-4, and to determine Bengalla's contribution to the exceedance. The report concluded that Bengalla did not contributed more than 50 µg/m^3 to the elevated reading at all monitors on 16/11/2019. Based on the prevailing wind direction, the maximum contribution of PM_{10}-1 is 4 µg/m^3, 0 µg/m^3 at PM_{10}-2 and 38 µg/m^3 at PM_{10}-3 and PM_{10}-4. The elevated levels were attributed to smoke resulting from the regional bushfire smoke events. A more significant impact was had on PM_{10}-3 and PM_{10}-4 than PM_{10}-2. BMC provided DPIE with the investigation report and a summary of operations undertaken at Bengalla on 28/11/2019.
	89	PM_{10}-2			
	153	PM_{10}-3			
	127	PM_{10}-4			
04/12/2019	104	PM_{10}-1	07/01/2020	07/01/2020	BMC engaged TAS to investigate the elevated PM_{10} levels at PM_{10}-1, PM_{10}-2 & PM_{10}-3, and to determine Bengalla's contribution to the exceedance. The report concluded that Bengalla did not contributed more than 50 µg/m^3 to the elevated readings. Based on the prevailing wind direction, the maximum contribution of PM_{10}-1 is 37 µg/m^3, 12 µg/m^3 at PM_{10}-2 and 0 µg/m^3 at PM_{10}-3. The elevated levels were attributed to a smoke plume passing over the Hunter Valley Region on 04/12/2019BMC provided DPIE with the investigation report and a summary of operations undertaken at Bengalla on 04/12/2019.
	79	PM_{10}-2			
	67	PM_{10}-3			
10/12/2019	172	PM_{10}-1	07/01/2020	07/01/2020	BMC engaged TAS to investigate the elevated PM_{10} levels at PM_{10}-1, PM_{10}-2, PM_{10}-3 and PM_{10}-4, and to determine Bengalla's
	119	PM_{10}-2			
	168	PM_{10}-3			

Date of elevated result	Result (µg/m^3)	Monitor	Date BMC received	Date DPIE notified	Description
	157	PM_{10}-4			contribution to the exceedance. The report concluded that Bengalla did not contributed more than 50 µg/m^3 to the elevated readings on 10/12/2019. Based on the prevailing wind direction and through co-located real-time monitors, the maximum contribution of PM_{10}-1, PM_{10}-2, PM_{10}-3 and PM_{10}-4 was found to be 0 µg/m^3. The elevated levels were attributed to smoke resulting from the regional bushfire smoke events. BMC provided DPIE with the investigation report and a summary of operations undertaken at Bengalla on 10/12/2019.
16/12/2019	187	PM_{10}-1	07/01/2020	07/01/2020	BMC engaged TAS to investigate the elevated PM_{10} levels at PM_{10}-1, PM_{10}-2, PM_{10}-3 and PM_{10}-4, and to determine Bengalla's contribution to the exceedance. The report concluded that Bengalla did not contributed more than 50 µg/m^3 to the elevated readings on 16/12/2019. Based on the prevailing wind direction, the maximum contribution of PM_{10}-1, PM_{10}-2, PM_{10}-3 and PM_{10}-4 was found to be 0 µg/m^3. The elevated levels were attributed to regional bushfire smoke events. BMC provided DPIE with the investigation report and a summary of operations undertaken at Bengalla on 16/12/2019.
	93	PM_{10}-2			
	118	PM_{10}-3			
	143	PM_{10}-4			
22/12/2019	152	PM_{10}-1	07/01/2020	07/01/2020	BMC engaged TAS to investigate the elevated PM_{10} levels at PM_{10}-1, PM_{10}-2, PM_{10}-3 and PM_{10}-4, and to determine Bengalla's contribution to the exceedance. The report concluded that Bengalla did not contributed more than 50 µg/m^3 to the elevated readings. Based on the prevailing wind direction, the maximum contribution of Bengalla to PM_{10}-1, PM_{10}-2, PM_{10}-3 and PM_{10}-4 was found to be 0 µg/m^3. The elevated levels were attributed to regional bushfire smoke events. BMC provided DPIE with the investigation report and a summary of operations undertaken at Bengalla on 22/12/2019.
	84	PM_{10}-2			
	158	PM_{10}-3			
	113	PM_{10}-4			
28/12/2019	72	PM_{10}-1	07/01/2020	07/01/2020	BMC engaged TAS to investigate the elevated PM_{10} levels at PM_{10}-1, PM_{10}-2, PM_{10}-3 and PM_{10}-4, and to determine Bengalla's
	59	PM_{10}-2			
	106	PM_{10}-3			

Date of elevated result	Result (µg/m^3)	Monitor	Date BMC received	Date DPIE notified	Description
	133	PM_{10}-4			contribution to the exceedance. The report concluded that Bengalla did not contributed more than 50 µg/m^3 to the elevated readings on 28/12/2019. Based on the prevailing wind direction, the maximum contribution of PM_{10}-1 and PM_{10}-2 is 0 µg/m^3, 34 µg/m^3 at PM_{10}-3 and 29.3 µg/m^3 at PM_{10}-4. The elevated levels were primarily attributed to regional bushfire smoke events. BMC provided DPIE with the investigation report and a summary of operations undertaken at Bengalla on 28/12/2019.
Annual Rolling Exceedances					
28/12/2019	49.3	PM_{10}-1	07/01/2020	07/01/2020	BMC engaged TAS to investigate the elevated annual rolling averages for PM_{10}, TSP and Depositional Dust levels. This report has been received and is referenced in regard to Bengalla Project Alone criteria.
	37.9	PM_{10}-2			
	38.7	PM_{10}-3			
	48.9	PM_{10}-4			
28/12/2019	124	HV1			
	112.5	HV2			
	95.1	HV4			
	143	HV6			
28/12/2019	4.4 g/m^2/ month	D20			

APPENDIX J

Non- Aboriginal Heritage Sites

Bengalla Mining Company Non Aboriginal Heritage Sites

Bengalla Homestead

Bengalla Homestead December 2019

Bengalla Homestead December 2019

Bengalla Homestead December 2019

Gazebo at Bengalla Homestead September 2019

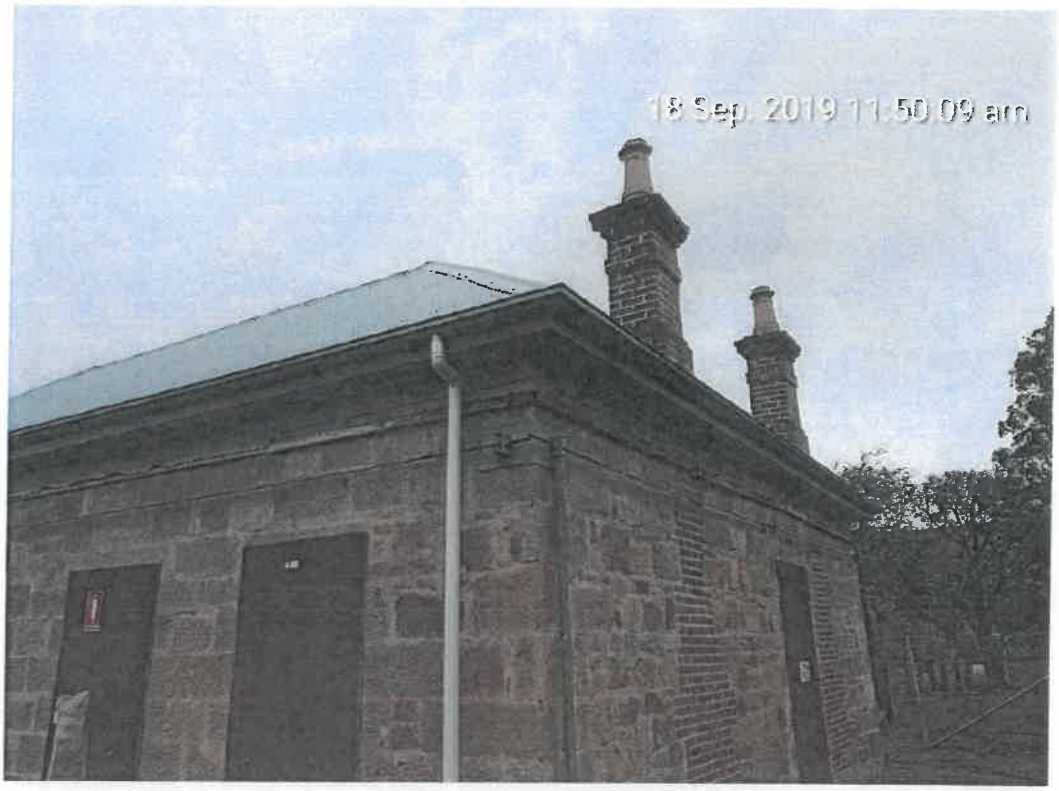
Book Keepers Cottage at Bengalla Homestead September 2019

Internal Fireplace in Bengalla Homestead December 2019

Internal Fixtures in Bengalla Homestead December 2019

Bengalla Homestead Court Yard December 2019

Overdene Cottage



Overdene Homestead September 2019

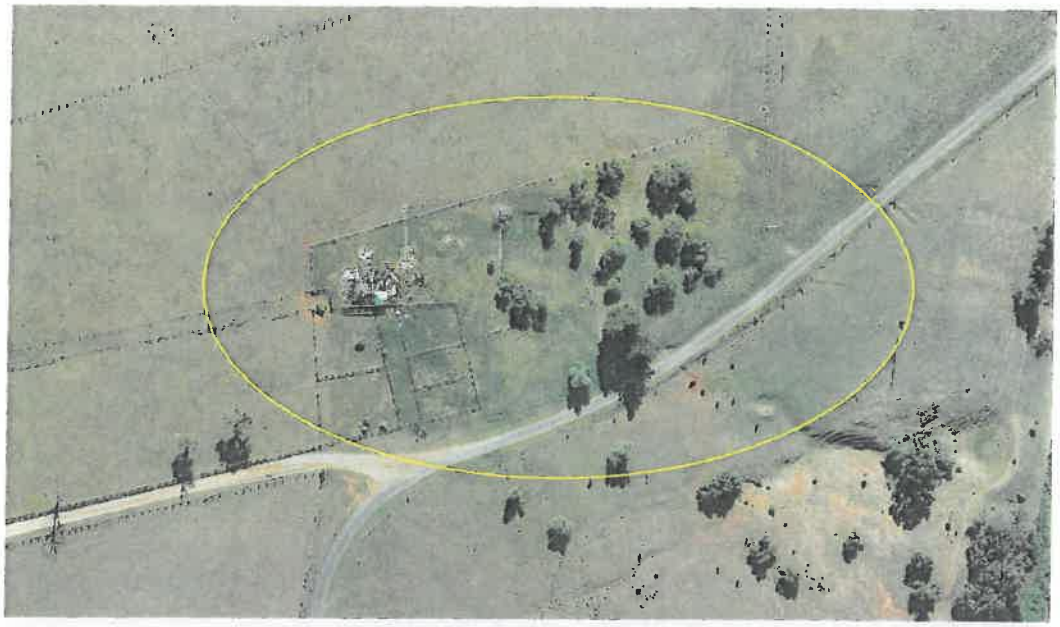
Inside Overdene Homestead September 2019

Keys Family Private Cemetery

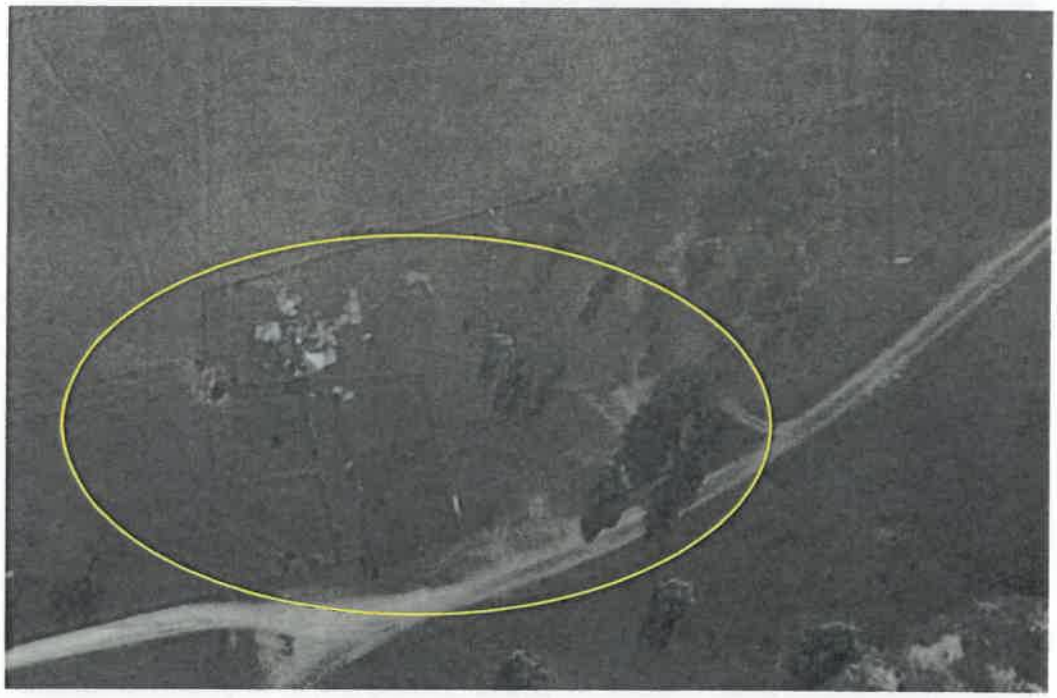
Keys Family Private Cemetery December 2019

Keys family Private Cemetery December 2019

Old Bengalla



Old Bengalla 2019 (April 2020)



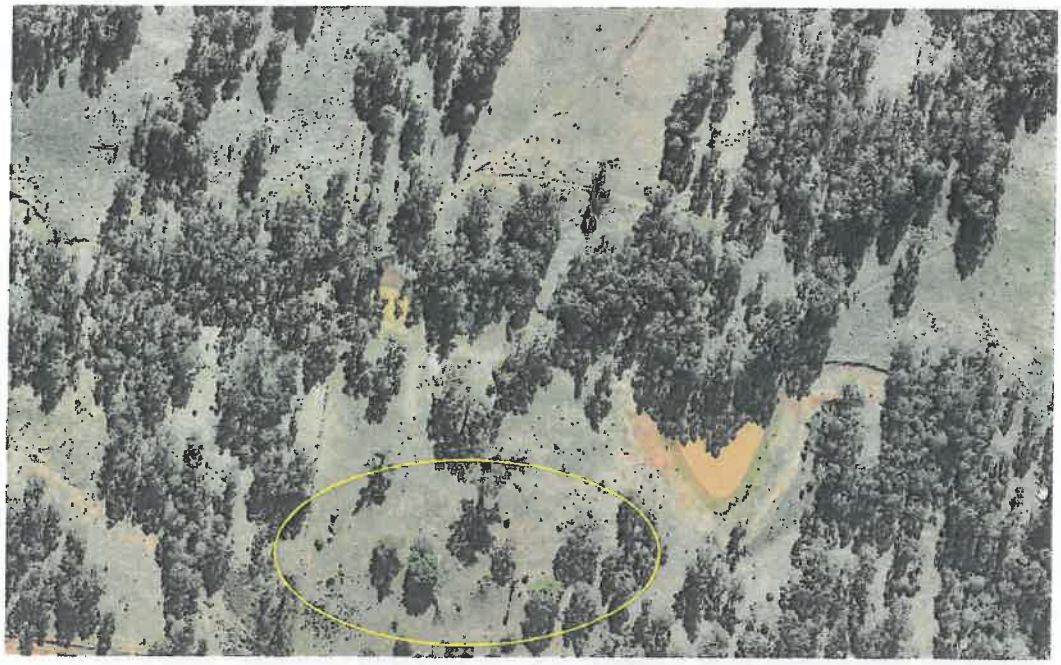
Old Bengalla 2019 (December 2018)

Overdene Homestead and Blunts Butter Factory 2019

Overdene and Blunts Butter Factory 2019 (April 2020)

Overdene and Blunts Butter Factory 2019 (December 2018)

House Site 1

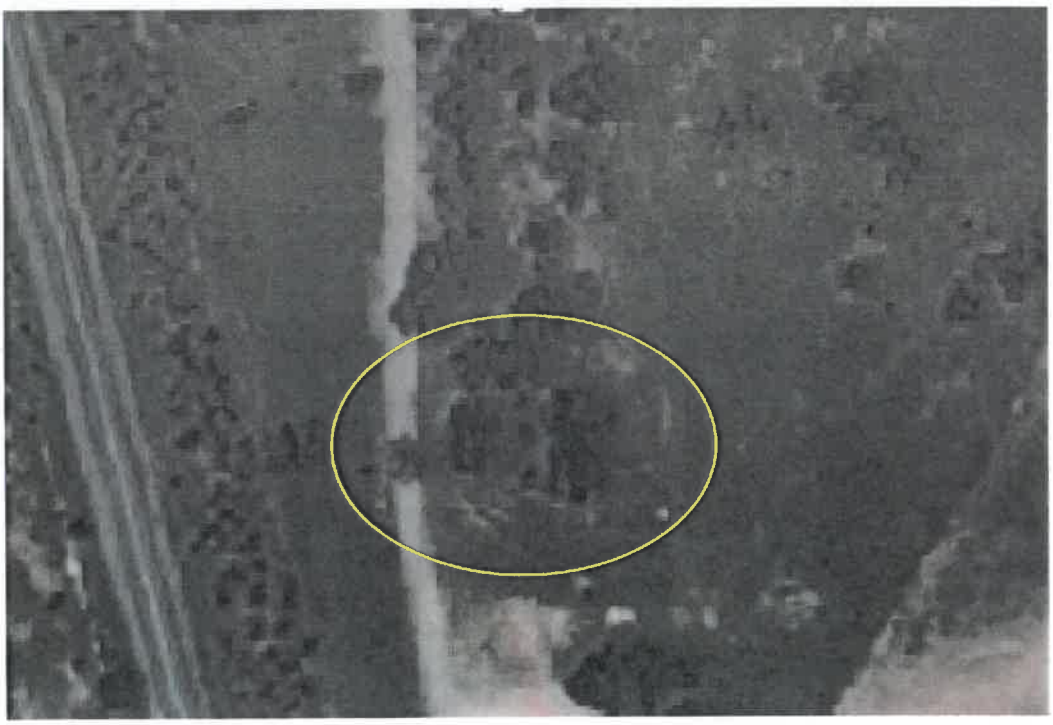


House Site 1 2019 (April 2020)

House Site 1 2019 (December 2018)

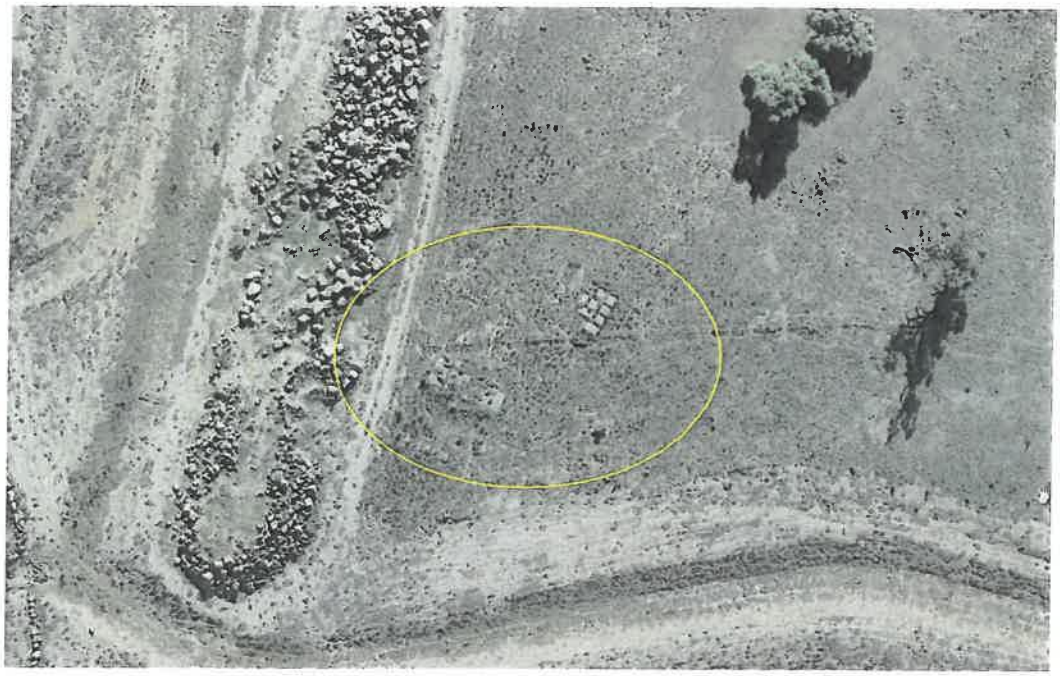
House Site 2

House Site 2 2019 (April 2020)

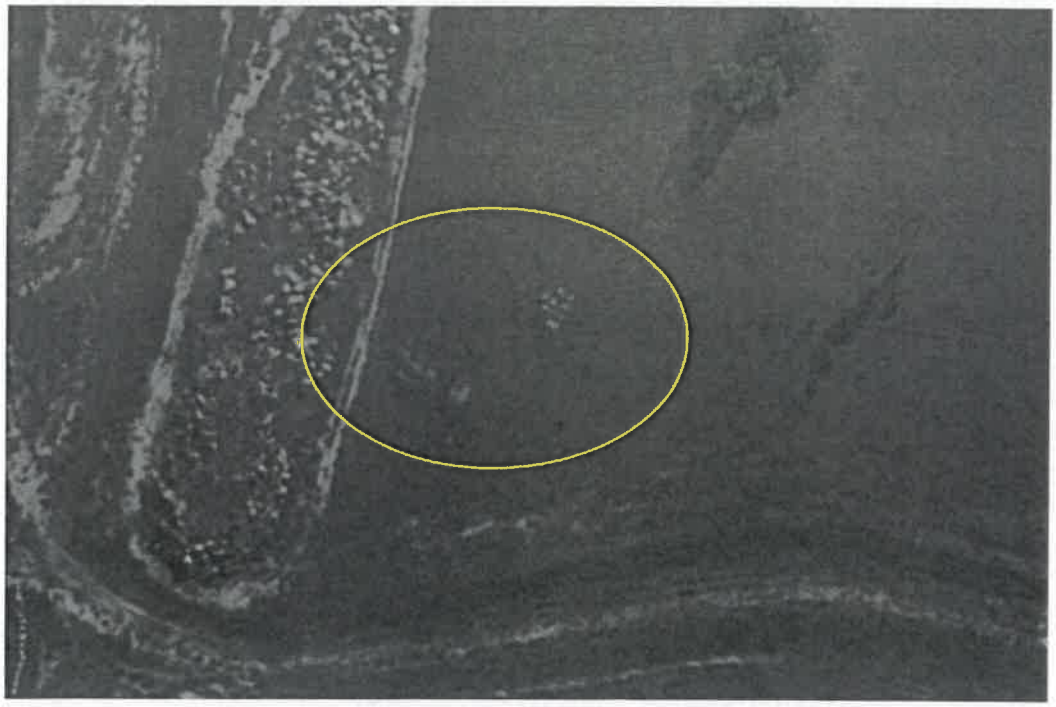


House Site 2 2019 (December 2018)

House Site 3



House Site 3 2019 (April 2020)



House Site 3 2019 (December 2018)

APPENDIX K

Correspondence: Department of Planning, Industry and Environment (DPIE)

- ***Bengalla Mine request for extension of time for submission of Annual Review***
- ***DPIE request for additional information 27 May 2020***
- ***Bengalla Mine response to DPIE request for additional information***

Simpson, Pam (BMC)

From: Heidi Watters <Heidi.Watters@Planning.nsw.gov.au>
Sent: Thursday, 26 March 2020 11:45 AM
To: White, Craig (BMC)
Cc: Joel Curran; Jennifer Sage; Bengalla Environmental
Subject: RE: Bengalla Mine Annual Review 2019

Hi Craig

Given the current circumstances, an extension until 10 April is approved.

Please submit the report via the Major Projects website – instructions are in the link in my signature below. If you have any questions about this process, please contact Joel or myself.

Kind regards

Heidi Watters
Team Leader Compliance

Planning & Assessment | Department of Planning, Industry and Environment
T 02 6575 3401 | **M** 0472 820 374 | **E** heidi.watters@planning.nsw.gov.au
PO Box 3145 | Singleton NSW 2330

If you are submitting a compliance document or request as required under the conditions of consent or approval, please note that the Department is no longer accepting lodgement via compliance@planning.nsw.gov.au.

The Department has recently upgraded the Major Projects Website to improve the timeliness and transparency of its post approval and compliance functions. As part of this upgrade, proponents are now requested to submit all post approval and compliance documents online, via the Major Projects Website. To do this, please refer to the instructions available here.

www.dpie.nsw.gov.au

NSW GOVERNMENT | Planning, Industry & Environment

The Department of Planning, Industry and Environment acknowledges that it stands on Aboriginal land. We acknowledge the traditional custodians of the land and we show our respect for elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.

From: White, Craig (BMC) <Craig.White@bengalla.com.au>
Sent: Thursday, 26 March 2020 11:15 AM
To: DPE PSVC Compliance Mailbox <compliance@planning.nsw.gov.au>
Cc: Heidi Watters <Heidi.Watters@Planning.nsw.gov.au>; Joel Curran <Joel.Curran@planning.nsw.gov.au>; Bengalla

Environmental <Bengalla.Environmental@Bengalla.com.au>
Subject: Bengalla Mine Annual Review 2019

Heid/Joel

Bengalla Mining Company Pty Limited (**BMC**) are well advanced regarding completion of the Bengalla Mine Annual Review 2019 (**Review**) which is due 31 March 2020.

Current circumstances with respect to COVID-19 has resulted in changes to the BMC work environment, working from home Etc.

These changed circumstances have lengthened the time to complete tasks.

As a result BMC request an extension of time to close of business 10 April 2020 to lodge the Review.

Regards
Craig

Craig White – Environment Superintendent
Bengalla Mining Company Pty. Ltd.
Bengalla Road, Muswellbrook NSW 2333 Australia
T: (02) 6542 9525 | **M:** 0428 429 525 | **E:** craig.white@bengalla.com.au

Planning, Industry & Environment

Craig White
Environment Superintendent
Bengalla Mine
PO Box 4
SINGLETON NSW 2330

Via Email ONLY: Craig.White@bengalla.com.au

27/05/2020

Dear Mr White

Bengalla Mine Project (SSD-5170)
Annual Review - Request for Additional Information

I refer to the 2019 Annual Review submitted to the Department of Planning, Industry and Environment (the Department) as required under Schedule 5 Condition 4 of SSD 5170, as modified (the consent) for Bengalla Mine.

The Department has reviewed the Annual Review and considers more information is required to satisfy the reporting requirements of the consent and the Department's *Annual Review Guideline* (October 2015).

You are requested to submit a revised Annual Review that includes the following information:

1. **Section 4.2 Other Operations** – please revise the information provided on train movements from Bengalla to ensure it is consistent with the Coal Transport Report 2019 published on the Bengalla website.
2. **Section 6.7 Waste Management** – please include an analysis of the effectiveness of waste minimisation and management measures implemented during the reporting period.
3. **Section 6.12.2 Offset Biodiversity** – please include a presentation and commentary on the biodiversity offset monitoring results, as stated in Section 10.3 of the Biodiversity Offset Management Plan. The commentary should provide the results of the surveys conducted during the reporting period and include any proposed measures that should be implemented to improve the performance of rehabilitation and restoration activities with the Biodiversity Offset Areas.
4. **Section 6.13.2.1 Weed Management** – please include additional information on weed management undertaken within in the Biodiversity Offset Areas, including identification of those areas subject to weeding, the techniques used, target species controlled, any new species identified, the chemicals used and any revised approaches to weed control in light of lessons from the previous performance period.
5. **Section 6.13.2.2 Pest Management** – please include information on the outcomes of the pig baiting program implemented following the report of pigs near the Bengalla train loading facility, including the type of bait/s used, quantities of bait deployed, the areas subject to control and estimates of the number of animals culled.
6. **Section 6.11 Non-Aboriginal Heritage** – please include a summary of all management actions undertaken for the heritage sites identified in the Historic Heritage Management Plan (i.e. not only Bengalla and Overdene Homesteads). This includes, but is not limited to:

- Reporting on outcomes from the annual independent dilapidation survey reports for Bengalla and Overdene Homesteads including commencement and/or completion of works identified as necessary for the structural integrity of the homestead buildings;
- Outcomes of annual inspections conducted for all historic heritage sites (not only Bengalla and Overdene Homesteads) including Keys Family private cemetery, Old Bengalla, Blunts Butter Factory, House Site 3 and any management actions arising from those.
- Updates on the status of all ongoing short-term management actions identified in the Conservation Management Plans for Overdene and Bengalla Homestead. For example, any maintenance carried out on Bengalla Homestead to address the settlement of the north east corner and Building 11 – Machinery shed.

7. **Section 8 Rehabilitation** – please include:
    - an outline of key issues identified during the year that may affect successful rehabilitation of the site such as weed infestation, poor germination rates in woodland species and other factors alluded to in the Rehabilitation Monitoring Report at Appendix H.
    - a summary of rehabilitation activities proposed for the next reporting period, such as those actions identified in the Rehabilitation Monitoring Report at Appendix H including, but not necessarily limited to, the targeted monitoring of *Acacia saligna* and a High Density Woody Vegetation project to commence in 2020.
8. **Section 9.3 Environmental Complaints** – please include a brief summary of any actions undertaken or proposed as an outcome of the complaints received.

You are requested to provide the information, or notification that the information will not be provided, to the Department by **24 June 2020**. If you are unable to provide the requested information within this timeframe, you are required to provide, and commit to, a timeframe detailing the provision of this information.

If you have any questions, please contact Jennifer Sage, Compliance Officer on 0400 245 170 or at compliance@planning.nsw.gov.au

Yours sincerely

HWatters

Heidi Watters
Team Leader Northern
Compliance

As nominee of the Planning Secretary

BENGALLA

Bengalla Management Pty Limited
Bengalla Road (Locked Mailbag 5)
Muswellbrook NSW 2333 Australia

T: +61 2 6542 9500
F: +61 2 6542 9599

ABN 41 003 713 399

bengalla.com.au

Heidi Watters
NSW Department of Planning, industry & Environment
4 Parramatta Square
12 Darcy Street
Parramatta NSW 2150

24 June 2020

Dear Ms Watters

Bengalla Mine Project (SSD-5170)
Response to Annual Review – request for Additional Information

I refer to your letter dated 27/05/2020 requesting additional information for Bengalla Mine Project Annual Review 2019.

Bengalla have addressed your requests as below:

1. **Section 4.2 Other Operations** – *please revise the information provided on train movements from Bengalla to ensure it is consistent with the Coal Transport Report 2019 published on the Bengalla website.*

   Actual coal transported from Bengalla Mine was 9,985,611 Tonnes in 2019.
   Maximum train movements / day was 7.

2. **Section 6.7 Waste Management** – *please include an analysis of the effectiveness of waste minimisation and management measures implemented during the reporting period.*

   Waste generated from Bengalla Mine (Bengalla) during 2019 was 3,333 tonnes in 2019. The total increase in 2019 was 12% higher than 2018, with 44% total waste being recycled in 2019.

Table 1: Waste Management 2019

	2018	2019
Total	2948	3,333
Recycled	1295	1458

3. **Section 6.12.2 Offset Biodiversity** – *please include a presentation and commentary on the biodiversity offset monitoring results, as stated in Section 10.3 of the Biodiversity Offset Management Plan. The commentary should provide the results of the surveys conducted during the reporting period and include any proposed measures that should be implemented to improve the performance of rehabilitation and restoration activities with the Biodiversity Offset Areas.*

   The ecological monitoring program of the Biodiversity Offset Areas established for the Project commenced in 2016. A total of 28 permanent flora monitoring sites were established and surveyed. A suite of surveys was undertaken in 2019, including bird census, terrestrial IR camera

surveys for the Spotted-tailed Quoll and feral animals, arboreal IR camera surveys for the Squirrel Glider, ultrasonic bat detection and opportunistic observations.

The data collected for the 2019 report represents the third year of annual monitoring. Given that the monitoring program is still in its early stages, few measurable changes in survey results were detected in year three annual monitoring surveys. This is expected to change over time due to a combination of the implementation of management activities and natural regeneration. Table 2 details the 2019 assessment results against the performance criteria.

Table 2 Assessment against performance criteria

KPI / Measurable Indicators	Year 5 Performance Criteria	Results of Year 3 (2019) Monitoring
Vegetation Management Zones		
Zone 1 - Existing Forest and Woodland (Maintain condition of vegetation within benchmark)		
Total native species richness (NPS)	Maintenance or increase in native species richness	Ten of 19 monitoring sites recorded an equal or greater native plant species richness compared to baseline. Of the nine sites where native species richness was below baseline numbers, only one is below benchmark values.
% Native over-store cover (NOS)	Maintenance of current cover	Zero of 19 monitoring sites recorded an equal or greater native over storey cover compared to baseline. Of the 19 sites where native over storey was below baseline numbers, only 6 are also below benchmark values.
% Native mid-storey cover (NMS)	Maintenance of current cover	Fourteen of 19 monitoring sites recorded an equal or greater native mid-storey cover compared to baseline. Of the five sites where native mid-storey cover was below baseline numbers, four are also below benchmark values.
% Native ground cover (grasses) (NGCG)	Maintenance of cover above lower benchmark	One of 19 monitoring sites recorded an equal or greater native ground cover (grasses) compared to baseline However, 18 of the 19 monitoring sites are above lower benchmark for native ground cover (grasses).
% Native ground cover (shrubs) (NGCS)	Maintenance of current cover	Four of 19 monitoring sites recorded an equal or greater native ground cover (shrubs) compared to baseline. Of the 15 sites where native ground cover (shrubs) was below baseline numbers, nine are also below benchmark values.
% Native ground cover (other natives) (NGCO)	Maintenance of current cover above lower benchmark	Sixteen of 19 monitoring sites recorded an equal or greater native ground cover (other natives) compared to baseline. Seventeen of 19 monitoring sites are above lower benchmark for native ground cover (other natives).
% Exotic plant cover	Weed cover not increased above baseline	Twelve of 19 monitoring sites recorded an equal or lower exotic plant cover compared to baseline.
% overstorey regeneration (OR)	100%	Nine of 19 monitoring sites have 100% regeneration of all canopy species present.

KPI / Measurable Indicators	Year 5 Performance Criteria	Results of Year 3 (2019) Monitoring
Number of trees with hollows (NTH)	Maintenance of number of trees with hollows	Fifteen of 19 monitoring sites recorded an equal or greater number of trees with hollows compared to baseline.
Total length (m) of fallen logs (FL)	Maintenance of length (m) of fallen logs	Fourteen of 19 monitoring sites recorded an equal or greater length of fallen logs compared to baseline. Of the five sites where length of fallen logs was below baseline numbers, all are also below benchmark values.
Zone 2 - Derived Native Grasslands (Maintain and improve through assisted natural regeneration. Aim to increase to benchmark condition)		
Total native species richness (NPS)	Increase to at least 50% of lower benchmark.	All six monitoring sites recorded native species richness at least 50% of lower benchmark.
% Native over-storey cover (NOS)	No change expected in 5 years	Native over-storey cover absent from monitoring sites. Changes expected over a longer timeframe.
% Native mid-storey cover (NMS)	Increase to at least 50% of lower benchmark.	Native mid-storey cover absent from monitoring sites. Changes expected over a longer timeframe.
% Native ground cover (grasses) (NGCG)	Maintenance of cover within benchmark range.	Five of six monitoring sites within benchmark range for native ground cover (grasses), two of which exceed the upper benchmark.
% Native ground cover (shrubs) (NGCS)	Increase to at least 50% of lower benchmark.	Zero of six monitoring sites with native ground cover (shrubs) at least 50% of lower benchmark. Changes expected over a longer timeframe.
% Native ground cover (other natives) (NGCO)	Increase to at least 50% of lower benchmark.	Five of six monitoring sites with native ground cover (other natives) at least 50% of lower benchmark. Changes expected over a longer timeframe.
% Exotic plant cover	Weed cover not increased above baseline	Four of six monitoring sites recorded equal or decreased weed cover compared to baseline, which may be the result of dry conditions preceding surveys.
% overstorey regeneration (OR)	No change expected in 5 years	No significant change observed. Changes expected over a longer timeframe.
Number of trees with hollows (NTH)	No change expected in 5 years. Maintenance of trees with hollows.	No significant change observed. Changes expected over a longer timeframe.
Total length (m) of fallen logs (FL)	No change expected in 5 years	Six of six monitoring sites recorded a greater or equal length of fallen logs compared to baseline.
Zone 3 – Riparian (Rebuild/improve riparian corridors; protect waterways. Aim to increase to benchmark condition)		
Total native species richness (NPS)	Increase to at least 50% of lower benchmark.	All monitoring sites at least 50% of lower benchmark for native species richness.
% Native over-storey cover (NOS)	No change expected in 5 years	Two of three monitoring sites within benchmark range for native overstorey cover.
% Native mid-storey cover (NMS)	Increase to at least 50% of lower benchmark.	One of three monitoring sites at least 50% of lower benchmark for native mid-storey cover. Changes expected over a longer timeframe.

KPI / Measurable Indicators	Year 5 Performance Criteria	Results of Year 3 (2019) Monitoring
% Native ground cover (grasses) (NGCG)	Increase to at least 50% of lower benchmark.	All monitoring sites at least 50% of lower benchmark for native ground cover (grasses).
% Native ground cover (shrubs) (NGCS)	Increase to at least 50% of lower benchmark.	One monitoring sites at least 50% of lower benchmark for native ground cover (shrubs).
% Native ground cover (other natives) (NGCO)	Increase to at least 50% of lower benchmark.	All monitoring sites at least 50% of lower benchmark for native ground cover (other natives).
% Exotic plant cover	Weed cover not increased above baseline	Observed decrease in weed cover, which may be the result of dry conditions preceding surveys.
% overstorey regeneration (OR)	No change expected in 5 years	No significant change observed. Changes expected over a longer timeframe.
Number of trees with hollows (NTH)	No change expected in 5 years. Maintenance of trees with hollows,	No significant change observed. Changes expected over a longer timeframe.
Total length (m) of fallen logs (FL)	No change expected in 5 years	No significant change observed. Changes expected over a longer timeframe.
Box Gum Woodland and Derived Native Grassland		
Box Gum Woodland		
Increase in site condition value	No change predicted.	No significant change observed. Changes expected over a longer timeframe.
Increase in site context value	No change predicted.	No significant change observed. Changes expected over a longer timeframe.
Derived Native Grassland		
Increase in site condition value	Native species richness to increase to at least 50% of lower benchmark.	All monitoring sites with native species richness at least 50% of lower benchmark.
	Native ground cover (shrubs) to increase to at least 50% of lower benchmark.	No monitoring sites with native ground cover (shrubs) at least 50% of lower benchmark. Changes expected over a longer timeframe.
	Native ground cover (other natives) to increase to at least 50% of lower benchmark.	All monitoring sites with native ground cover (other natives) at least 50% of lower benchmark. Changes expected over a longer timeframe.
Increase in site context value	No change predicted.	No significant change observed. Changes expected over a longer timeframe.
Threatened Species		
Tiger Orchid : - Maintenance of resident species populations and existing habitat for species. - Increase in suitable habitat and increase in	Increase in the extent and condition of habitat	Species not detected during surveys. No obvious increase in area and condition. Changes expected over a longer timeframe.

KPI / Measurable Indicators	Year 5 Performance Criteria	Results of Year 3 (2019) Monitoring
species populations and area of occupancy.		
Squirrel Glider : - Maintenance of resident species populations and existing habitat for species. - Increase in suitable habitat and increase in species populations and area of occupancy.	- Increase in the extent and condition of habitat - Continued detection of the species	Species not detected during surveys. No obvious increase in area and condition. Changes expected over a longer timeframe.
Spotted-tailed Quoll : - Maintenance of resident species populations and existing habitat for species. - Increase in suitable habitat and increase in species populations and area of occupancy.	- Increase in the extent and condition of habitat - Continued detection of the species	Species recorded at three locations within the Kenalea Properties. No obvious increase in area and condition. Changes expected over a longer timeframe.
Threatened Microbats - Maintenance of resident species populations and existing habitat for species. - Increase in suitable habitat and increase in species populations and area of occupancy.	- Increase in the extent and condition of habitat - Continued detection of the species	Several species recorded at several locations within the Biodiversity Offset Areas. No obvious increase in area and condition. Changes expected over a longer timeframe.
Woodland Birds : - Maintenance of resident species populations and existing habitat for species. - Increase in suitable habitat and increase in species populations and area of occupancy.	- Increase in the extent and condition of habitat - Continued detection of the species	Five threatened woodland birds recorded within Kenalea and Merriwa River. No obvious increase in area and condition. Changes expected over a longer timeframe.
Regent Honeyeater and Swift Parrot : - Maintenance of resident species populations and existing habitat for species. - Increase in suitable habitat and increase in species populations and area of occupancy.	Increase in the extent and condition of habitat	Species not detected during surveys. No obvious increase in area and condition. Changes expected over a longer timeframe.

KPI / Measurable Indicators	Year 5 Performance Criteria	Results of Year 3 (2019) Monitoring
Weeds		
Weed density and distribution	Weed cover not increased above baseline	Changes to exotic species richness variable across the Biodiversity Offset Areas. Observed decrease in weed cover, which may be the result of dry conditions preceding surveys.
Weed diversity	Weed diversity not increased above baseline	No significant changes to weed species diversity observed.
Significant target weed infestations	Significant target weed infestations not increased above baseline	Significant weed infestations not mapped as part of annual monitoring. Some changes in occurrences of target species at monitoring sites observed.
Feral Animals		
Feral animal abundance	No increase from the baseline feral animal abundances	Changes in species occurrences observed, including detections of some previously recorded species and absence of previously recorded species at specific sites. Changes expected over a longer timeframe. However, impacts likely to persist as animals move from adjoining areas into the Biodiversity Offset Areas.
Habitat disturbance by feral animals	No increase from the baseline feral animal disturbance levels	No significant disturbance observed at the monitoring sites.

There were no proposed measures recommended in the 2019 report to improve the performance of rehabilitation and restoration activities with the Biodiversity offset Areas.

4. **Section 6.13.2.1 Weed Management** – *please include additional information on weed management undertaken within the Biodiversity Offset Areas, including identification of those areas subject to weeding, the techniques used, target species controlled, any new species identified, the chemicals used and any revised approaches to weed control in light of lessons from the previous performance period.*

Weed management across the biodiversity offset areas involves quarterly inspections and weed control programs.

Quarterly inspections are undertaken to determine weed control required for each quarter in each of the offset areas. Following identification, weed control commences and daily work records of site attendance are submitted which detail the sites treated, area (ha) treated, techniques and chemicals utilised and rates of application. Figures 1-3 show locations of weed control in the Offset areas.

Weeds present dictate chemicals to be utilised based on their effectiveness. Chemical used during 2019 include Grazon Extra, MCPA 750 and Garlon 600.

Weeds controlled include Prickly Pear, Patersons curse and African boxthorn across each offset with Tiger Pear being controlled in Merriwa Offset. Riparian zone weeds were also treated in Kenalea and Echo including noogoora burr and thorn apple.

Application was primarily via vehicle mounted spray rigs however backpacks were also used in some areas.

Drought conditions prevailed throughout 2019 resulted in some weed species remaining dormant and not being evident in 2019 (eg St Johns Wort).

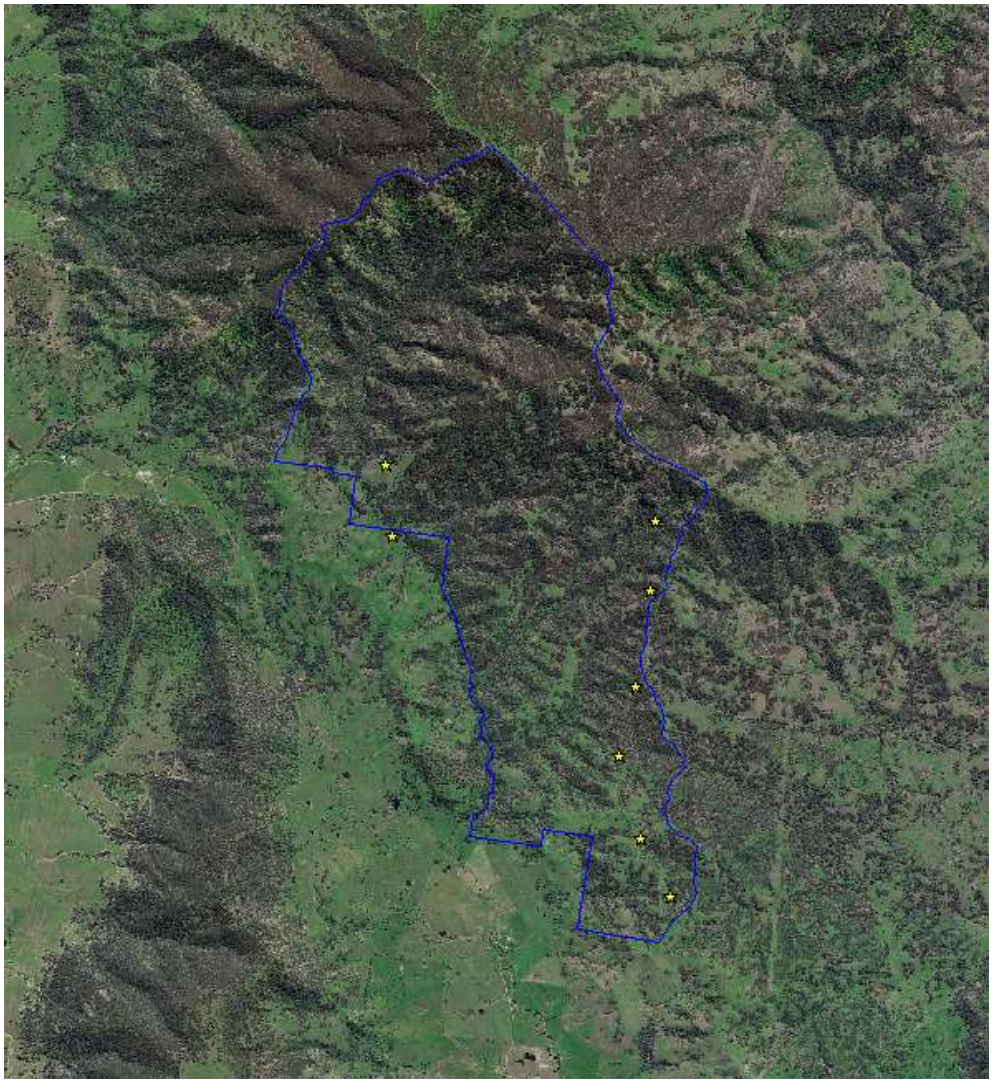


Figure 1: Black Mountain Weed Management Locations 2019

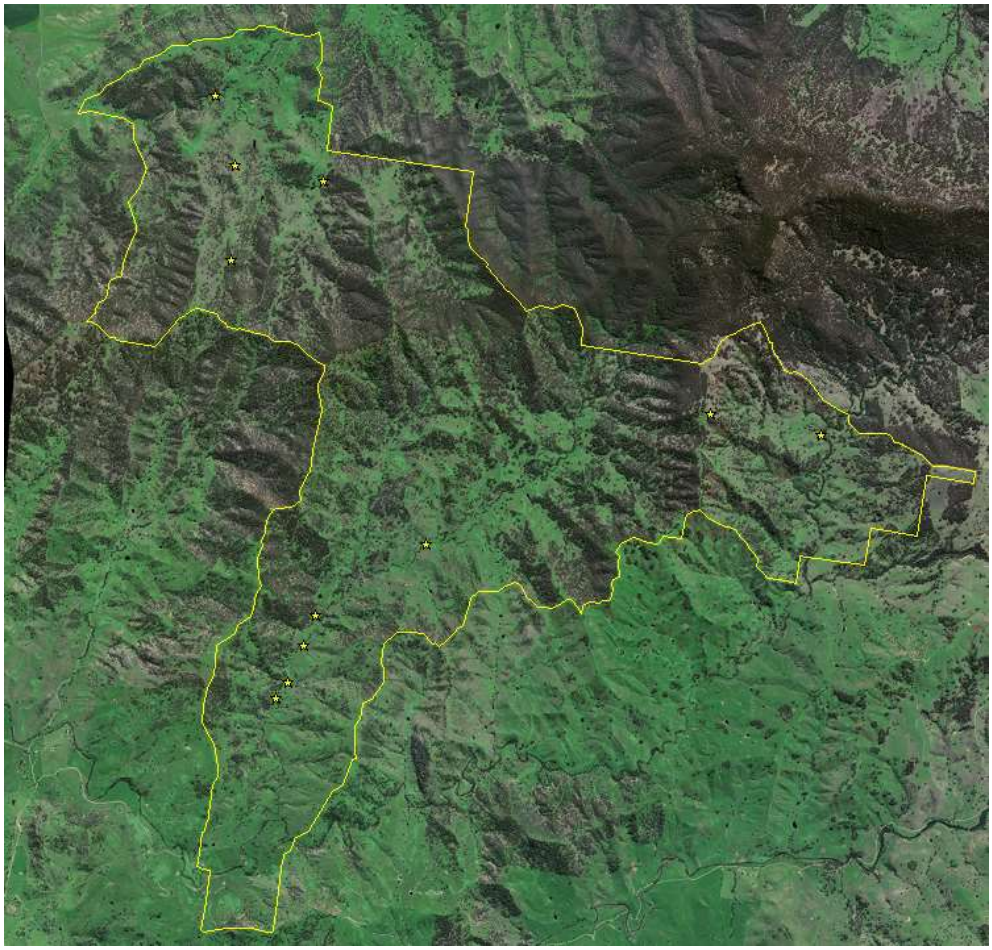


Figure 2: Kenalea Weed Management Locations 2019

Figure 3: Merriwa River Weed Management Locations 2019

5. **Section 6.13.2.2 Pest Management** – *please include information on the outcomes of the pig baiting program implemented following the report of pigs near the Bengalla train loading facility, including the type of baits/s used, quantities of bait deployed, the areas subject to control and estimates of the number of animals culled.*

   Pigs were observed around the train loadout in late 2019. A culling program was developed and then implemented in Q1 2020. Details of the results will be included in the 2020 Annual Review.

6. **Section 6.11 Non Aborignal Heritage** – *please include a summary of all management actions undertaken for the heritage sites identified in the Historic Heritage Management Plan (ie not only Bengalla and Overdene Homesteads). This includes, but is not limited to:*
   - *Reporting on outcomes from the annual independent dilapidation survey reports for Bengalla and Overdene Homesteads including commencement and/or completion of works identified as necessary for the structural integrity of the homestead buildings;*
   - *Outcomes of annual inspection conducted for all historic heritage sites (not only Bengalla and Overdene Homesteads) including Keys Family Private cemetery, Old Bengalla, Blunts Butter Factory, House Site 3 and any management actions arising from those;*
   - *Updates on the status of all ongoing short-term management actions identified in the Conservation Management Plans for Overdene and Bengalla Homestead. For example, any maintenance carried out on Bengalla Homestead to address the settlement of the north east corner and Building 11-Machinery shed.*

Annual dilapidation surveys for Bengalla Homestead and Overdene Homestead were conducted September 2019.

Bengalla Homestead
The 2019 inspection of Bengalla Homestead and associated buildings concluded that there appeared to be no further major degradation since the 2018 inspection.

Externally the condition of the homestead and service wing remained stable and the building was generally, in good repair. However, there was some minor cracking of the brickwork mortar joints under the western windows of the service wing that had developed since our 2018 inspection and should be monitored. Full renovation of the interior of the bookeepers cottage was still required and externally the building was generally in a good state of repair.

The renovated cottage service building and garden shed were in a good state of repair. The condition of the other remaining structures are consistent with the 2018 inspection including the hayshed, tool shed, steel water tower and stable.

All buildings and their repair work should continue to be monitored for any signs of cracks caused by foundation movement or mine workings nearby. Additionally, the termite bait stations should bemaintained and regular inspections carried out to ensure there is no termite activity in the vicinity of the buildings.

Figure 4: Bengalla Homestead December 2019

Figure 5: Bengalla Homestead December 2019

Figure 6: Bengalla Homestead December 2019

Figure 7: Gazebo at Bengalla Homestead September2019

Figure 8: Bookeepers Cottage at Bengalla Homestead September 2019

Figure 9: Internal Fireplace in Bengalla Homestead December 2019

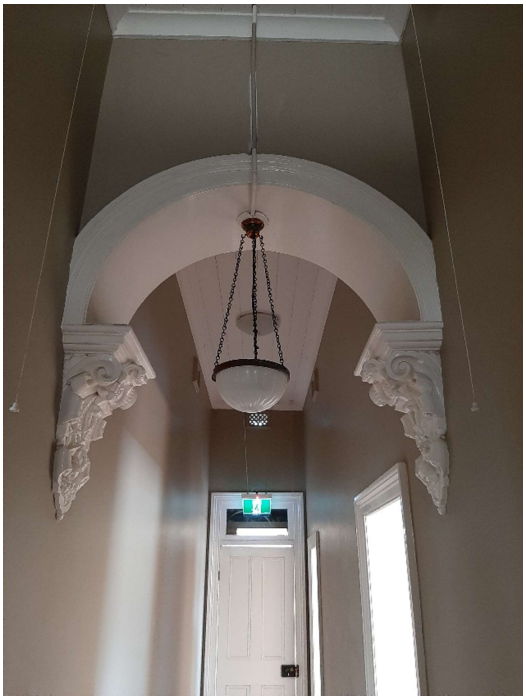


Figure 10: Internal Fixtures in Bengalla Homestead December 2019

Figure 11: Bengalla Homestead Courtyard December 2019

Overdene Homestead

The 2019 inspection of Overdene Homestead concluded that there appeared to be no further major degradation since the 2018 inspection.

The replacement of the roof sheeting and diversion of stormwater away from the building appeared to be successful and the previous restoration of the sandstone and brickwork appeared to be stable.

The remaining outstanding items for the external part of the building included the replacement of missing pipe props from the tie rod ends to assist in continually stabilising the structure.

Internally, the condition of the cottage appeared to be stable. Installation of a new floor system, restoration of windows, doors and internal walls was still outstanding.

Figure 12: Overdene Homestead September 2019

Figure 13: Inside Overdene Homestead September 2019

KeysFamily Private Cemetery

An annual inspection was undertaken on the Keys Family Private cemetery in December 2019. The cemetery was in good condition with the area mowed and headstones remain in good condition with no evidence of vandalism.

Figure 14: Keys Family Private Cemetery December 2019

Figure 15: Keys Family Private Cemetery December 2019

No other historic heritage sites were impacted during the period as shown in the following comparative photos from 2018 and 2019.

Old Bengalla 2019

Figure 16a: Old Bengalla 2019 (April 2020)

Figure 16b: Old Bengalla 2018 (December 2018)

Overdene Homestead and Blunts Butter Factory 2019

Figure 17a: Old Bengalla 2019 (April 2020)

Figure 17b: Old Bengalla 2018 (December 2018)

House Site 3

Figure 18a: House Site 3 2019 (April 2020)

Figure 18b: House Site 3 2018 (December 2018)

House Site 2

Figure 19a: House Site 2 2019 (April 2020)

Figure 19b: House Site 2 2018 (December 2018)

House Site 1

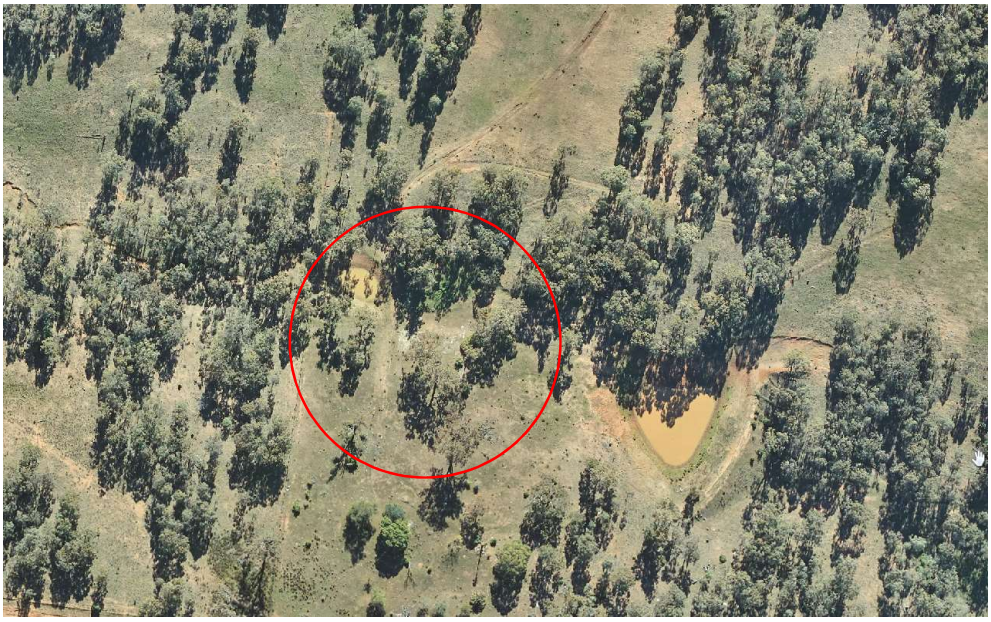


Figure 20a: House Site 1 2019 (April 2020)

Figure 20b: House Site 1 2018 (December2018)

Stockyards

Figure 21a: Stockyards (April 2020)

Figure 21b: Stockyards (December 2018)

Short Term Maintenance of the Bengalla and Overdene Homesteads 2019

Details shown in Table 3

Table 3: Short Term Maintenance of the Bengalla and Overdene Homesteads 2019

Reference	Maintenance	Response	Status
BENGALLA HOMESTEAD			
Whole Complex			
HHMP Appendix C, Section 7.3	3 monthly termite inspections	Termite inspections and bait stations were installed throughout 2019. (30/1/2019, 1/3/2019, 14/6/2019, 24/9/2019).	On-going
Building 1 – Homestead and Service Wing			
HHMP Appendix C, Section 7.3	Quarterly testing of fire management system	The Bengalla Homestead has been fitted with a mains smoke detection alarming system, which notifies Dispatch of any potential incidents allowing for response to be initiated from BMC. These systems get checked monthly.	Complete
Building 3 – Underground Cistern			
HHMP Appendix C, Section 7.3	Maintain to prevent further deterioration.	No maintenance works were undertaken during 2019.	On-going
Building 5 – Toilet/Shower			
HHMP Appendix C, Section 7.3	Undertake minimal maintenance to ensure stability of building	No maintenance were undertaken during 2019.	On-going
Building 6 - Gazebo			
HHMP Appendix C, Section 7.3	Quarterly inspection to ensure guttering is functioning and draining adequately	New downpipes and gutters have been installed.	On-going
Building 7 - Laundry			
HHMP Appendix C, Section 7.3	Retain any salvageable materials, including the laundry sink and bricks, for reuse elsewhere on site or for reconstruction. Materials to be stored in a suitable location with protection from the elements.	Laundry reconstructed using salvageable materials. New roof installed.	Complete
Building 8 – Book-keeper's Cottage			
HHMP Appendix C, Section 7.3	Stabilise footing defects.	Works completed in previous period.	Complete
Building 9 – Tennis Court			
HHMP Appendix	Maintain in current condition.	Lawn and grounds maintenance undertaken as required. New	On-going

Reference	Maintenance	Response	Status
C, Section 7.3		fencing has been installed near the main entry to the homestead and between the homestead and cottage.	
Building 12 – Modern Water-Tower			
HHMP Appendix C, Section 7.3	Maintain to prevent further deterioration	Tank Stand painted and new timber tank platform installed	On-going
Building 13 – Stockyards			
HHMP Appendix C, Section 7.3	Maintain in current condition.	No maintenance works were undertaken during 2019.	On-going
OVERDENE HOMESTEAD			
External			
HHMP Appendix D, Section 6.4	Treat termites and/or other pests appropriately.	Termite inspections and bait stations were installed throughout 2019. (30/1/2019, 1/3/2019, 14/6/2019, 24/9/2019).	On-going
HHMP Appendix D, Section 6.4	Repair damage caused by termites, where integral to structural integrity.	Internal foundation walls have been repointed and repaired ready for the installation of a new timber flooring system.	On-going
HHMP Appendix D, Section 6.4	Check and repair/replace, if necessary, the roof, all downpipes, guttering and drainage gullies for leaks and to ensure free-flowing drainage.	Pipe props have been replaced from the tie rod ends to assist in continually stabilising the structure. Some roof sheeting has been replaced	On-going
HHMP Appendix D, Section 6.4	Repair mortar where necessary, internally and externally.	Internal mortar continued to be monitored during 2019.	On-going
Internal			
HHMP Appendix D, Section 6.4	Undertake a detailed inspection of the foundations and rectify/repair, including hall archway and fireplace in Room 3.	No maintenance works undertaken duing 2019.	On-going

7. **Section 8 Rehabilitation** – *please include:*
   - *An outline of key issues identified during the year that may affect successful rehabilitation of the site such as weed infestation, poor germination rates in woodland species and other factors alluded to in the Rehabilitation Monitoring Report at Appendix H.*
   - *A summary of rehabilitation activities proposed for the next reporting period, such as those actions identified in the Rehabilitation Monitoring Report at Appendix H including, but not necessarily limited to, the targeted monitoring of Acacia saligna and a High Density Woody Vegetation project to commence in 2020.*

   An Independent Rehabilitation Monitoring assessment was undertaken November 2019. It was noted in the report that the ongoing severe state of drought (ongoing for the past 3 years) has affected the condition of rehabilitation and negatively impacted on the 2019 monitoring results.

In addition, the Upper Hunter region has also experienced unusually hot seasonal weather with temperatures exceeding long term averages thus also impacting on moisture evaporation rates.

The rehabilitation monitoring assessment concluded that potential impacts or effects of the ongoing drought included that:

- Conditions were poorly conducive to seed germination and seedling establishment / survival, which may have particularly affected the performance condition in younger rehabilitation areas.
- Detrimental impacts on ground cover plant growth and vigour, reducing vegetative cover.
- Detrimental impacts on species composition, diversity, vegetation structure and foliage cover.
- Compounded issues and grazing impacts on ground cover vegetation from herbivore species.
- Reduced erosive forces and sediment movement associated with poorer rainfall and reduced occurrences of significant rainfall events.

Ongoing drought has impacted on soil salinity levels as there is less water available to leach salts. Soils salinity was reported as unlikely to impact on existing vegetations, however may reduce growth rates and inhibit germination of new growth. Conversely, some areas of rehabilitation exhibited slight alkalinity, potentially inhibiting the germination of native species.

Weeds have impacted on the rehabilitation performance, primarily galenia and African boxthorn. Those weeds were targeted in the annual Weed Action Plan through spraying and removal. This management practice is ongoing.

Vertebrate pests, predominantly kangaroos have also impacted on new rehabilitation establishment.

Rehabilitation activities for 2020 will be generally in accordance with the Mining Operations Plan.

8. **Section 9.3 Environmental Complaints** – *please include a brief summary of any actions undertaken or proposed as an outcome of the complaints received.*

During 2019 several actions were undertaken following a complaint received. These actions included reviewing operations and amending operaitons where required, relocating lighting plants, supplementary noise monitoring, road maintenance on roads near Bengalla where required.

If you have any questions, please contact Craig White.

Yours sincerely

Craig White
Environment Superintendent
Bengalla ining Companyp

FW: Bengalla Mine 2019 Annual Review

Reply | Reply All | Forward | ...

WC White, Craig (BMC)
To Bengalla Environmental

Thu 23/07/2020 12:38 PM

From: Jennifer Sage <jennifer.sage@dpie.nsw.gov.au>
Sent: Tuesday, 30 June 2020 11:49 AM
To: White, Craig (BMC) <Craig.White@newhopegroup.com.au>
Subject: Bengalla Mine 2019 Annual Review

Hello Craig

It was good to meet you on the phone today.

Thanks for the additional information that we requested to be included in the Annual Review. As discussed just now, could you please amend the Annual Review report to include this information, and submit it to the Major Projects website against RFI-3567. This request for information was created against the original case that you created when you submitted the Annual Review in April (Case ID: SSD-5170-PA-11).

You should submit two copies of the report – one with track-changes as well as a final version that is suitable for publishing on the website.

To 'tidy up' your cases against SSD 5170, can you withdraw the letter you provided with the additional information – Case ID: SSD-5170-PA-21. Refer to this guide on "How to withdraw a project" for instructions on how to do this. If you are unable to follow this process for any reason (i.e. perhaps the project doesn't appear in your dashboard, or you don't have the option to 'Withdraw' in the 'Actions' menu), then we may need assistance from the Major Projects Support Team (MajorProjectsSupport@planning.nsw.gov.au).

All the best for next week.

Regards
Jen

Jennifer Sage
Compliance Officer

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Our Vision: Together, we create thriving environments, communities and economies.

The Department of Planning, Industry and Environment acknowledges that it stands on Aboriginal land. We acknowledge the traditional custodians of the land and we show our respect for elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.