CENTENNIAL

CENTENNIAL COAL

MYUNA COLLIERY

ANNUAL REVIEW

January 2022 to December 2022

March 2023

Centennial Coal
Environment Matters

Table 1. Annual Review Title Block

Name of Operation	Myuna Colliery
Name of Operator	Centennial Myuna Pty. Limited
Development Consent/ Project Approval #	PA10_0080 MOD3 SH110-148
Name of holder of Development Consent / Project Approval	Centennial Myuna Pty. Limited
Mining Leases # **Exploration Licences**	ML1632, ML1370 and MPL344, EL4444 and EL6640
Name of Holder of Mining Lease	Centennial Myuna Pty. Limited
Water License #	WAL 41560
Name of Holder of Water License	Centennial Fassifern Pty. Limited
RMP Start Date	1st August 2022
RMP End Date	n/a
Annual Review Start Date	1st January 2022
Annual Review End Date	31st December 2022

I, , certify that this audit report is a true and accurate record of the compliance status of Myuna Colliery for the period 1st January 2022 to 31st December 2022 and that I am authorized to make this statement on behalf of Centennial Myuna Pty Limited.

Note:

a) *The Annual Review is an 'environmental audit' for the purposes of s122B(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	CRAIG GILLARD
Title of Authorised Reporting Officer	MANAGING DIRECTOR & CEO
Signature of Authorised Reporting Officer	
Date	31/5/2023

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Tables

Figures

Appendices

Appendix No	Appendix Name
1	2022 Myuna Colliery Annual Noise Monitoring Report
2	2022 Ecological Monitoring Report

1. STATEMENT OF COMPLIANCE

Table 2 provides a statement of compliance with the relevant approvals during the reporting period.

Table 2. Statement of Compliance

Were all conditions of the relevant approval(s) complied with?	
Project Approval 10_0080 (MOD3)	NO
Development consent SH110/148	YES
Mining Operations Plan 2016-2022	YES
Mining Lease 1632	YES
Mining Lease 1370	YES
Mining Purposes Lease 334	YES
Exploration Lease 4444	YES
Exploration Lease 6640	YES
EPL 366	NO
WAL 41560	YES
Section 151 Point Wolstoncroft SCA	YES
Section 151 Pulbah Island SCA	YES
Section 151 Wangi Point SCA	YES

Table 3 provides a list of conditions that were not complied with during the reporting period.

Table 3. Non-Compliances

Relevant Approval/s	Condition #	Condition summary	Compliance Status	Comment	Where Addressed in Annual Review
PA10_0080	C25 Schedule 3	Water quality monitoring schedule	Non-Compliant	Missed water quality Sample	Sections 7, 11.
PA10_0080	C17 Schedule 3	Depositional Dust Monitoring	Non-Compliant	Lost dust sample	Sections 7, 11.
EPL366	M2.2	Depositional Dust Monitoring	Non-Compliant	Lost dust sample	Sections 7, 11.

Note: Compliance Status Key for Table 1-2

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

2. INTRODUCTION

Myuna Colliery is an underground coal mine owned and operated by Centennial Myuna Pty Limited. Myuna is located 25 km southwest of Newcastle NSW in the Lake Macquarie and Wyong Local Government Areas. The Colliery lease lies within the Parishes of Awaba, Coorumbung, Morisset and Wallarah in the County of Northumberland subsidence district and is located within the Shire of Lake Macquarie.

Lake Macquarie City Council (LMCC) granted Development Consent SH110_148 for the development and operation of the Myuna and Cooranbong Collieries in 1977. The Development Consent was granted pursuant to the provisions of the now repealed Local Government Act 1919. The Development Consent remains in force and authorises the extraction of coal within the Development Consent Mining Area.

The Development of Myuna Colliery began in 1979 and underground mining using bord and pillar mining methods commenced in 1982. Centennial Coal Company Limited acquired Myuna Colliery in 2002 and has operated the mine since that time.

On 18 January 2012, the then Minister of Planning and Infrastructure granted Project Approval (PA) 10_0080 to Centennial Myuna. A modification to PA10_0080 was approved 1st February 2015.

PA 10_0080 (MOD1) authorises the continued mining in areas outside the existing Development Consent SH110_148 mining area and within the boundary of existing mining leases held by Centennial Myuna. PA 10_0080 MOD1 authorises:

- the use of bord and pillar methods in the Wallarah, Great Northern and Fassifern coal seams;
- the continued use of ancillary infrastructure until 31st December 2032;
- the extraction of not more than 3 million tonnes of ROM coal from the site in any calendar year.

MOD 3 was an administrative change to the rehabilitation conditions to ensure consistency between the development consent and the mining leases following the rehabilitation reforms.

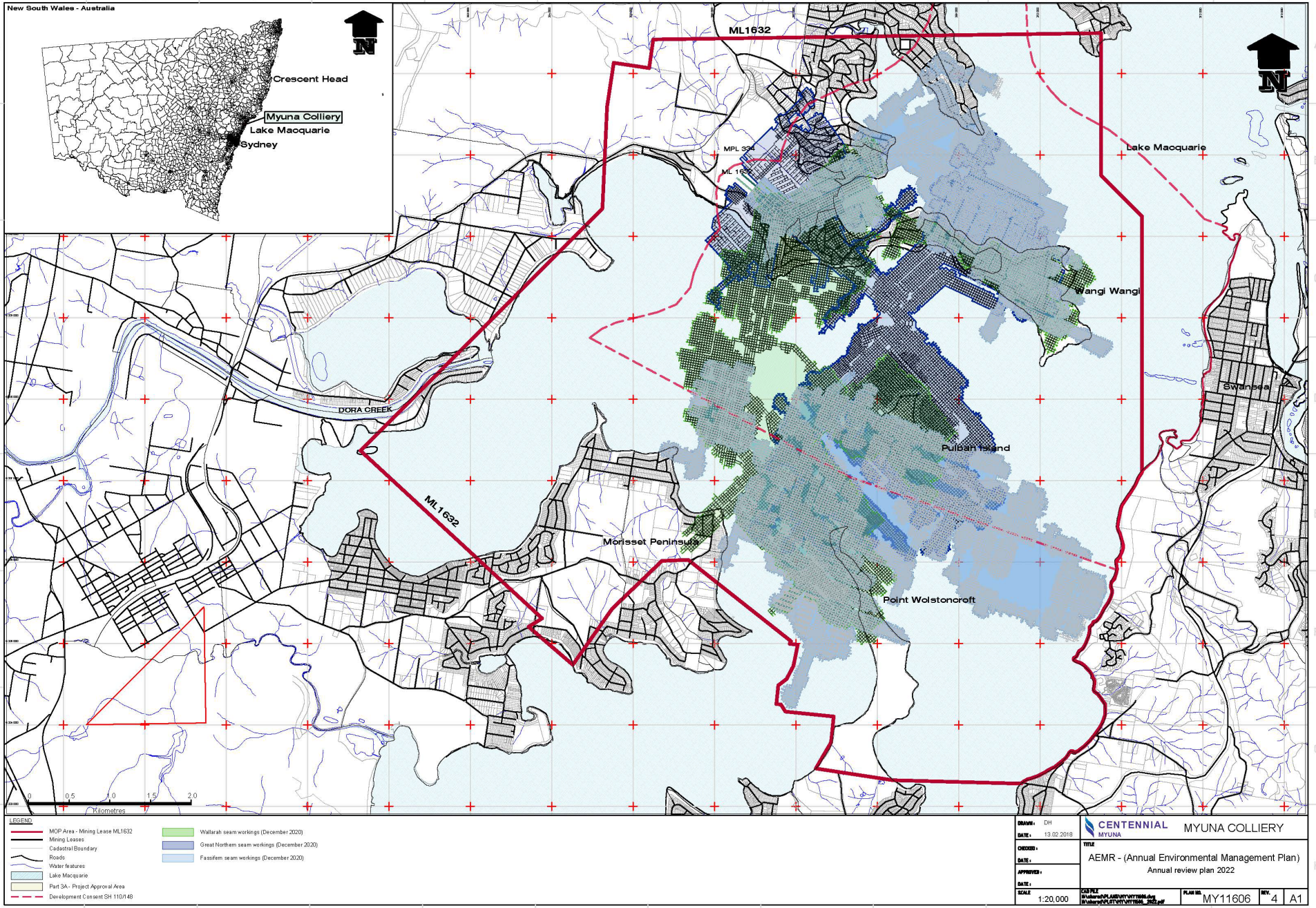
Plan MY11606, shows;

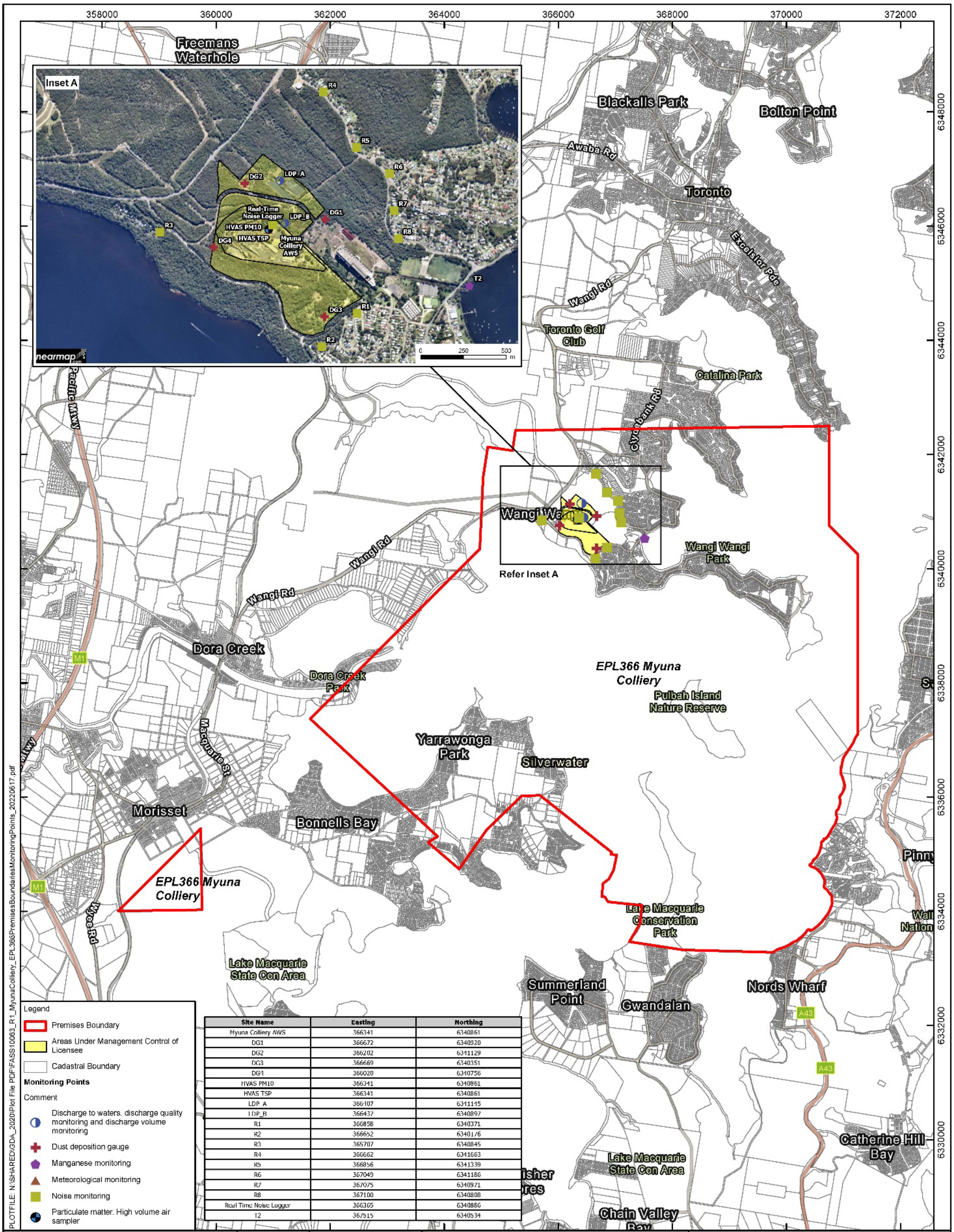
- the operation and its regional context,
- Development Consent SH110_148 and Project Approval 10_0080 boundaries,
- mining lease boundaries, and
- current operational disturbance footprint.

Table 4 provides the names and contact details of the key personnel who are responsible for the environmental management of the operation.

Table 4. Environmental Management Contact Details

Name	Position	Email	Phone
Owen Farrugia	Mine Manager	myunacolliery@centennialcoal.com.au	02 4970 0257
Kieran Fiatarone	Environment and Community Officer		02 4970 0263
Nicholas Krajewski	Technical Services Manager		02 4970 0203


New South Wales - Australia
Crescent Head
Myuna Colliery
Lake Macquarie
Sydney
ML1632
MPL 334
ML 1632
Lake Macquarie
Wangi Wangi
Swansea
DORA CREEK
Pulbah Island
ML1632
Morisset Peninsula
Point Wolstoncroft
0 0.5 1.0 1.5 2.0
Kilometres
LEGEND
MOP Area - Mining Lease ML1632
Mining Leases
Cadastral Boundary
Roads
Water features
Lake Macquarie
Part 3A - Project Approval Area
Development Consent SH 110/148
Wallarah seam workings (December 2020)
Great Northern seam workings (December 2020)
Fassifern seam workings (December 2020)
DRAWN: DH
DATE: 13.02.2018
CHECKED:
DATE:
APPROVED:
DATE:
SCALE 1:20,000
CENTENNIAL MYUNA
MYUNA COLLIERY
TITLE
AEMR - (Annual Environmental Management Plan)
Annual review plan 2022
CAD FILE
PLAN NO. MY11606
REV. 4
A1



Site Name	Easting	Northing
Myuna Colliery AWS	366341	6340861
DG1	366672	6340920
DG2	366202	6341129
DG3	366669	6340351
DG4	366020	6340756
HVAS PM10	366341	6340861
HVAS TSP	366341	6340861
LDP_A	366107	6341145
LDP_B	366437	6340897
R1	366858	6340371
R2	366652	6340176
R3	365707	6340845
R4	366662	6341663
R5	366856	6341339
R6	367049	6341186
R7	367075	6340971
R8	367100	6340808
Real Time Noise Logger	366365	6340886
T2	367515	6340534

0 1,000 2,000 3,000 meters

Coordinate System: GDA2020 MGA Zone 56

LOCATION	Myuna
SEAM	N/A
DRAWN	D.MacBain
CHECKED	D.Hart
APPROVED	K.Fiatarone
SCALE	1:60,000 @ A3

MYUNA COLLIERY
Environment Protection Licence No.366 (EPL366) Premises Boundaries and Monitoring Points

CENTENNIAL MYUNA

DATE: 15/06/2022 FASS10063 R1

PLOTFILE: N:\SHARED\GDA_2020\Plot File PDF\FASS10063_R1_MyunaColliery_EPL366PremisesBoundariesMonitoringPoints_20220617.pdf

Esri, HERE, Garmin, METI/NASA, USGS. Nearmap image dated 16 April 2022.

3. APPROVALS

The Myuna Colliery Holding is made up of Mining Lease No 1632 (ML1632), Mining Lease No.1370 (ML1370) and Mining Purposes Lease No.334 (MPL334). Surface land for mine infrastructure is within ML1632 (13.54 ha) and MPL334 (33.3 ha) giving a total surface mining lease area of 46.84 ha. The total area of the Myuna Colliery Holding is 7008 hectares.

MPL334 was granted the 20th October 1994 for a period of 21 years. The renewal of the Mining Purposes Lease 334 took effect 20th October 2015 for a further period of 21 years to 20th October 2036. The lease conditions were amended upon renewal.

Myuna Colliery is classed a Level 1 mine. PA 10_0080 was granted by the Minister for Planning on 18th January 2012 under Section 75J of Part 3A of the EP&A Act 1979.

Table 5 includes a list of all of the environmental approvals held by Myuna Colliery under the EP&A Act, Mining Act, POEO Act, NPWS Act, Water Act, Water Management Act, Radiation Act, and any changes made to these approvals during the reporting period.

Table 5. Approvals held by Centennial Myuna

Name	Description	Issued By	Expiry Date	Changed during reporting period?
SH. 110/148	Development Consent for Myuna Colliery	Lake Macquarie City Council	No expiration date specified in the consent. Subject to renewal of mining leases.	N
PA 10_0080	Myuna Colliery Mining Project	Department of Planning and Environment	31/12/2032	Y
ML 1632	Mining Lease	Department of Planning and Environment – Division of Resources and Geosciences now managed by Department of Regional NSW	13/10/2043	Y
MPL 334	Mining Purposes Lease		20/10/2036	Y
ML 1370	Mining Lease		07/03/2033	Y
EL 4444	Exploration Lease		23/10/2026	Y
EL 6640	Exploration Lease		23/04/2026	Y
Section 151 Licence	Mining Operations – Various Licence, Point Wolstoncroft	National Parks and Wildlife Services	10/09/2025	N
Section 151 Licence	Mining Operations – Various Licence, Pulbah Island		31/10/2021	N

Name	Description	Issued By	Expiry Date	Changed during reporting period?
Section 151 Licence	Mining Operations – Various Licence, Wangi Wangi Point		15/02/2021	N
WAL 45160	Water Access Licence	Department of Primary Industries – Water	Perpetuity	N
20BL173259	Bore Licence (Monitoring Bores)		Perpetuity	N
EPL 366	Environment Protection Licence (EPL)	Environmental Protection Authority	N/A	Y

3.1. Changes made to Approvals during reporting period

3.1.1. EPL366

February 2022 Revision

An update to EPL366 was issued by the EPA on February 25, 2022. The following changes were made in relation to condition E1 for manganese monitoring. Condition E1 of the Licence requires the Licensee to undertake a surface water monitoring program in Wangi Bay and provide the measured manganese concentration results on a quarterly basis. The Environment Protection Authority (EPA) reviewed the manganese monitoring results provided in accordance with condition E1 and identified the need to simplify future reviews of the monitoring data and to identify pollutant concentration trends. To facilitate this, the EPA has added the requirement to provide trend analysis of monitoring results and comparison against relevant water quality guidelines.

September 2022 Revision

A variation to EPL366 was approved on 15th September 2022. The variation submitted by Centennial requested a reduction of the monitoring frequency from daily to monthly for surface water discharges from settling ponds (EPA identification point number 9) to Wangi Creek. The EPA approved the variation noting that Myuna has achieved compliance with water quality concentration limits for Point 9, particularly since the implementation of water management improvements in 2016.

3.1.2. Mining Leases 1632, 1370, 334 and Exploration Licences 4444, 6640

In July 2021, The NSW Mining Amendment (Standard Conditions of Mining Leases - Rehabilitation) Regulation 2021 (Mining Amendment Regulation) came into effect and led to a review of mining and exploration licences. To support the implementation of the new standard rehabilitation conditions, Mining, Exploration and Geoscience (MEG) has reviewed each individual mining lease and has removed any duplicate, inconsistent, outdated or redundant conditions.

All mining leases now have four (4) standard main conditions. Where applicable, special conditions have been transferred across from the existing leases and typically relate to features such as infrastructure, dam safety and reject emplacement areas.

3.1.3. PA10_0080 (Mod 3)

PA 10_0080 (MOD 3) was approved 25th November 2022. In July 2021, The NSW Mining Amendment (Standard Conditions of Mining Leases - Rehabilitation) Regulation 2021 (Mining Amendment Regulation) came into effect changing the requirements for Rehabilitation Management Plans (previously known as Mining Operations Plans). The requirements of the updated legislation and requirements of the Myuna Project Approval did not align with each other. To accommodate the changes Myuna Colliery will submit a rehabilitation strategy to DPE within 6 months of the approval.

3.2. Annual Review Requirements

The Annual Review has been developed to satisfy the reporting requirements of the approvals listed in Table 6.

Table 6. Annual Review Requirements

Approval	Condition No.	Requirement	Where addressed in Annual Review
Project Approval 10_0080 MOD3	Schedule 5 Condition 4	By the end of March 2013, and annually thereafter, the Applicant must review the environmental performance of the project to the satisfaction of the Secretary. This review must:	Noted
		(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 next year;	Sections 8 & 8.1
		(b) include a comprehensive review of the monitoring results and complaints records of the project over the past calendar year, which includes a comparison of these results against the: • relevant statutory requirements, limits or performance measures/criteria; • requirements of any plan or program required under this approval; • monitoring results of previous years; and • predictions in the EA;	Sections 6 & 7
		(c) identify any non-compliance over the past year, and describe what actions were (or are being) taken to ensure compliance;	Section 11
		(d) identify any trends in the monitoring data over the life of the project;	Section 6 & 7
		(e) identify any discrepancies between the predicted and actual impacts of the project, and	Section 6 & 7

Approval	Condition No.	Requirement	Where addressed in Annual Review
		analyse the potential cause of any significant discrepancies; and	
		(f) describe what measures will be implemented over the next year to improve the environmental performance of the project.	Section 6 & 7

4. OPERATIONS SUMMARY

Table 7. Production Summary

Material	Approved Limit (PA10_0080 MOD 1)	Previous Reporting Period (Actual)	This Reporting Period (Actual)	Next Reporting Period (Forecast)
Waste Rock/ Overburden	N/A	N/A	N/A	N/A
ROM Coal (TPA)	3,000,000	866,838	1,050,621	1,145,850
Coarse reject	N/A	N/A	N/A	N/A
Fine reject (Tailings)	N/A	N/A	N/A	N/A
Saleable product (TPA)	3,000,000	866,838	1,050,621	1,145,850

4.1. Other Operations

Table 8. Operations Summary

Limits	Approved Limit (PA10_0080 MOD 1)	Previous Reporting Period (Actual)	This Reporting Period (Actual)	Comment (if applicable)
Hours of operation	24/7	24/7	24/7	Nil
Transport (rail)	N/A	N/A	N/A	Nil
Transport (road)	N/A	N/A	N/A	Nil

*All ROM coal from Myuna Colliery is transported via a privately owned overland conveyor to the Eraring Power Station.

4.2. Mining Operations

Mining activities during the period included 2 x super panel production units (2 x continuous miners per production unit). Both of these units were operating in the Fassifern Seam (one in the Fassifern North region, one in the Fassifern South region). The mining method for these units is the bord and pillar Myuna Herringbone System.

4.3. Exploration During This Reporting Period

Myuna Colliery undertook a survey program in the North-Eastern portion of the combined Project Approval/Development Consent area. This work was required to ensure that a minimum of 40 m of rockhead is kept between the bottom of Lake Macquarie and the Mine's workings.

The following survey methods were used:

- Sub-bottom Profiling (Sparker survey)
- Bow towed magnetometer survey
- Rockhead and surface to seam drilling program.

The exploration program commenced in June 2022 and was completed by November 2022. This program was completed with consultation and notification to the relevant stakeholders.

4.4. Exploration Next Reporting Period

There are no planned exploration activities for the next reporting period.

4.5. Land Disturbance

There has been no land disturbance at Myuna Colliery during the 2022 reporting period.

4.6. Construction

There has been no construction at Myuna Colliery during the 2022 reporting period.

4.7. Next Report Period

Planned production for the next reporting period is as per the 2022 reporting period (2 x super panels operating in the Fassifern Seam using the Myuna Herringbone System).

5. ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

The 2021 Annual Review was submitted to the Department of Planning and Environment (DPE), on 31st March 2021 in accordance with Schedule 5, Condition 4 of the Project Approval 10_0080. It was also submitted to the Department of Planning and Environment – Resources Regulator (RR) on the 31st March 2021 in order to satisfy Condition 3 of ML1370 and MPL334 as well as Condition 4 of ML1632 in accordance with the guidelines published on the DRG's website.

Table 9. Actions from previous Annual Review

Action Required	Requested By	Action Taken	Where Addressed in Annual Review
Report on the status of the long term security arrangement for biodiversity offsets required by the development consent for the mine. Information on type(s) of long-term security arrangements that have been implemented and/ or are to be implemented for the mine must be included.	DPE	The offset requirements in PA 10_0080 Schedule 3 Condition 5 only relate to exceedances of performance measures due to subsidence. Myuna has not commenced secondary extraction and has not exceeded the biodiversity performance measures, therefore biodiversity offsets have not been triggered.	n/a

Action Required	Requested By	Action Taken	Where Addressed in Annual Review
Report greenhouse gas emissions for the reporting period and include comparison of actual greenhouse gas emissions against the predictions in the environmental assessments(s) for the mine. Include method used to calculate the environmental assessment predictions(s) and annual emissions are calculated the same	DPE	Included in this Annual Review	Section 6.5
Report all reasonable and feasible steps undertaken during the reporting period to improve energy efficiency and reduce greenhouse gas emissions generated by the mine	DPE	Included in this Annual Review	Section 6.5

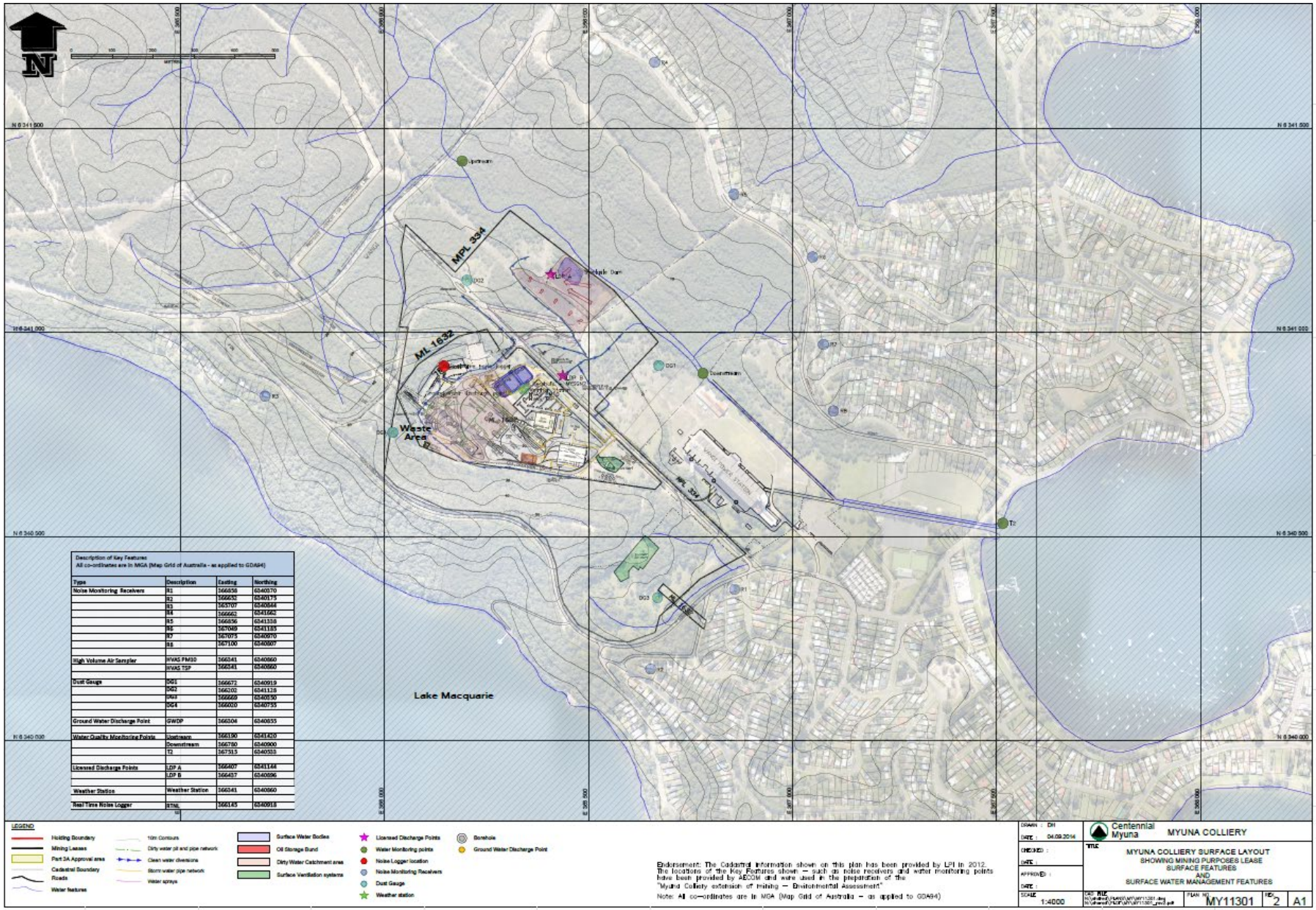
6. ENVIRONMENTAL PERFORMANCE

This section includes a summary of the environmental monitoring and management measures implemented at Myuna Colliery during the 2022 reporting period.

The monitoring locations are summarised in Table 10 below and shown on Plan MY11301 on the following page.

Table 10. Summary of Monitoring Requirements

Monitoring Type	Overview of Monitoring Requirements	Requirement of Approval / Management Plan	Where Addressed in Annual Review
Meteorological	Temperature, wind speed, humidity, rainfall, sigma-theta	Northern Region Air Quality & Greenhouse Gas Management Plan	Section 6.1
Noise	Quarterly at 8 locations	Northern Region Noise Management Plan EPL 366	Section 6.2
Air quality	4 x DGs - Monthly 2 x HVAS – every 6 days	Northern Region Air Quality & Greenhouse Gas Management Plan EPL 366	Section 6.3
Biodiversity	Annual surveys at 3 locations	Biodiversity Management Plan	Section 6.4
Greenhouse Gas	Monthly gas bag sample.	Northern Region Air Quality & Greenhouse Gas Management Plan	Section 6.5
Heritage	As required	Northern Region Aboriginal Cultural Heritage Management Plan. Northern Region Historic Heritage Management Plan	Section 6.6
Water	Surface Water Volume & Quality - Various Monthly Groundwater Depth	Water Management Plan EPL 366	Section 7
Rehabilitation	N/A	Rehabilitation Management Plan	Section 8


MPL 334
ML 1632
Waste Area 2
Lake Macquarie
Upstream
Downstream
Description of Key Features
All co-ordinates are in MGA (Map Grid of Australia - as applied to GDA94)
Type | Description | Easting | Northing
Noise Monitoring Receivers | N1 | 366858 | 6340370
N2 | 366632 | 6340175
N3 | 365707 | 6340844
N4 | 366662 | 6341662
N5 | 366836 | 6341338
N6 | 367049 | 6341185
N7 | 367075 | 6340970
N8 | 367100 | 6340807
High Volume Air Sampler | HVAS PM10 | 366341 | 6340660
HVAS TSP | 366341 | 6340660
Dust Gauge | DG1 | 366672 | 6340919
DG2 | 366202 | 6341128
DG3 | 366669 | 6340350
DG4 | 366020 | 6340755
Ground Water Discharge Point | GWDP | 366304 | 6340655
Water Quality Monitoring Points | Upstream | 366190 | 6341420
Downstream | 366780 | 6340900
T2 | 367315 | 6340533
Licensed Discharge Points | LDP A | 366407 | 6341144
LDP B | 366437 | 6340896
Weather Station | Weather Station | 366341 | 6340660
Real Time Noise Logger | RTNL | 366143 | 6340918
LEGEND
Holding Boundary
Mining Leases
Part 3A Approval area
Cadastral Boundary
Roads
Water features
10m Contours
Dirty water pit and pipe network
Clean water diversions
Storm water pipe network
Water sprays
Surface Water Bodies
Oil Storage Bund
Dirty Water Catchment area
Surface Ventilation systems
Licensed Discharge Points
Water Monitoring points
Noise Logger location
Noise Monitoring Receivers
Dust Gauge
Weather station
Borehole
Ground Water Discharge Point
Endorsement: The Cadastral information shown on this plan has been provided by LPI in 2012. The locations of the Key Features shown – such as noise receivers and water monitoring points have been provided by AECOM and were used in the preparation of the "Myuna Colliery extension of mining – Environmental Assessment".
Note: All co-ordinates are in MGA (Map Grid of Australia – as applied to GDA94)
DRAWN : DH
DATE : 04.09.2014
CHECKED :
DATE :
APPROVED :
DATE :
SCALE 1:4000
Centennial Myuna
MYUNA COLLIERY
TITLE
MYUNA COLLIERY SURFACE LAYOUT
SHOWING MINING PURPOSES LEASE
SURFACE FEATURES
AND
SURFACE WATER MANAGEMENT FEATURES
PLAN NO. MY11301
REV. 2
A1

6.1. Meteorological Summary

Meteorological monitoring is completed as per conditions M5.1 and M5.2 of EPL 366 and Section 4.4.4 of the approved Northern Region Air Quality and Greenhouse Gas Management Plan. The location of the Myuna onsite weather station is shown on Plan MY11301, above. The weather station is maintained to conform to the requirements of the NSW EPA Approved Method AM-2 and NSW EPA Approved Method AM-4.

Table 11 below shows that rainfall at Myuna Colliery was above average with a total of 1957mm for 2022, in comparison to an annual average of 1128mm. The wettest months for 2022 were March and July which exceeded 393mm and 453mm respectively. This is in the top 1 percentile rainfall recorded for each of these months. Monthly minimum temperatures were colder than average across all months except June, whilst monthly maximum temperatures were comparable to the long-term averages. Note that average rainfall data presented below is from the Cooranbong (Avondale) Weather Station which has records since November 1902 and temperature data is from Newcastle Nobbys Signal Station which has records from January 1862 to date.

Table 11. Meteorological Data Summary

Month	2022 total monthly rainfall (mm)	Average total monthly rainfall (mm)	2022 monthly minimum temperature (°C)	Average monthly minimum temperature (°C)	2022 monthly maximum temperature (°C)	Average monthly maximum temperature (°C)
January	107.4	108.9	16	16.2	32.5	35
February	157.2	135.4	13.7	16.4	33.7	33.1
March	393.8	125.1	13	14.3	29.5	32.3
April	217.6	117.1	10.1	10.9	28.6	29.1
May	140.8	93.8	6.1	7.7	25.5	25.3
June	23	102.6	8.9	5.9	19.2	21.7
July	453.8	67.5	2.8	5.2	20.7	22
August	43.4	59.9	3.6	5.8	23.1	24.2
September	135.8	58.3	6	7.7	23.4	28.6
October	199	68.7	7	10	29.4	31.6
November	57.8	81.8	7.1	11.9	32.7	33.5
December	27.6	96.6	10.3	14.2	31.3	34.5
Annual Total	**1957**					

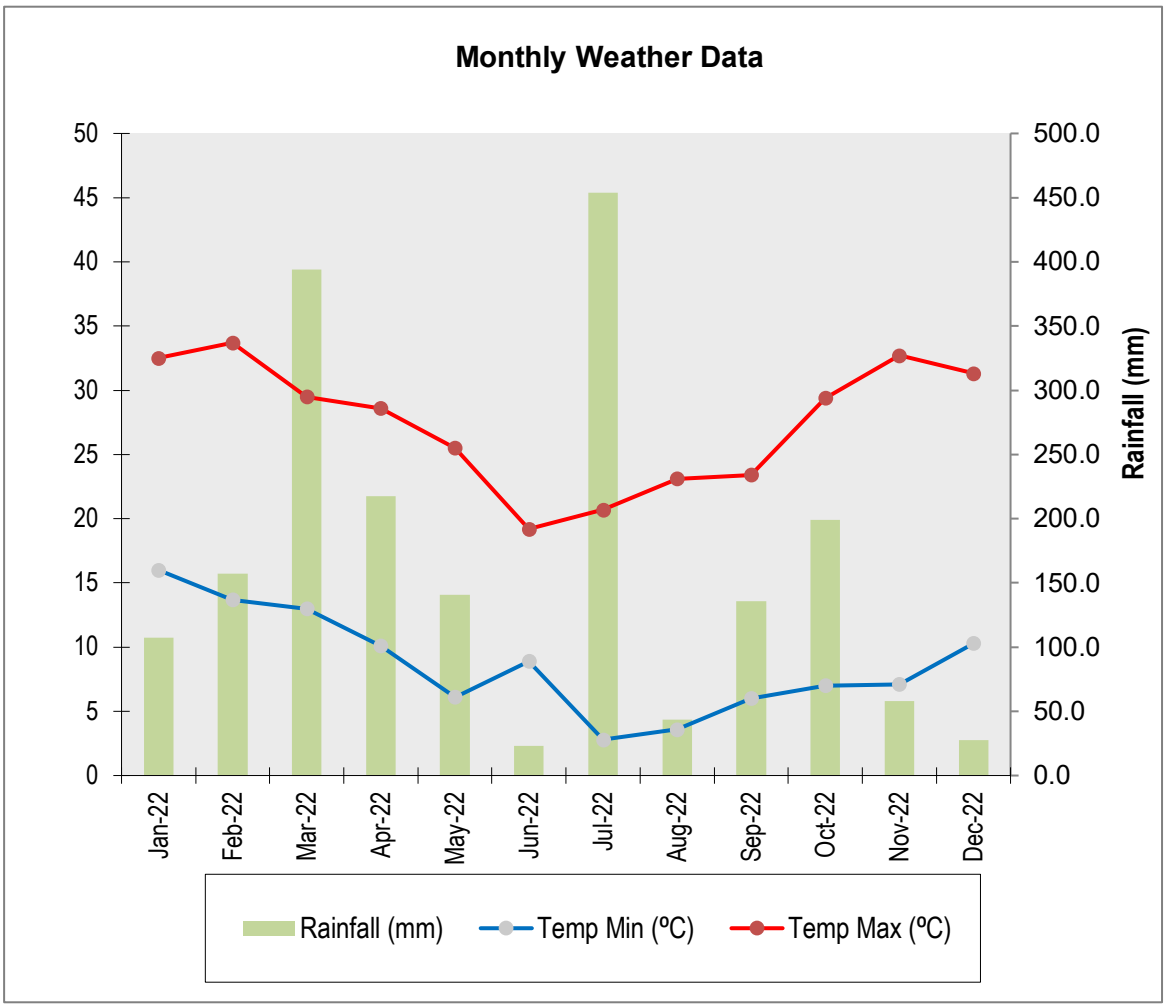


Figure 1. Meteorological Data from Myuna AWS 2022

6.2. Noise

The control strategies were implemented as per the Northern Region Noise Management Plan and were adequate to manage the risks associated with the operation during the reporting period.

The Northern Region Noise Management Plan outlines potential sources and impacts of elevated noise levels. The Plan also identifies measures which must be in place to reduce noise levels. All contractors and employees undergo induction and regular refresher training that identifies individual responsibilities for noise management.

Quarterly noise monitoring throughout 2022 has been conducted in accordance with the requirements of Schedule 3 Condition 11, 12, 13 and 14 of the Myuna Project Approval (PA) PA10_0080, dated 1st February 2015 (PA 10_0080 MOD3) Myuna Colliery Environment Protection Licence (EPL) 366 version dated 15th September 2022 (EPL 366).

Centennial Myuna commissioned SLR Consulting Australia Pty Ltd (SLR) to produce an annual compliance noise monitoring report for Myuna Colliery.

The report provides a summary of quarterly compliance noise monitoring of Myuna operations during 2022 and is provided in full at Appendix 1.

The objectives of the noise monitoring programme for 2022 were as follows:

- Conduct operator attended noise surveys at eight locations (R1, R2, R3, R4, R5, R6, R7 and R8) surrounding the colliery during day, evening and night-time periods.
- Quantify all sources of noise within each of the attended noise surveys, including measured and/or estimated contribution and maximum level of individual noise sources.
- Assess the noise emissions of Myuna Colliery and determine compliance with respect to the limits contained in the PA.

EIS Predictions

Operational noise levels are predicted to continue to meet the project specific noise criteria and the consent conditions at all assessed residential receivers under calm and prevailing weather conditions.

Result Summary

Table 12 below shows a summary of the noise monitoring data for Myuna Colliery, 2022. Operator attended noise monitoring was conducted at eight (8) locations to determine the noise contributions of Myuna Colliery with the relevant criteria. There were no exceedances or non-compliances for the 2022 reporting period.

Table 12. Myuna Noise Monitoring Results Summary 2022

Location	Q1	Q2	Q3	Q4	Criteria Limit
Day (LAeq (15 minute) dBA)					
R1	I/A	30	I/A	I/A	35
R2	I/A	27	I/A	I/A	35
R3	I/A	I/A	I/A	I/A	35
R4	I/A	<25	I/A	30	35
R5	I/A	<25	I/A	I/A	37
R6	I/A	<30	I/A	33	37
R7	<30	33	I/A	25	37
R8	I/A	I/A	I/A	I/A	37
Evening (LAeq (15 minute) dBA)					
R1	<30	34	I/A	I/A	35
R2	32	32	I/A	I/A	35
R3	I/A	I/A	30	I/A	35
R4	<30	33	I/A	30	40
R5	30	31	I/A	I/A	42
R6	<30	35	I/A	33	42
R7	32	38	I/A	25	42

R8	<30	34	I/A	I/A	42
Night (LAeq (15 minute) dBA)					
R1	35	35	I/A	35	35
R2	34	34	25	29	35
R3	<30	<30	32	30	35
R4	29	35	I/A	35	38
R5	30	32	I/A	38	39
R6	35	36	I/A	38	39
R7	35	38	I/A	39	39
R8	31	35	I/A	30	39

1. I/A = Inaudible
2. Within 2dB tolerance as per Section 11.1.3 of the NSW Industrial Noise Policy (INP). A development will be deemed to be in non-compliance with a noise consent or licence if the monitored noise level is more than 2dB above the statutory noise limit specified in the consent or licence condition.

6.3. Air Quality

Control strategies were implemented as per the Northern Region Air Quality and Greenhouse Gas Management Plan and were adequate to manage the risks associated with the operation during the reporting period.

The Northern Region Air Quality and Greenhouse Gas Management Plan outlines potential sources and impacts of elevated dust levels. The Plan also identifies measures which must be in place to reduce dust and environmental activities conducted to minimise elevated dust levels. All contractors and employees undergo induction and refresher training that identifies individual responsibilities for air quality management.

6.3.1. Dust Deposition

Results summary

The air quality monitoring data is assessed against the Project Approval and EPL limit criteria. There were no exceedances of the air quality limit criteria for the report period.

Depositional dust monitoring was performed at Myuna Colliery during 2022 on a monthly basis at four depositional dust gauges. The limit criterion for depositional dust is 4 g/m^2/month, applied as an annual average.

The current air quality controls include enclosed conveyor and coal handling plant, water sprays on the conveyor system and haul road, mobile water cannon, a road sweeper and a water cart operating on site during coal haulage activities. Controls have been implemented in the reporting period.

Figure 2 and Table 12 below show the depositional dust monitoring results of Myuna Colliery for 2022 in comparison to the long-term results and EIS predictions. At all four dust gauges the annual averages were lower than long term averages and as a result the 2 g/m^2/month max annual average increase limit was not exceeded.

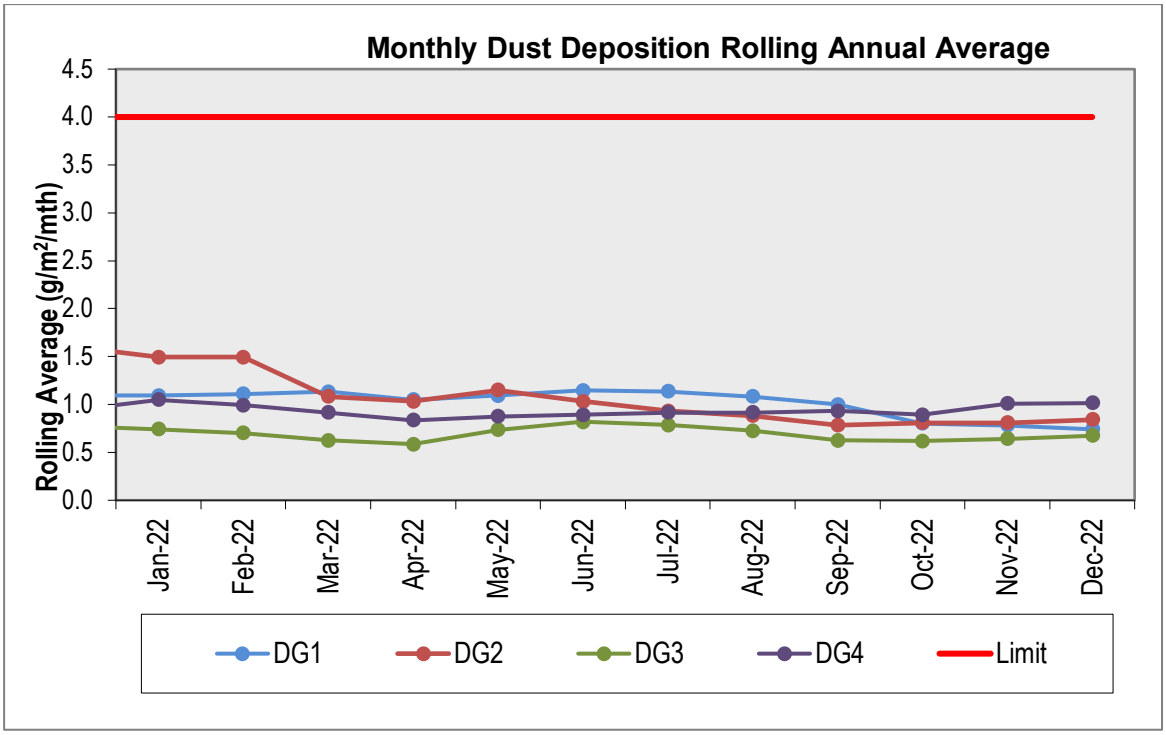


Figure 2. Dust Depositional Gauge – Rolling Annual Average

Table 13. Air Quality Environmental Performance

Dust Monitor	Approval criteria	EIS / EA Predictions	Performance during the reporting period	Long Term Average
DG1	2 g/m^2/month Max Annual Average Increase	<0.1	-0.35	0.03
	4 g/m^2/month Total Annual Average	1.9	0.74	0.9
DG2	2 g/m^2/month Max Annual Average Increase	<0.1	-0.26	0.03
	4 g/m^2/month Total Annual Average	1.9	0.84	1.1
DG3	2 g/m^2/month Max Annual Average Increase	<0.1	-0.10	-0.06
	4 g/m^2/month Total Annual Average	1.9	0.8	1.4
DG4	2 g/m^2/month Max Annual Average Increase	<0.1	0.08	0.0005

Dust Monitor	Approval criteria	EIS / EA Predictions	Performance during the reporting period	Long Term Average
	4 g/m^2/month Total Annual Average	1.9	1.02	1.3
HVAS PM_{10}	30 µg/m^3 Annual Average	10.8	9.59	13.63
	50 µg/m^3 24 hr Average	10.5 to 51.7	8.57	13.40
HVAS TSP	90 µg/m^3 Annual Average	36.1	16.92	29.7

Trend

Myuna Colliery has 19 years of dust monitoring data over the period from January 2003 to December 2022. Data for a 10 month period from February 2007 to November 2007 is not available. A trend analysis was undertaken using a linear trend line for the dust deposition monitoring from January 2003 to December 2022.

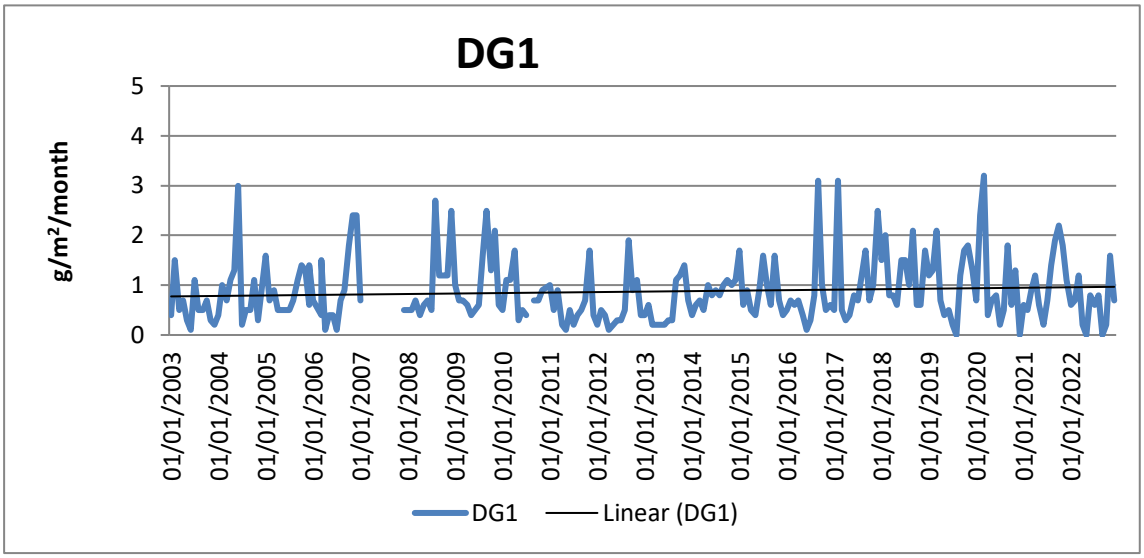


Figure 3. ***DG1 Trend Analysis Graph***

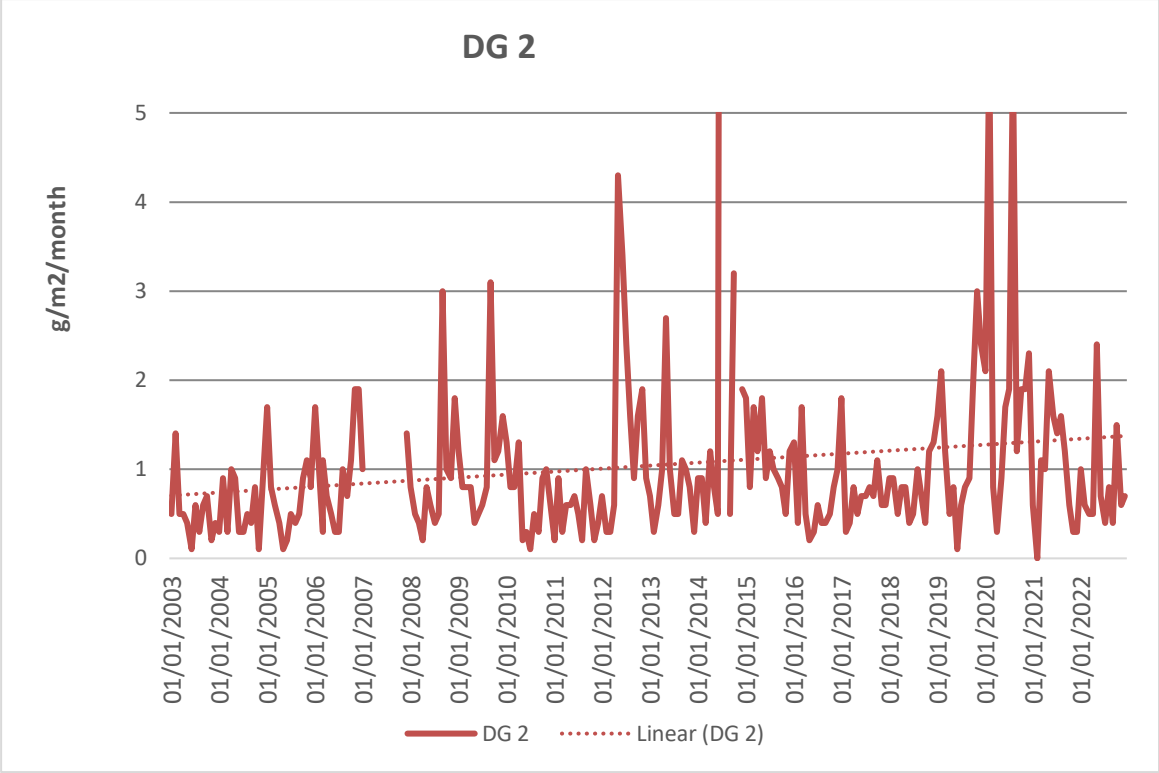


Figure 4. *DG2 Trend Analysis Graph*

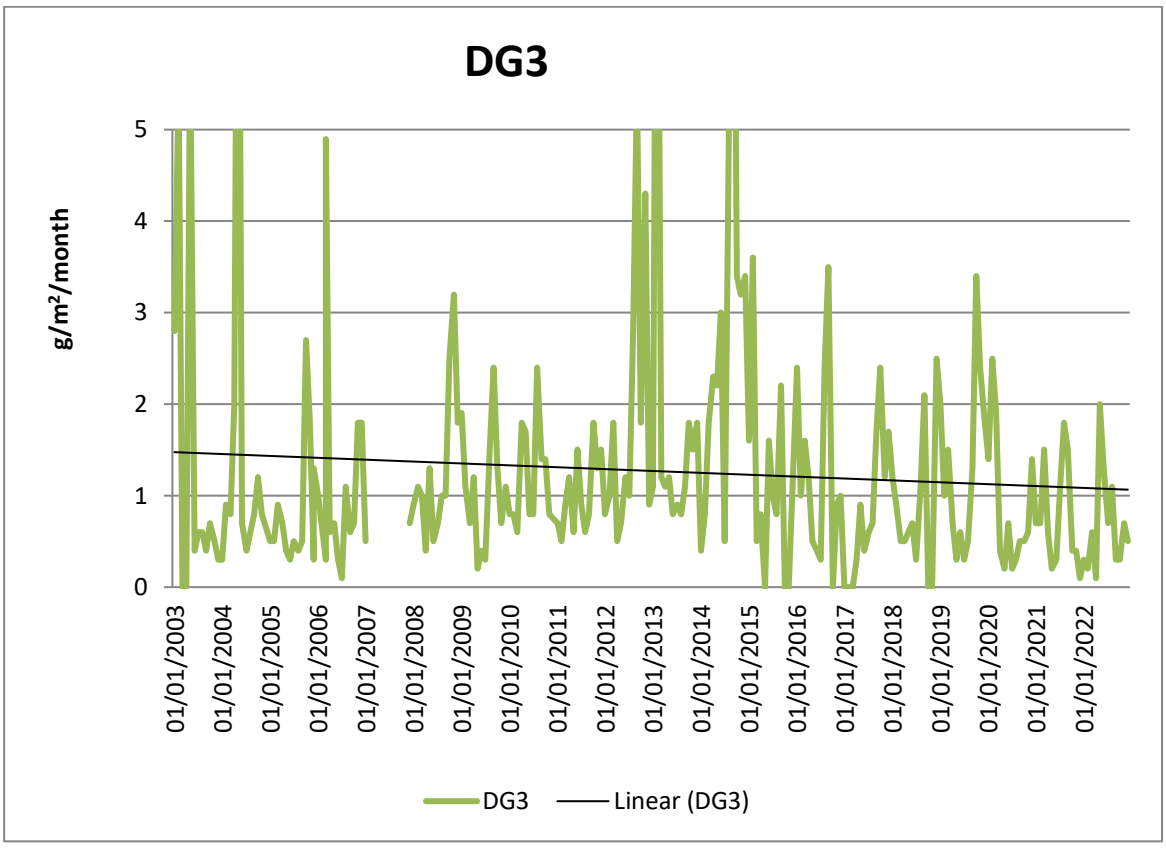


Figure 5. *DG3 Trend Analysis Graph*

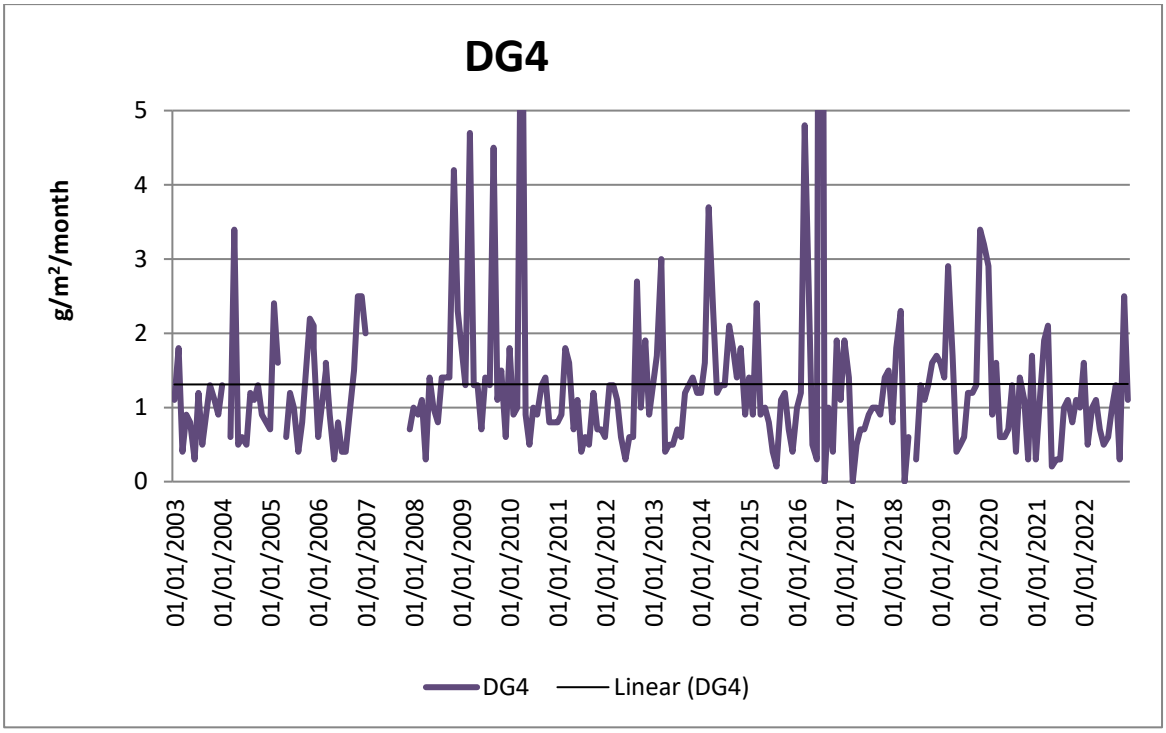


Figure 6. DG4 Trend Analysis Graph

The 2022 annual average and long-term average for each dust gauge is provided in Table 12. The 2022 annual averages for all dust gauges are less than the 19-year long term averages. The long-term trend lines of DG 3 and 4 display a consistent trend for the monthly dust deposition while DG 1 and 2 display a slightly increasing trend.

EA Prediction

The Myuna Colliery Extension of Mining Project Air Quality Impact Assessment (Heggies 2010) predicted the dust deposition levels would be below the Project air quality criteria at all receptors for depositional dust. The dust deposition results for the report period have been consistent with the EA prediction.

6.3.2. HVAS

Result Summary

Air quality monitoring for PM10 and Total Suspended Particles (TSP) commenced in August 2013. The monitoring has been conducted in accordance with Schedule 3 Condition 17 of PA10_0080 and Condition M2 of and EPL 366.

The air quality monitoring data is assessed against the Project Approval. The annual average limit criterion for TSP is 90 µg/m^3 and for PM10 is 30 µg/m^3. The 24 hour limit criterion for PM10 is 50 µg/m^3. There were no exceedances of the 24 hour limit criteria for PM10, or the annual average limit during the report period.

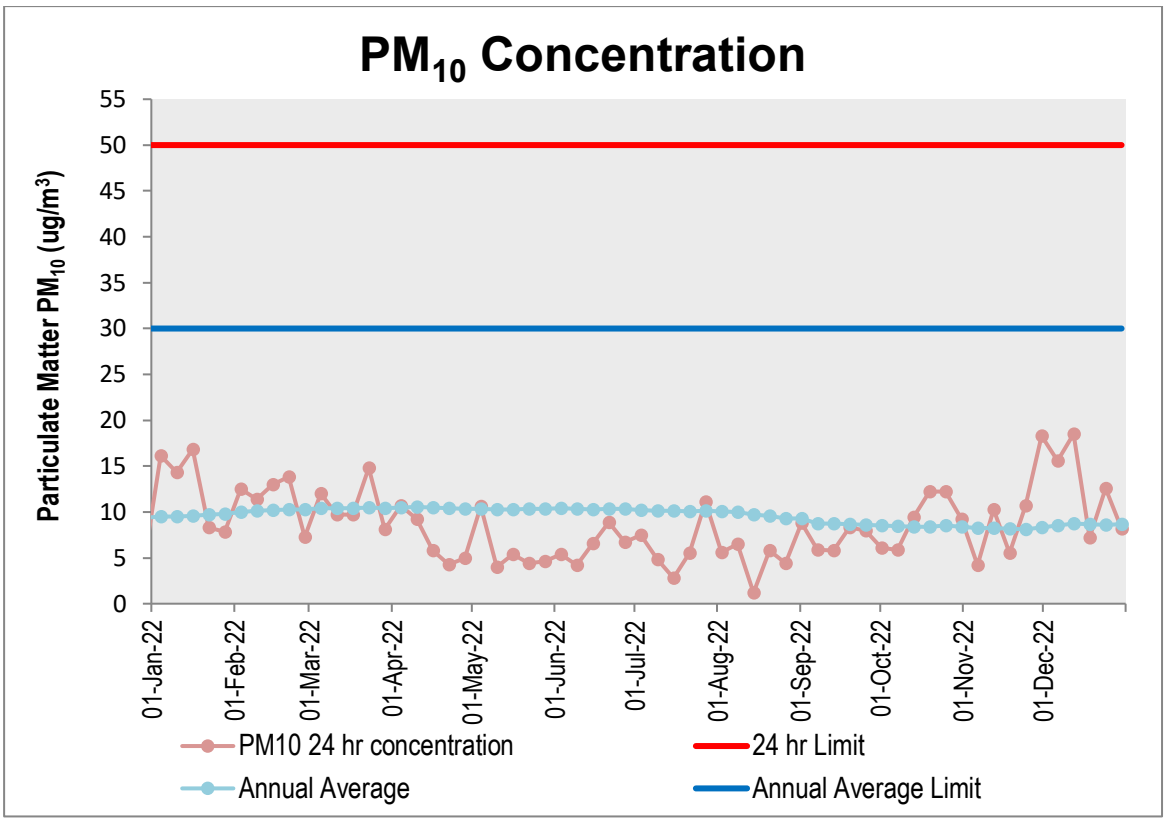


Figure 7. HVAS PM_{10} Rolling Annual Average & 24 hr Results

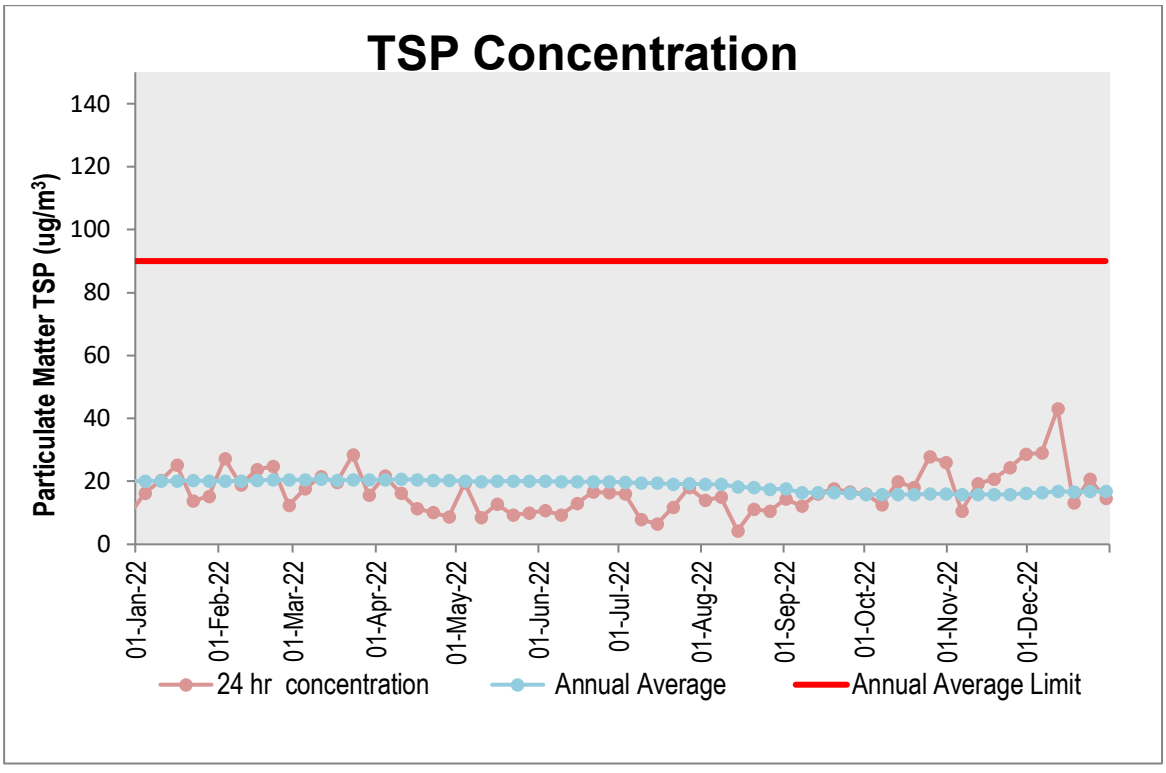


Figure 8. HVAS TSP Rolling Annual Average & 24 hr Results

The maximum recorded 24 hour PM10 concentration for the report period was 18.5 µg/m^3 and the maximum recorded 24 hour TSP concentration for the report period was 43 µg/m^3. Higher than average rainfall was observed during the 2022 reporting period.

Trend

The 2022 annual averages for TSP and PM10 are lower than the long-term average.

The trend analysis was undertaken using a linear trend line for the TSP and PM_{10} monitoring data from August 2013 to December 2022. The trend lines indicate slightly deceasing trends for the TSP and PM_{10} over the long-term monitoring period.

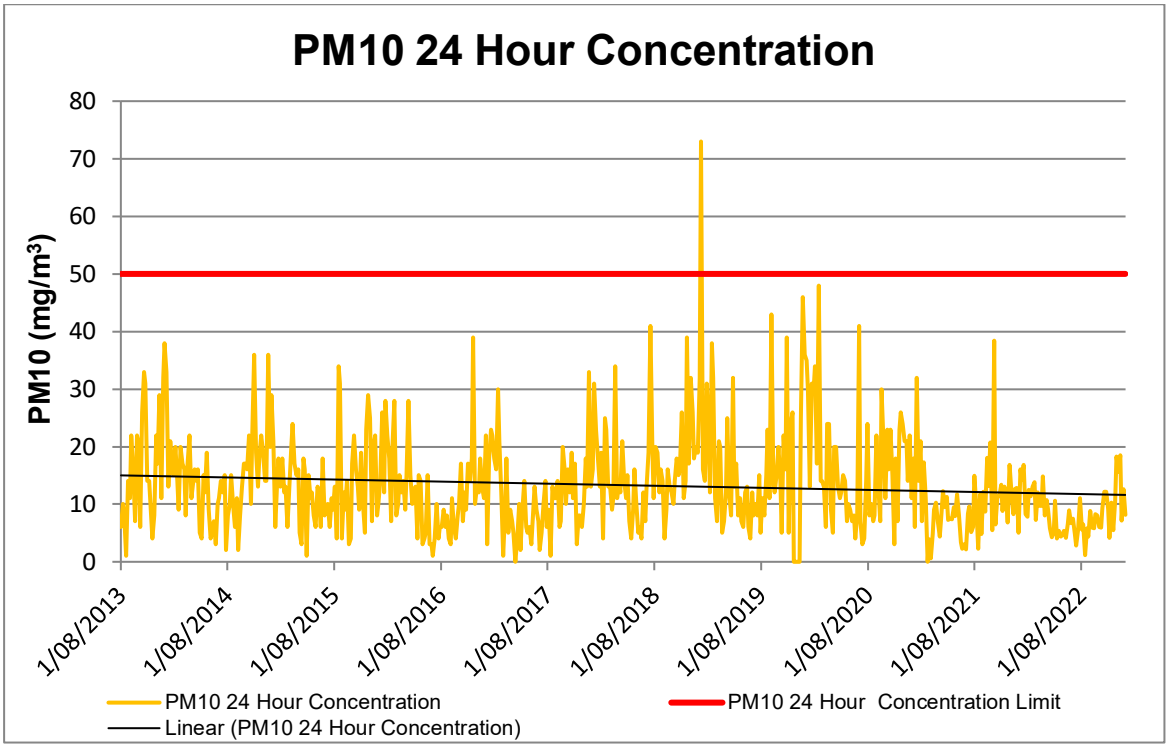


Figure 9. HVAS PM_{10} Trend Analysis Graph

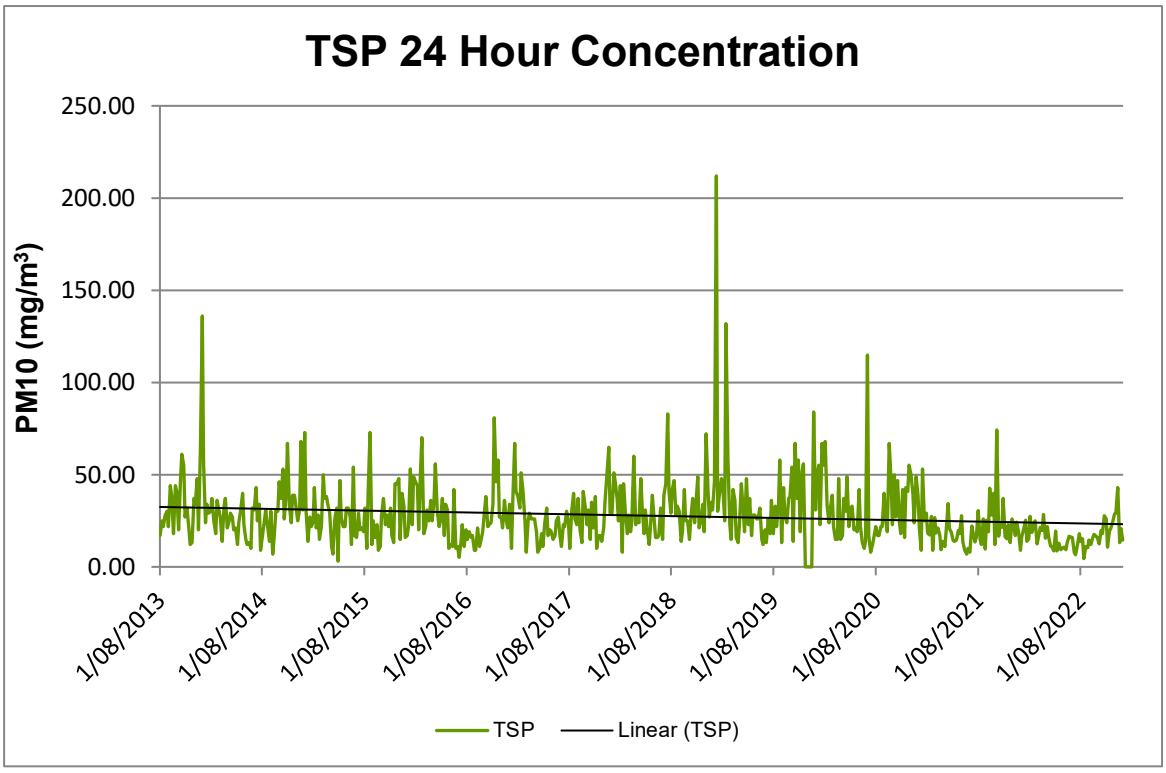


Figure 10. HVAS TSP Trend Analysis Graph

EA Prediction

The Myuna Colliery Extension of Mining Project Air Quality Impact Assessment (Heggies 2010) predicted the cumulative annual average TSP and PM_{10} concentrations would be below the project air quality goal at all private receptors. Cumulative maximum 24-hour PM_{10} concentrations attributable to the Project were predicted to be below the project air quality goals at all surrounding dwellings excluding periods of regional pollution events. The TSP and PM_{10} results for the report period have been consistent with the EA prediction.

6.4. Biodiversity

Control strategies were implemented as per the Biodiversity Management Plan and were adequate to manage the risks associated with the operation during the report period.

The Biodiversity Management Plan for the site outlines measures in place to protect and enhance the Swamp Sclerophyll Forest on Coastal Floodplains Endangered Ecological Community (EEC) on Wangi Creek.

Myuna Colliery engaged a consultant (RPS) to conduct monitoring of the EEC near Wangi Creek. The 2022 Endangered Ecological Community Monitoring: Myuna Colliery 2022 Annual Report is provided in Appendix 2.

The annual EEC monitoring program has the purposes of addressing Conditions 28 (c) and (d) of the approved MP_10-0080 MOD3.

The purpose of the monitoring is to determine if there is any measurable change in the health/ condition of Swamp Sclerophyll Forest on Coastal Floodplains EEC and Callistemon linearifolious; a species listed as vulnerable under the BC Act. Where change is detected, and is deemed to be a negative change, the monitoring is to inform Myuna Colliery of the possible reasons for change and provide recommendation for the management of these changes.

Result Summary

The monitoring of Endangered Ecological Monitoring comprised of three plots in two Vegetation Management Areas (VMAs) located in Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and Southeast Corner Bioregions. The RPS report presents the results from the 2022 EEC Monitoring event for comparison with data collected by Umwelt in 2018 and 2019, and RPS since 2020.

Plot 1 of VMA 1 recorded an above average total count of native species since 2015 (33 species), with a corresponding native percent of total species being 82.5%. This was slightly lower than the previous monitoring event. Total number of exotic species observed numbered seven, a reduction of one species since the previous monitoring event. Similarly, the percent of total exotic species was effectively unchanging with values of 17.6% and 17.5% for 2021 and 2022 respectively. Attributes that fell below the BAM benchmark for PCT 1649 include shrub richness, forb richness, tree cover, grass & grass-like cover, forb cover, fern cover, other cover, total length of fallen logs and number of large trees.

Plot 2 of VMA 1 recorded the third highest number of native species since 2015 (39 species), with a reduction of the percent total of native species from 93.9% in 2021 to 89.7% in 2022. Total count of exotic species had increased from three species in 2021 to four species in 2022. Similarly, the percent total of exotic species increased from 6.1% in 2021 to 10.3% in 2022. Attributes that fell below the PCT benchmark include fern richness, other richness, fern cover, total length of fallen logs and number of large trees.

The comparison of vegetation and habitat attributes against PCT benchmarks for VMA 1 recorded negligible variations in exceedances from the previous monitoring event. Results for VMA 1 were generally above the PCT benchmark. Most of the values below the benchmark were repeated

triggers from 2021. Whilst slight variation was recorded in floristic data, photo monitoring shows vegetation and habitat composition to be relatively similar to previous monitoring results.

Plot 3 of VMA 2 recorded the second highest native species count since monitoring began (27 species). There was also an increase in percent total of native species throughout the plot between the 2021 and 2022 monitoring events (71.4% to 77.1% respectively). Total exotic species was lower than the previous monitoring event (8 species compared to 12 species in 2021). A slight reduction in percent total of exotic species was observed between the 2021 and 2022 monitoring events (28.6% and 22.9% respectively). Vegetation and habitat attributes were mostly above the corresponding PCT benchmark. Previous monitoring events have also outlined elevated exotic species presence in the plot. This is likely a consequence of initial condition of the plot and subsequent management over time.

Variations in species composition and structure could be influenced by several variables including:

- High water flow moving vegetative material and sediments throughout the creek line, transporting potential weed propagative, material and removing lower stratum habitat features and vegetation.
- Seasonal variation in weather patterns influencing the occurrence of some species; and
- Potential variations in plot location (particularly at the edges of the plots).

The reduced number of C. linearifolius individuals can be primarily attributed to impacts related to heavy water flow experienced within the riparian zone during the 2020 monitoring event. During the 2022 monitoring event, signs of stabilisation for individuals was observed with new leaf growth present on all relocatable individuals.

Results from the 2022 EEC monitoring indicate no immediate impacts of concern on PCT 1649: Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and Southeast Corner Bioregions EEC from mining related activities. Floristic data and comparisons of habitat attributes have remained relatively constant to prior monitoring events, with any slight variations likely attributed to variables unrelated to mining operations.

Trend

Annual Weed Action Plans conducted at Myuna Colliery, including an annual weed survey and on ground works has resulted in the ongoing suppression and removal of high threat weed species including Lantana, Bitou Bush, Pampas Grass, Pine Trees and Castor Oil Plant among others.

EA Prediction

The Myuna Colliery Extension of Mining Project Terrestrial Flora and Fauna Assessment (RPS 2011) predicted due to negligible surface impacts that the project was unlikely to impact on any threatened species, endangered populations or threatened ecological communities.

6.5. Greenhouse Gas

The control strategies were implemented as per the Northern Region Air Quality and Greenhouse Gas Management Plan and were adequate to manage the risks associated with the operation during the reporting period.

Environmental Performance

Estimation of the GHG emissions associated with the Myuna was undertaken using the emission factors and methods outlined in the National Greenhouse and Energy Reporting (Measurement) Determination 2008.

Reasonable and feasible steps were undertaken during the reporting period to improve energy efficiency and reduce greenhouse gas emissions generated by the mine. Include the following:

- Cost effective measures to improve energy efficiency;
- Regular maintenance of plant and equipment to minimise fuel consumption; and
- Consideration of energy efficiency in plant and equipment selection
- Replacement of the aging ducted air conditioning unit in the administration building with individually controlled split systems in each office; and
- Replacement of fluorescent lights in the administration building with LED lights, where possible

Table 14 provides the total emissions by source in carbon dioxide equivalent tonnes for the reporting period.

Table 14. Total GHG Emissions from Site Operations

Emissions Sources July 2021-June 2022	Total (t_{CO2-e})	*EIS / EA Prediction
Scope 1 Emissions (direct emissions)		
Coal Extraction (Fugitives)	301,576	576,593
Diesel Fuel	1,051	1,333
Oils	113	689
Greases	0	
SF6	4	0
Electricity	24,791	32,955
LPG	0	1
TOTAL	**327,532**	**611,571**

*EIS/ EA prediction was based on a production rate of 2MTPA

6.6. Heritage

Control strategies implemented as per the Northern Region Aboriginal Cultural Heritage Management Plan (ACHMP) and the Northern Region Historic Heritage Management Plan were adequate to manage the risks associated with the operation during the reporting period.

Result Summary

No monitoring was required under the Northern Region Historic Heritage Management Plan (HHMP) or the Northern Region Aboriginal Cultural Heritage Management Plan (ACHMP) for the 2022 reporting period.

EA Prediction

The Myuna Colliery Extension of Mining Project Cultural Heritage Assessment (RPS 2011) considered there was minimal potential for impact from the Project on sensitive Aboriginal cultural places or objects or on European cultural heritage items.

6.7. MINE SUBSIDENCE

Myuna Colliery has a requirement to limit vertical subsidence within Zone A to a maximum of 20mm for first workings as per Schedule 3 Condition 1 of PA10_0080. Myuna Colliery's mine design was assessed and approved on the basis that first workings are designed and mined according to industry standards so that workings are long term stable and non-subsiding (resulting in negligible impacts).

Myuna Colliery has not undertaken secondary extraction within the reporting period, and therefore has not triggered the requirement for an approved Extraction Plan. Subsidence monitoring within Zone A is completed as due diligence with no measured subsidence beyond the 20mm limit in Zone A.

6.7.1. Environmental Management

Myuna Colliery is currently a bord and pillar operation with no secondary workings. Therefore, the requirement for an extraction plan has not been triggered and the respective additional environmental monitoring and management, is not required.

6.7.2. Environmental Performance

Table 15 below shows the performance measures for subsidence impacts to biodiversity, built features and public safety. First workings to date at Myuna Colliery have been conducted with no measured or anticipated subsidence. Therefore, an assessment of impact with reference to predicted subsidence impacts is not applicable, as noted.

Table 15. Assessment of Subsidence Performance against Performance Measures and Predicted Impacts

Feature	Subsidence Performance Measures	[1]Predicted Subsidence Impact EIS	Assessment of Performance against Predicted Impact
Biodiversity			
Threatened species, populations, or their habitats and endangered ecological communities	Negligible impact or environmental consequences.	Negligible impacts	n/a
Seagrass beds	Negligible environmental consequences including: • negligible change in the size and distribution of seagrass beds; • negligible change in the functioning of seagrass beds; and	Negligible impacts	n/a

Feature	Subsidence Performance Measures	[1]Predicted Subsidence Impact EIS	Assessment of Performance against Predicted Impact
	• negligible change to the composition or distribution of seagrass species within seagrass beds.		
Benthic communities	Minor environmental consequences, including minor changes to species composition and/or distribution.	Negligible impacts	n/a
Built Features			
Key public infrastructure: Eraring Power Station Ash Dam	Negligible impact or consequence.	Negligible impacts	n/a
Other public infrastructure (including sewage pipes; power and telecommunications cables). Other built features (including jetties and boat moorings)	Always safe. Serviceability should be maintained wherever practicable. Loss of serviceability must be fully compensated. Damage must be fully repaired, replaced or fully compensated.	Negligible impacts	n/a
Public Safety			
Public Safety	Negligible additional risk.	Negligible impacts	n/a

[1.] Negligible impacts, subject to further assessment in conjunction with any mine design.

7. WATER MANAGEMENT

WAL 41560 has superseded Bore Licence 20MW065029, which was granted in December 2010 for the purpose of dewatering up to 4380 ML/ year of ground water from mine workings at Myuna Colliery. Ground water extracted from the underground mine workings is currently discharged from site via LDP 9. Volumetric and water quality monitoring data at LDP 9 is therefore representative of ground water volumes and ground water quality extracted from the mine workings.

The volume of ground water extracted from the workings authorised by the licence shall not exceed 4380 ML in any twelve-month period. The total volume of water discharged through LDP 9 for 2022 is 1754ML. There were no exceedances of the volume limit criteria during the reporting period.

Table 16 identifies the water take under the water licences.

Table 16. Water Take

Water Access Licence	Water Supply Works Approval	Water Sharing Plan	Entitlement	TOTAL TAKE
WAL 41560	20MW065029	North Coast Fractured and Porous Rock Ground Water Sources	4380	1840

Note: Volume is reported in megalitres per year (ML/y)

The Wallarah, Great Northern and Fassifern seams contain reservoirs which are used for the retention and settlement of mine water and surface water prior to pumping to the surface settlement ponds. The pump line and syphon line are metered for the purpose of measuring the volume pumped to the underground. The volume of surface water pumped to the underground reservoir during the 2022 reporting period was approximately 229 ML.

The underground water storages in the Wallarah Seam, the Great Northern Seam and the Fassifern Seam are based on an average seam height of 3 m and a recovery ratio of 0.333, Centennial Myuna has estimated the volume of water storages in each of the seams. The underground water storage volumes are shown below in the table below.

The hydrogeological model developed for Myuna Colliery assumes that the volumes of each of these storages are constant.

Table 17. Water Storage

Seam	Water Storage Volume (ML)
Wallarah	1381
Great Northern	1045
Fassifern	2184

Myuna Colliery used 155 ML of potable water for the 2022 reporting period.

In accordance with the requirements of the Water Management Plan, the transfer of water from the underground workings to the surface has been monitored daily. The transfer volume for the 2022 report period was approximately 1840 ML.

7.1. Surface Water Monitoring

Control strategies were implemented as per the Water Management Plan and were adequate to manage the risks associated with the operation during the report period.

Myuna Colliery has a Water Management Plan which discusses responsibilities, pollution sources, hazards, risks and mitigation strategies of water management. Regular refresher training and site inductions discuss water management to make personnel aware of the site issues.

The surface water monitoring has been conducted in accordance with the conditions of EPL366. This Licence specifies monitoring and reporting requirements along with concentration limits for water discharged through LDP 9 and LDP 10. Other EPL monitoring requirements included E1 Manganese monitoring in Wangi Bay.

There was no discharge of water through LDP 10 in 2022.

Table 18. Summary of Surface Water Monitoring Locations

Monitoring Point Reference	Description / Creek Catchment
LDP 9	Discharge Location 1 into Wangi Creek. EPL Monitoring Location 9, formerly referred to as LDP B.
LDP 10	Discharge Location 2 into Wangi Creek. EPL Monitoring Location 10, formerly referred to as LDP A.

7.1.1. Surface Water Monitoring Results

Mine water discharged from LDP 9 is required to be monitored daily during discharge for the following parameters.

- Volume
- pH
- Total Suspended Solids (TSS)
- Oil and Grease

Discharge of mine water occurred on every day in the reporting period. A sample was collected and analysed for the parameters on every day of discharge, except for on September 6, further details of this are discussed in section 11. See Tables 16 and 17 for the monitoring results summary for 2022.

The flow volumes through LDP 9 are monitored continuously in accordance with EPL366. The daily volume discharge limit for LDP 9 is 13000 kL. The maximum daily volume discharged was 9,990 kL during the reporting period. The average daily volume discharged for 2022 was 4,805 kL. There were no exceedances of the LDP 9 volume limit criteria during the reporting period.

The pH of the mine water discharged through LDP 9 was consistent throughout 2022 with a minimum pH level of 7.1 and a maximum of 7.9. The limit criterion for pH is a range between 6.5 and 8.5. There were no exceedances of this limit during the reporting period.

The concentration of total suspended solids analysed in the mine water discharged through LDP 9 was consistently low with an average concentration of 10.1 mg/L and a maximum concentration of 27 mg/L during 2022. The concentration limit for TSS is 50 mg/L. There were no exceedances of this limit during the reporting period.

The concentration of oil and grease analysed in the mine water discharged through LDP 9 was consistently low with a maximum of 0 (<5) mg/L for the reporting period. The concentration limit for oil and grease is 10 mg/L. There were no exceedances of this limit during the reporting period.

Graphs of the main water quality analytes for LDP 9 for the reporting period are provided in 10 and 11 below.

Table 19. LDP 9 Water Quality

Pollutant	Unit of Measure	No. of Samples required by licence	No. of Samples collected and analysed	Lowest sample value	Mean of samples	Highest sample value	EPL Limit	Recommended Trigger Value (EA)
pH	pH	365	364	7.1	7.7	7.9	6.5 – 8.5	6.5 – 8.5
Total Suspended Solids	mg/L	365	364	0	10	27	50	<50
Oil & Grease	mg/L	365	364	0	0	0	10	-

Table 20. LDP 10 Water Quality Results Summary

Pollutant	Unit of Measure	No. of Samples required by licence	No. of Samples collected and analysed	Lowest sample value	Mean of samples	Highest sample value	EPL Limit	Recommended Trigger Value (EA)
pH	pH	0	0	0	0	0	6.5 – 8.5	6.5 – 8.5
Total Suspended Solids	mg/L	0	0	0	0	0	50	<50
Oil & Grease	mg/L	0	0	0	0	0	10	-

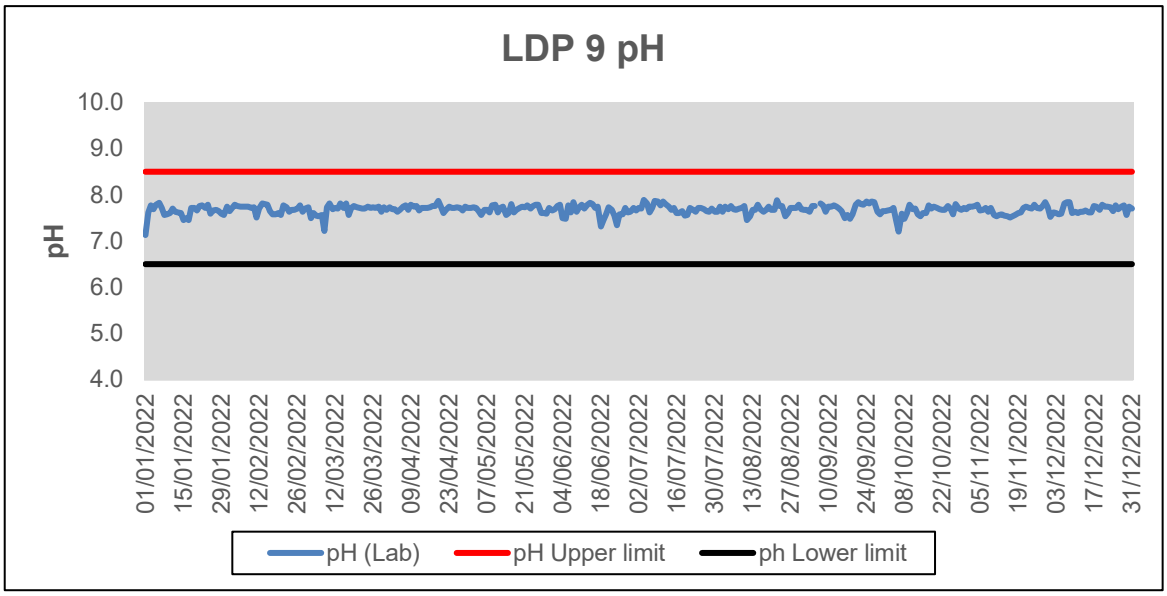


Figure 11. LDP 9 Water Quality Monitoring Results – pH

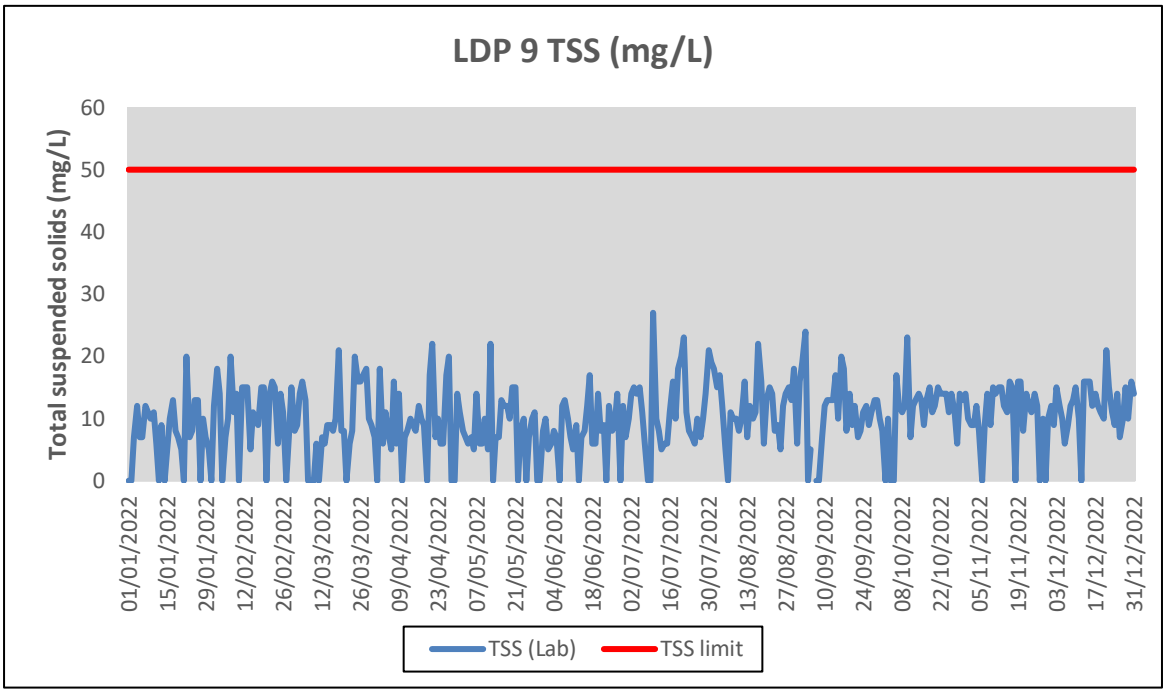


Figure 12. LDP 9 Water Quality Monitoring Results – TSS

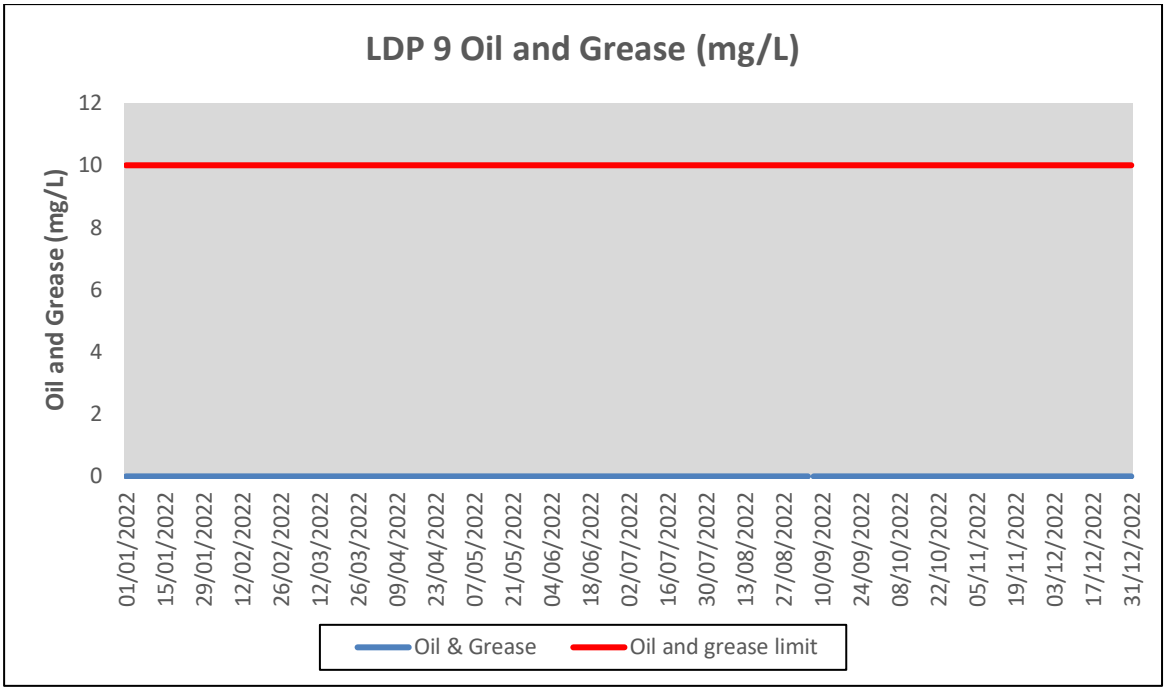


Figure 13. LDP 9 Water Quality Monitoring Results – Oil and Grease

Water Volume is required to be monitored daily during discharge at the licenced discharge points in accordance with EPL 366. Table 21 provides the discharge volume results for LDP 9 for the Annual Review period. There was no discharge from LDP 10 during the period

Table 21. LDP 9 Discharge Volumes

Monitoring Point Reference	Frequency	No. of Measurements made	Lowest Result (kL)	Mean Result (kL)	Highest Result (kL)	EPL Limit
LDP 9 (EPL Point 9)	Daily During Discharge	365	805	4805	9990	13000

7.1.2. Data interpretation

As shown in the figures below, linear trend lines were applied to the monitoring data from 2011 to December 2022 for pH, TSS and Oil & Grease. The trend lines show that results have been relatively consistent over this period.

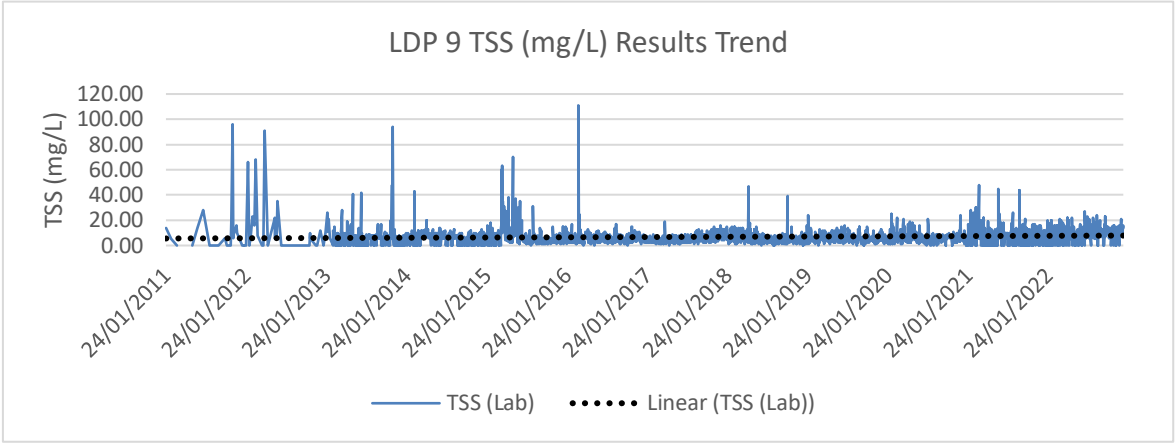


Figure 14. LDP 9 TSS Monitoring Results and Linear Trend Line

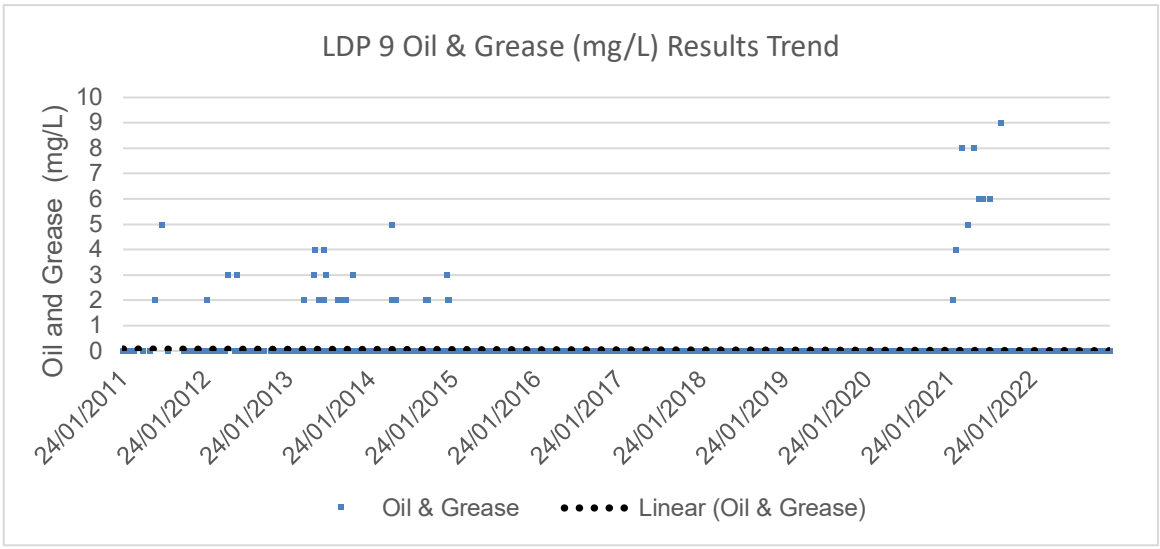


Figure 15. LDP 9 Oil and Grease Monitoring Results and Linear Trend Line

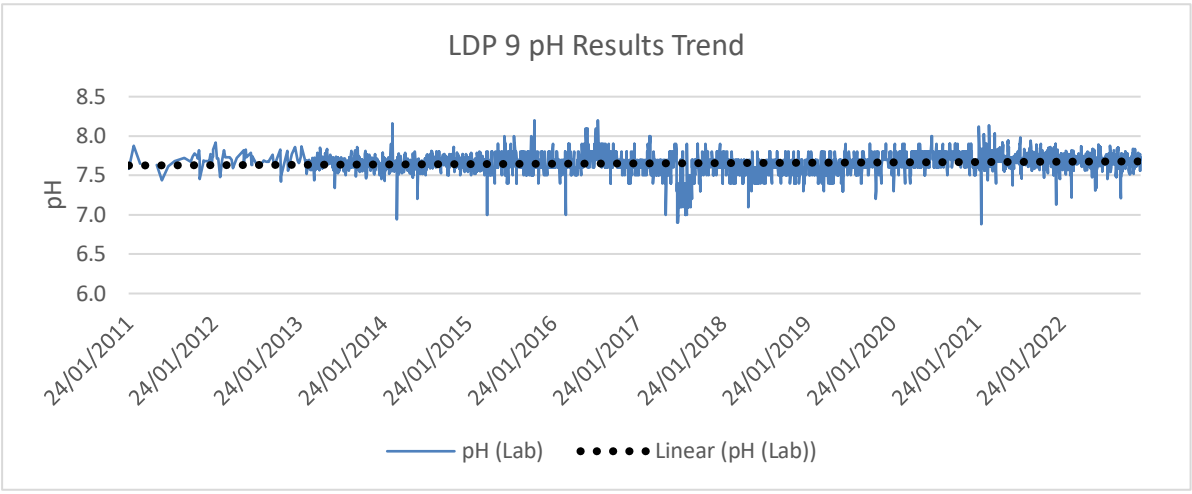
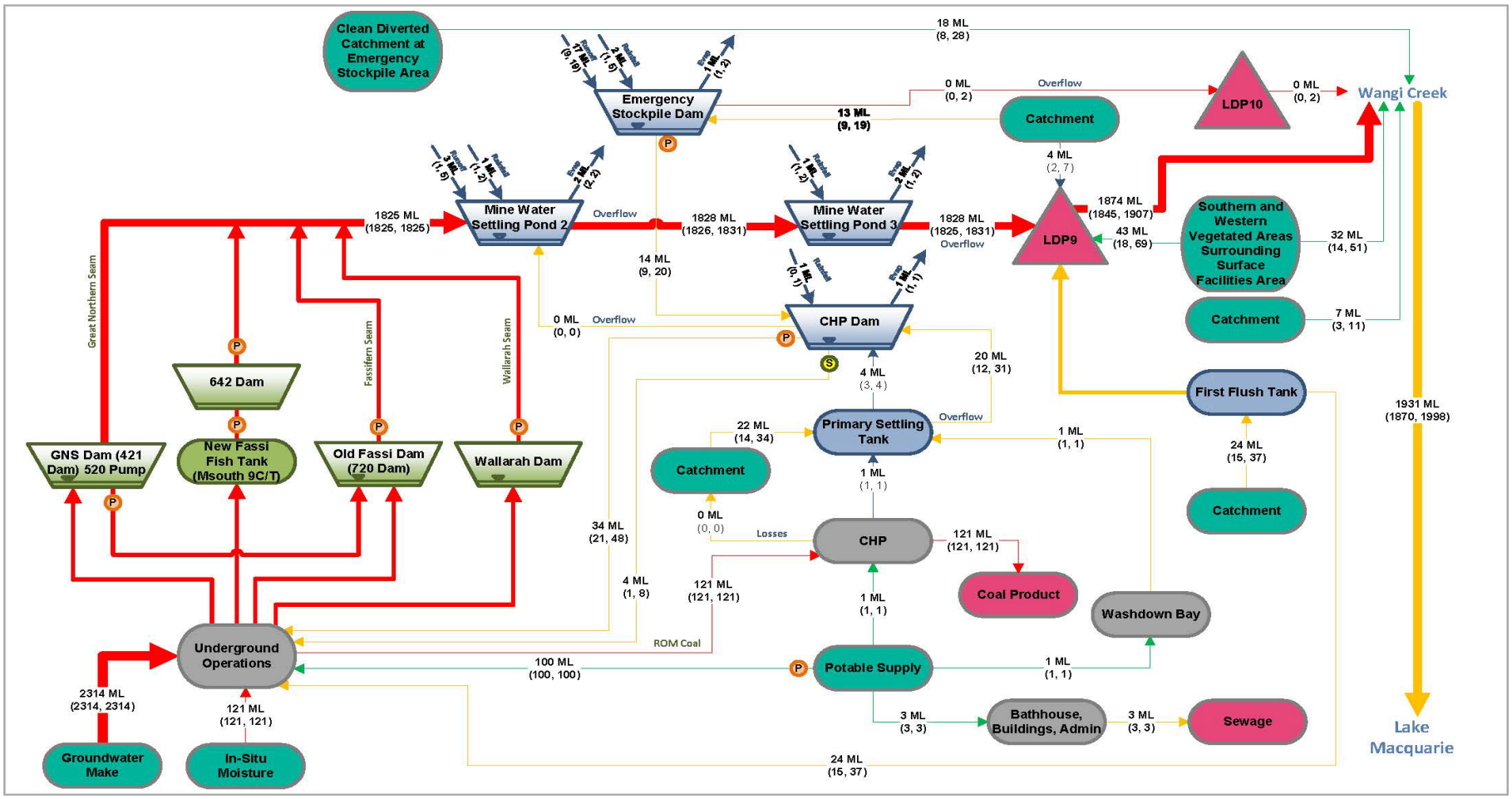


Figure 16. LDP 9 pH Monitoring Results and Linear Trend Line

7.2. Water Balance

The overall water balance for 2022 is shown as a water cycle schematic on the next page. The results shown are the modelled outputs from the water balance model and include modelled estimates of water volumes that are not able to be directly measured.



7.3. Groundwater Management

In November 2017, Myuna commenced monitoring of groundwater levels around the pit top area. The groundwater monitoring network includes ten shallow alluvial monitoring bores which were installed in August 2012. Details of the groundwater monitoring bores are provided below in Table 22.

Table 22. Groundwater Monitoring Bore Details

Bore	Monitoring Period	Lithology	Bore Depth (m)	Monitoring Parameters
MW01	Nov 2017 – Ongoing	Alluvium	6	Groundwater Level
MW05	Nov 2017 – Ongoing	Alluvium	18.5	Groundwater Level
MW06	Nov 2017 – Ongoing	Alluvium	13	Groundwater Level
MW07	Nov 2017 – Ongoing	Alluvium	8.5	Groundwater Level
MW08	Nov 2017 – Ongoing	Alluvium	9	Groundwater Level
MW09	Nov 2017 – Ongoing	Alluvium	7	Groundwater Level
MW10	Nov 2017 – Ongoing	Alluvium	10	Groundwater Level
MW11	Nov 2017 – Ongoing	Alluvium	7	Groundwater Level
MW12	Nov 2017 – Ongoing	Alluvium	8	Groundwater Level
MW13	Nov 2017 – Ongoing	Alluvium	11	Groundwater Level

7.3.1. Groundwater Monitoring Results

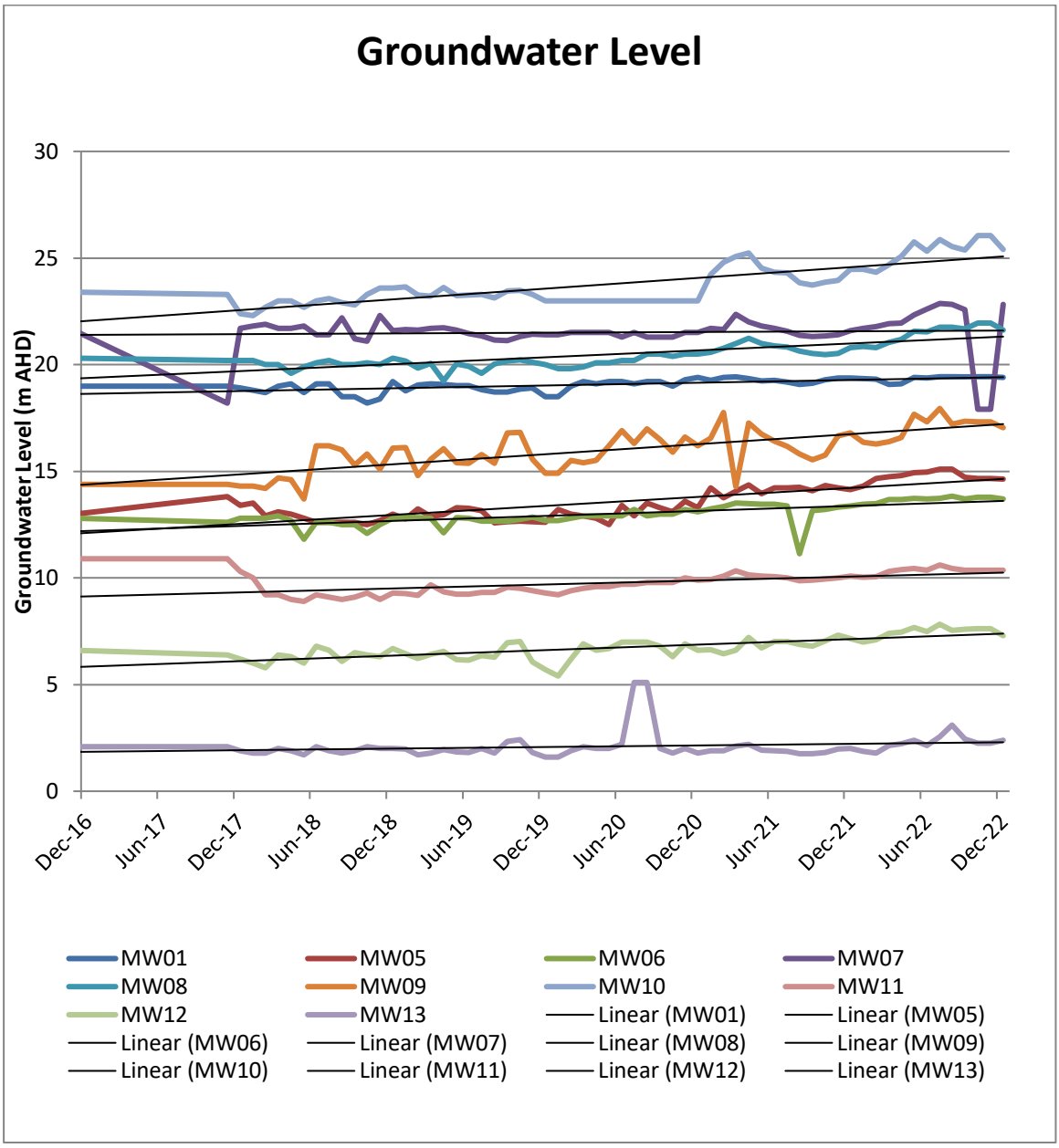
As discussed in Section 7.3, the groundwater monitoring network at Myuna Colliery includes ten alluvial monitoring bores. Observed groundwater levels at these monitoring bores for 2022 are shown below in Table 23.

Table 23. Groundwater Levels for Myuna Colliery

Bore	Groundwater Level (m AHD)												
	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	**EIS Prediction**
MW01	19.4	19.3	19.1	19.1	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.4	Minimal Impact
MW05	14.3	14.7	14.7	14.8	14.9	15.0	15.1	15.1	14.7	14.7	14.7	14.6	Minimal Impact
MW06	13.5	13.5	13.7	13.7	13.7	13.7	13.7	13.8	13.7	13.8	13.8	13.7	Minimal Impact
MW07	21.7	21.8	21.9	22.0	22.3	22.6	22.9	22.8	22.6	17.9	17.9	22.8	Minimal Impact
MW08	20.8	20.8	21.0	21.2	21.6	21.6	21.8	21.8	21.7	22.0	22.0	21.6	Minimal Impact
MW09	16.4	16.3	16.4	16.6	17.7	17.3	17.9	17.2	17.3	17.3	17.3	17.1	Minimal Impact
MW10	24.5	24.3	24.7	25.1	25.8	25.3	25.9	25.5	25.4	26.1	26.1	25.4	Minimal Impact
MW11	10.0	10.1	10.3	10.4	10.4	10.4	10.6	10.5	10.4	10.4	10.4	10.4	Minimal Impact
MW12	7.0	7.1	7.4	7.4	7.7	7.5	7.8	7.5	7.6	7.6	7.6	7.3	Minimal Impact
MW13	1.9	1.8	2.1	2.2	2.4	2.2	2.6	3.1	2.4	2.3	2.3	2.4	Minimal Impact

7.3.2. Data Interpretation

Groundwater levels at all monitoring locations remained relatively stable during the reporting period. Groundwater levels have been relatively stable at all other groundwater monitoring locations since November 2016.



7.4. Manganese Monitoring

The monitoring of filterable Manganese is undertaken as per special condition E1 Additional Monitoring of EPL366, in Wangi Bay on a quarterly schedule. There is no limit criteria applied to the Manganese monitoring. The monitoring results are submitted to the EPA quarterly.

Result Summary

Four samples are collected quarterly from Wangi Bay at the outlet of Wangi Creek. The average of the samples for each quarter is provided in Table 24.

Table 24. Manganese Monitoring Results

Manganese Monitoring					
Location	**Unit of Measure**	**Mar-22**	**Jun-22**	**Sep-22**	**Dec-22**
T2-5M(1)	mg/L	0.061	0.02	0.201	0.040
T2-5M(2)	mg/L	0.138	0.019	0.082	0.030
T2-10M(1)	mg/L	0.018	<0.010	0.000	0.041
T2-10M(2)	mg/L	0.018	<0.010	0.000	0.028

Trends

The Manganese monitoring has been conducted over a period of ten years from 2011. Manganese concentrations recorded in Wangi Bay over the ten-year period of monitoring display a relatively constant trend at T2 10m and a downward trend at T2 5m.

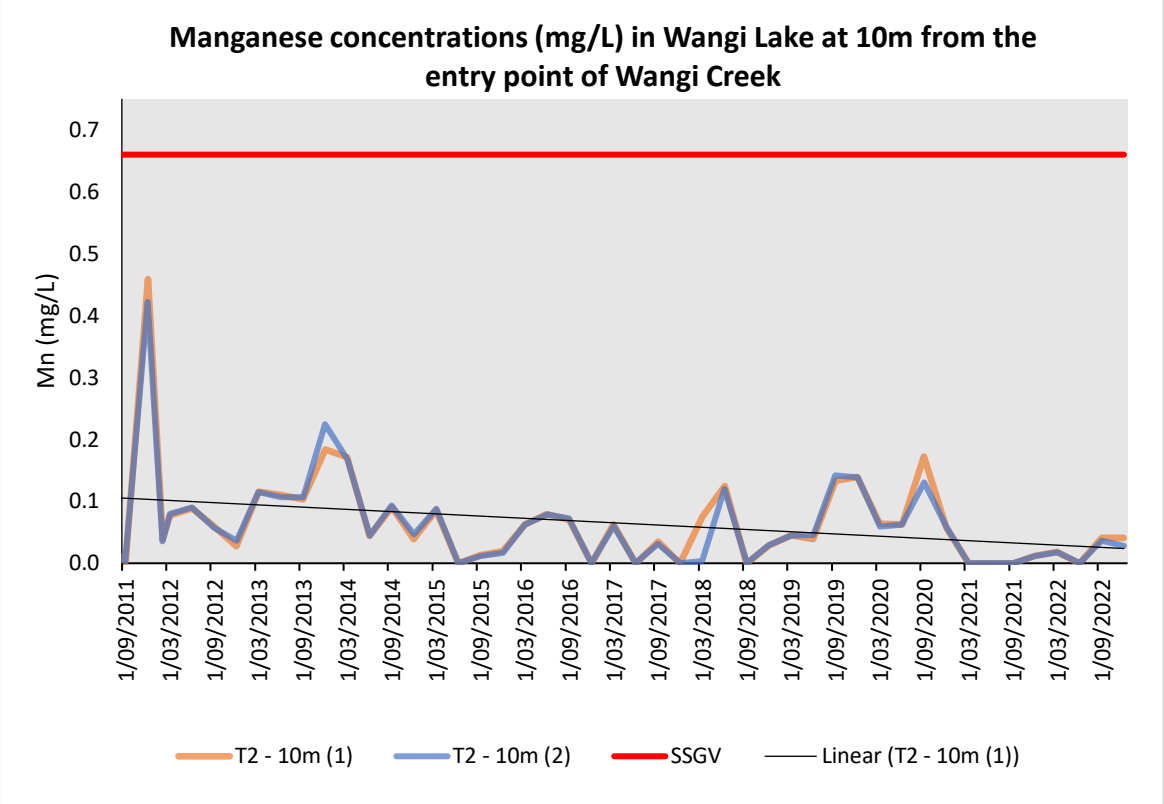


Figure 17. Manganese Monitoring Results and Linear Trend Line

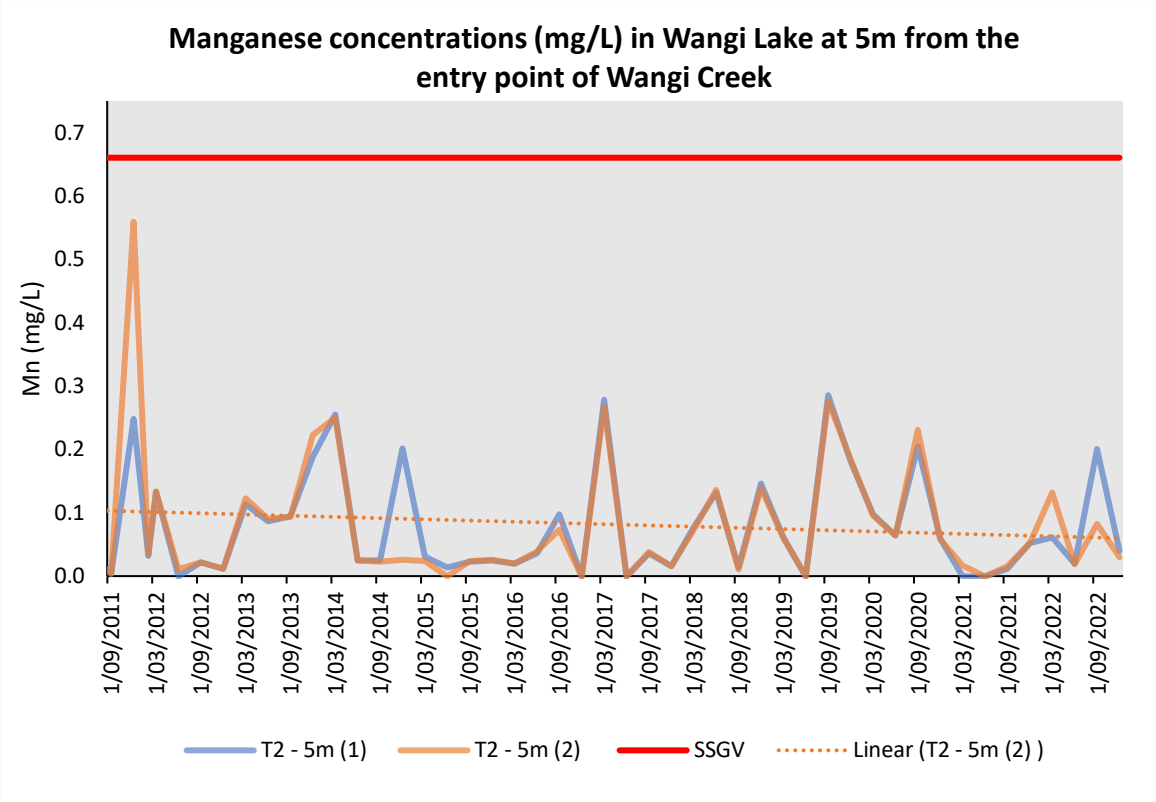


Figure 18. *Manganese Monitoring Results and Linear Trend Line*

8. REHABILITATION

As of this annual review (2022), rehabilitation will be presented in the Annual Rehabilitation Report which will be submitted to the RR and made available on the Centennial Myuna website document. An overview of rehabilitation activities during the report are as below.

8.1. Rehabilitation Planning Activities

Planning progressed to establish a scope of works for the Rehabilitation Strategy, required by PA 10_0080 (MOD3), to be submitted to DPE in 2023.

8.2. Subsidence Repair and Remediation

There were no subsidence repair and remediation activities undertaken at the site during the reporting period.

8.3. Exploration

A surface exploration program on Lake Macquarie was undertaken between May and December 2022. The program included hydrographic and magnetic surveys (profiling of the lakebed and geological structures), and geotechnical drilling to inform mine design and planning.

A total of 26 rockhead boreholes and 6 surface to seam boreholes were completed in the North-Eastern portion of the project boundary in November 2022. All boreholes were progressively rehabilitated.

Further details of the exploration program are provided in Section 4.1

8.4. Rehabilitation Management and Maintenance Activities

Rehabilitation management and maintenance activities undertaken at the site during the reporting period including:

- Weed management activities were completed on site as apart of ongoing weed management, informed by EEC condition monitoring conducted on an annual basis; and
- Weekly environmental inspections.

9. COMMUNITY

9.1. Community Consultation and Engagement

The Myuna Colliery Community Consultative Committee (CCC) has been established to provide a formal conduit for exchange of information and views between the local community and Myuna's Management Team.

Regular agenda items for the meetings include:

- Progress at the Mine – Operational;
- Monitoring and Environmental Performance;
- Community Complaints and Responses;
- Update on Management Plans & External Audits; and
- Information provided to the community and any feedback.

There were two CCC meetings held in March and October. The Chairman and Committee were provided with regular quarterly updates of the operation and performance electronically throughout the report period. Copies of the meeting minutes and presentations are available on the Centennial Myuna website.

9.2. Community Sponsorships

Centennial Myuna continues to support the local community through various sponsorship schemes. The following is the sponsorship and support carried out locally during the calendar year:

- Wangi Bowling Club;
- Wangi Women's Bowling Club
- Toronto Bridge Club
- Wangi Wangi Lions Club
- Morisset Meals on Wheels
- Macquarie Scorpions
- Wangi Community Fireworks
- Rathmines Public School
- Westpac Rescue Helicopter

Centennial Myuna will continue to support local Community and Sporting Groups.

9.3. Complaints

A community complaints register is kept on site and published on the Centennial Myuna website. All community enquiries and complaints received by Myuna Colliery are to be recorded as per MY-EWP-038 Community Complaint and Enquiries Procedure. This information is then entered into the Centennial Coal Environment and Community Database (ECD).

One complaint was received in 2022 in relation to odour during rockhead drilling for the 2022 Geotechnical Exploration Project. Further details were sought from the complainant via email with no response. There was no address or phone number provided with the complaint. The Myuna Environmental representative attended the foreshore adjacent to the drilling barge with no notable odours.

There were no complaints or enquiries for the report period relating to Myuna general surface operations.

Table 25. Complaints History

Year	Air	Water	Noise	Waste	Other	Total
2022	0	0	0	0	1	1
2021	0	0	0	0	11	11
2020	0	0	0	0	193	193
2019	0	0	0	0	0	0
2018	0	0	0	0	0	0
2017	0	0	0	0	0	0
2016	0	0	0	0	0	0
2015	0	0	0	0	0	0
2014	0	0	0	0	0	0

10. AUDITING

10.1. Independent Environmental Audit

Centennial Myuna engaged IEMA Environmental Pty Ltd (IEMA) as the independent expert approved by the DPE to carry out an Independent Environmental Audit (IEA) of Myuna Colliery in accordance with Condition 9, Schedule 5 of Project Approval 10_0080 MOD3.

The audit period was defined as from 7th May 2019 (last date of the previous IEA site inspection) to 20th June 2022 (date of site visit conducted by IEMA Environmental). The Independent Environmental Audit assessed compliance with the PA10_0080 MOD 1, EPL366, Mining Lease 1632, Mining Lease 1370 and Mining Purposes Lease 334. In addition, the audit included a review of the adequacy of the strategies, plans and programs required under the project approval. Table 26. below summarizes the results of the audit.

An Action Plan was developed and submitted to the Department of Planning and Environment which describes the corrective actions to be undertaken for each non-compliance and recommendation. The Action Plan has a scheduled completion date for each action. The Audit Report and Action Plan has been published on the Centennial Coal website.

Progress against the action plan is shown in Table 27. The next Independent Environmental Audit is scheduled for June 2025.

Table 26. Independent Environmental Audit Compliance

Compliance Status	PA 10_0080	PA 10_0080 SOC	EPL 366	ML 1632	ML 1370	MPL 334	Total
Compliant	41	8	48	6	5	3	**111**
Not triggered	13	4	12	7	6	5	**47**
Admin Non-Compliance	5	0	4	0	0	0	**9**
Low Non-Compliance	1	0	1	0	0	0	**2**
Medium Non-Compliance	0	0	0	0	0	0	**0**
High Non-Compliance	0	0	0	0	0	0	**0**
Not Verified	0	0	0	0	0	0	**0**
Observation	0	0	0	0	0	0	**0**
Note	3	0	11	1	1	3	**19**
Total	**63**	**12**	**76**	**14**	**12**	**11**	**188**

Table 27. Independent Environmental Audit Action Plan

Item No.	Title Condition No.	Aspect	Compliance/ Recommendations	Action Required	Proposed Completion	Progress
NC REC 1	PA 10_0080 S3 C13	Noise Management Plan	Update Noise Management Plan to ensure consistency with site operations/monitoring undertaken.	Myuna Colliery will revise the Northern Region Noise Management Plan– Appendix B.	31/03/2023	In Progress
NC REC 2	EPL 366 M2.3	Water Monitoring	Liaise with the EPA regarding the frequency of monitoring at LDP 9. The daily discharge monitoring is overly onerous for a site that has met water quality criteria in Condition L2.4 for numerous years. These discussions may result in an EPL variation.	Myuna Colliery has submitted a licence variation with the EPA to change the frequency of monitoring at LDP 9.		Complete
NC REC 3	EPL 366 M2.4	Water Monitoring	Request condition M2.4 becomes a 'note' in the next EPL variation as relates to Condition M2.3.	See R2 MYU 2022 IEA as above.		Complete
NC REC 4	EPL 366 M5.1	Automated Weather Station	Any future data loss from the Automatic Weather Station should be reported in the Annual Review and EPL Annual Return, along with details of how the issue has been rectified.	Myuna Colliery will report future data loss from the AWS in the Annual Review and EPL Annual Return with details on how the issue has been rectified. A note will be included in the Monthly Website report concerning data continuity.		n/a
6	PA 10_0080 schedule 3 condition 13	Noise	IEMA recommends that the external noise consultant undertakes real-time monitoring when doing attended monitoring rather than continuous real-time monitoring at the site	Myuna Colliery will investigate feasibility of external noise consultant undertaking real-time monitoring during attended monitoring		Complete
7	PA 10_0080 schedule 3 condition 22	Water management	Update the Water Management Plan to include the following:	Myuna Colliery will revise the Water Management plan with consideration of the changes noted in IMP REC 2.	31/03/2023	Draft Submitted to DPE NOV 2022

Item No.	Title Condition No.	Aspect	Compliance/ Recommendations	Action Required	Proposed Completion	Progress
			- Additional details explaining that the first flush tank can also discharge to Wangi Creek during overflow conditions. - Revised water schematic and updated figures throughout. - Additional column in Table 3-1 to list where water goes to. - Justification of why monitoring of groundwater alluvial bores is no longer required at the site. - Justification of why monitoring of coal seam aquifers not possible - Proposed monitoring changes (monthly to quarterly) based on a high level of compliance for many years. - Inclusion of groundwater trigger values based on the proposed changes to groundwater monitoring. - Review of TARPs and monitoring requirements in relation to alluvial monitoring and reflect current operations.			
8	PA 10_0080 schedule 3 condition 24	Erosion and sediment control	Undertake minor repair to access tracks to clean water drain around site boundary (near conveyors) following high rainfall (note now complete).	Completed since audit.		Complete
9	PA 10_0080 schedule 3 condition 24	Erosion and Sediment control	Undertake minor reshaping of the waste storage area and laydown additional gravel to improve water flow in periods of heavy rainfall.	Myuna Colliery undertakes ongoing maintenance of the waste sorting area which includes the stabilization of ground with material and drainage improvement works.		Complete

Item No.	Title Condition No.	Aspect	Compliance/ Recommendations	Action Required	Proposed Completion	Progress
10	PA 10_0080 schedule 3 condition 27	Water management	Inform NRAR of the breach of Wangi Creek Bed into Myuna Canal. Remediation to Wangi Creek is proposed to be undertaken in consultation with relevant departments and technical experts. Centennial Myuna should then prepare and implement a remediation plan for these works.	Myuna Colliery will prepare and implement a remediation plan for the Wangi Creek breach into the Myuna Canal. Remediation will be undertaken in consultation with relevant departments.	30/06/2023	In Progress
11	EPL 366 A2.1	Administrative	Update Plan in next EPL Variation to remove portion of ML 1632 transferred to Chain Valley from premises boundary.	Myuna Colliery will update Plan PC7301, 10/02/2021 to reflect recent changes to ML1632.	31/09/2023	Complete
12	EPL 366 L5.6	Noise	Request removal of requirement to locate noise monitoring equipment within 1 metre of a dwelling façade when assessing LA1(1minute) noise limits as part of next EPL variation	Myuna Colliery will apply for an EPL variation as per the recommendation of IMP REC 7 and IMP REC 8.		Complete
13	EPL 366 M4.1	Noise	Liaise with EPA to standardise condition M4.1 (noise monitoring frequency) with other Centennial Operations			Complete

11. INCIDENTS AND NON-COMPLIANCES DURING THE REPORTING PERIOD

Table 28. Incident/Non-Compliance Summary 1 (a)

Nature of the incident/non-compliance	Failure to collect Grab Sample at LDPB Monitoring Point 9 During Daily Discharge
Date of incident/ non-compliance (if known; if not known state not known)	6 September 2022
The location of the incident/ non-compliance (include a figure if appropriate), if known	N/A
Detail the cause of the incident/non-compliance	The missed sample is due to a contractor rescheduling miscommunication.
Detail action that has been, or will be, taken to mitigate any adverse effects of the incident/ non-compliance	No adverse environmental effects due to the incident.
Detail action that has been, or will be, taken to prevent recurrence of the incident/ non-compliance	A duplicate sample was taken for the following day. No further action to be taken.
Consultation with relevant agency (who, when and the response), or agencies if more than one	Notification letters sent to DPIE, EPA on 4 October 2022 and reported in the Annual Return.

Table 29. Incident / Non-Compliance Summary 2 (b)

Nature of the incident/non-compliance	Lost Depositional Dust Sample
Date of incident/ non-compliance (if known; if not known state not known)	5 September 2022
The location of the incident/ non-compliance (include a figure if appropriate), if known	DG1 as described in EPL366 and PA10_0080
Detail the cause of the incident/non-compliance	The glass container for the dust gauge was found broken in situ at the time of recovery. The root cause of the damage is unknown.
Detail action that has been, or will be, taken to mitigate any adverse effects of the incident/ non-compliance	No adverse effect or impacts due to the incident.
Detail action that has been, or will be, taken to prevent recurrence of the incident/ non-compliance	Review of dust gauges was completed onsite.
Consultation with relevant agency (who, when and the response), or agencies if more than one	Reported in the Monthly website report (October), the 2022 Annual Return (February 2023) reported the DPIE by letter (September 2022).

Table 30. Summary of Reportable Incidents and Regulatory Actions

Compliance Type	Agency(ies)	Number	Reference	Response
Incidents	EPA, DPIE	2	a	To be reported in the annual review, no further action required.
	EPA, DPIE		b	To be reported in the annual review, no further action required.
Caution Notices		0	Nil	
Warning Letters		0	Nil	
Penalty Notices		0	Nil	
Prosecutions		0	Nil	

Note: This table includes actions taken by DPE/DPIE, DRG, Resources Regulator and the EPA during the reporting period.

12. ACTIVITES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

Planned activities for the next reporting year:

- Ongoing implementation of strategies contained in Myuna's approved Management Plans to manage the risks associated with the operation
- Review and revision of Management Plans as per approval (10_0080) conditions.
- Independent Environmental Audit Action Plan

APPENDIX 1 - Myuna Colliery Annual Noise Monitoring Report

MYUNA COLLIERY

Annual Noise Compliance Report
2022 Noise Monitoring

Prepared for:

Centennial Coal Pty Limited
P.O Box 1000
Toronto NSW 2283

SLR Ref: 630.11620-R29
Version No: -v1.0
February 2023

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Centennial Coal Pty Limited (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
630.11620-R29-v1.0	7 February 2023	Shannon Harvey	Martin Davenport	Martin Davenport

CONTENTS

DOCUMENT REFERENCES

TABLES

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FIGURES

APPENDICES

1 Introduction

Centennial Myuna Pty Limited (Myuna) has commissioned SLR Consulting Australia Pty Ltd (SLR) to produce an annual compliance noise monitoring report for the Myuna Colliery located in Wangi Wangi, New South Wales (NSW).

The purpose of this report is to provide a summary of quarterly compliance noise monitoring of Myuna operations during 2022.

Quarterly noise monitoring throughout 2022 has been conducted in accordance with the requirements of Schedule 3 Condition 11, 12, 13 and 14 of the Myuna Project Approval (PA) PA10_0080, dated 1 February 2015 (PA 10_0080 MOD1) and Section 3 of the Statement of Conditions contained within the Myuna Colliery Environment Protection Licence (EPL) 366 version dated 13 November 2015 (EPL 366).

The objectives of the noise monitoring programme for 2022 were as follows:

- Conduct operator attended noise surveys at eight locations (R1, R2, R3, R4, R5, R6, R7 and R8) surrounding the colliery during day, evening and night-time periods.
- Quantify all sources of noise within each of the attended noise surveys, including measured and/or estimated contribution and maximum level of individual noise sources.
- Assess the noise emissions of Myuna Colliery and determine compliance with respect to the limits contained in the PA.

1.1 Acoustic Terminology

The following report uses specialist acoustic terminology. An explanation of common terms is provided in **Appendix A**.

2 Noise Criteria

2.1 Project Approval, EPL and NRNMP

Noise monitoring at Myuna Colliery was conducted in accordance with the EPL 366, PA 10_0080 MOD1 requirements and the Northern Regions Noise Management Plan (NRNMP). The site specific EPL and PA noise limits were summarised in Appendix B of the NRNMP and are reproduced in **Table 1**.

Table 1 Extract of Appendix B, Table 2 of the NRNMP - Project Approval and EPL Noise Criteria dB(A)

Location	Day	Emergency Day	Evening	Night	
	$L_{Aeq\ (15\ min)}$	$L_{Aeq\ (15\ min)}$	$L_{Aeq\ (15\ min)}$	$L_{Aeq\ (15\ min)}$	$L_{A1\ (1\ min)}$
R1, R2 and R3 Summerhill Drive and Wangi Close, Wangi Wangi	35	40	35	35	45
R4, Donelly road, Arcadia Vale	35	44	40	38	49
R5, R6, R7 and R8 Donelly road, Arcadia Vale	37	44	42	39	49
All other privately-owned land	35	40	35	35	45

Notes:

- To identify locations see **Figure 1**.
- Emergency Day noise limits only apply during the Day period when the Eraring Power Station overland conveyor is not in operation and Myuna's Emergency Coal Stockpile must be used.
- Noise generated by the project is to be measured in accordance with the relevant procedures and exemptions (including certain meteorological conditions) of the INP.

In addition, quarterly monitoring was conducted in accordance with the following requirements which are set out in condition M4.1 of EPL 366:

In order to determine compliance with condition L5.1, attended noise monitoring must be undertaken in accordance with conditions L5.5 and L5.6, and

a) at each one of the locations listed in condition L5.1;

b) occur quarterly within the reporting period of the Environmental Protection Licence with a least 2 months between monitoring periods;

c) occur during each day, evening and night period as defined in the NSW Industrial Noise Policy (EPA 2000) for a minimum of 15 minutes for three of the quarters;

d) the night time 15 minute attended monitoring in accordance with (c) must be undertaken between the hours of 1am and 4am;

e) one quarterly monitoring must occur during each day, evening and night period as defined in the in the NSW Industrial Noise Policy (EPA 2000) for a minimum of 1.5 hours during the day; 30 minutes during the evening; and 1 hours during the night;

f) each quarterly monitoring must be undertaken on a different day of the week not including Saturdays, Sundays and Public Holidays; and

g) these monitoring conditions take effect in the 2015 Environment Protection Licence Period.

3 Operational Noise Monitoring Methodology

3.1 General Requirements

All acoustic instrumentation employed throughout the monitoring programme has been designed to comply with the requirements of AS IEC 61672.1 – 2019 *Electroacoustics—Sound level meters*, AS IEC 60942 2017 *Electroacoustics – Sound calibrators* and carried current NATA or manufacturer calibration certificates. Instrument calibration was checked before and after each measurement survey, with the variation in calibrated levels not exceeding ±0.5 dBA.

3.2 Methodology - Operator Attended Noise Monitoring

Noise monitoring for Q1, Q2, Q3 and Q4 was conducted in accordance with the NRNMP.

Operator attended noise measurements for the first, second and fourth quarterly monitoring periods were conducted during the day, evening and night-time periods for a minimum of 15 minutes per period at each of the eight nominated noise monitoring locations representing the most affected receiver locations, listed in **Table 2** and **Figure 1.**

During the third quarterly monitoring period operator attended noise measurements were conducted at each of the eight nominated locations for a minimum of 1.5 hours during the day, 30 minutes during the evening and one hour during the night-time period.

During the operator attended noise measurements, the character and relative contribution of ambient noise sources and colliery contributions, where applicable, were determined.

Table 2 Noise Monitoring Locations

Monitoring Location	Receiver Type	Address	Monitoring Location - MGA Zone 56	
			Easting (m)	Northing (m)
R1	Residence	2 Turrama Street, Wangi Wangi	366858	6340370
R2	Residence	2 Moani Street, Wangi Wangi	366562	6340175
R3	Residence	3 Sunset Close, Wangi Wangi	365707	6340844
R4	Residence	119 Donnelly Road, Arcadia Vale	366662	6341662
R5	Residence	93 Donnelly Road, Arcadia Vale	366857	6341348
R6	Residence	83 Donnelly Road, Arcadia Vale	367049	6341185
R7	Residence	63 Donnelly Road, Arcadia Vale	367091	6340965
R8	Residence	53 Donnelly Road, Arcadia Vale	367072	6340821

The objective of the operator attended noise monitoring was to measure the energy average ($L_{Aeq(15minute)}$) and the night-time $L_{A1(1minute)}$ noise level contributions at the nearest potentially affected receptors. The purpose is to determine the noise contribution of Myuna Colliery operations over a 15 minute measurement period for comparison with the relevant limits. In addition, the operator quantifies and characterises the overall levels of ambient noise in the area (i.e. L_{Amax}, L_{A1}, L_{A10}, L_{A90}, and L_{Aeq}) over the 15 minute measurement interval.

Operator attended noise measurements were conducted using the following equipment:

- Quarter 1 - Brüel & Kjær Type 2250L sound level meter (s/n 3003389).
- Quarter 2 - Brüel & Kjær Type 2250L sound level meter (s/n 3003389)..
- Quarter 3 - Brüel & Kjær Type 2270 and SVAN 957 sound level meters (s/n 2679354 and 20664 respectively).
- Quarter 4 - Brüel & Kjær Type 2250L sound level meter (s/n 3003389).

Table 3 presents a summary of which days of the week the quarterly monitoring was conducted in accordance with the NRNMP.

Table 3 Days of the Week Quarterly Monitoring was Conducted, Year 2022

Period	Days of the Week (Excluding Weekends and Public Holidays)				
	Monday	Tuesday	Wednesday	Thursday	Friday
Day	Q4	Q3	Q1	Q2	
Evening	Q4	Q3	Q1	Q2	
Night	Q4	Q3	Q1	Q2	

1. Taken to mean the night time period from 10:00 pm on the stated day to 7:00 am of the following day.

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Myuna Colliery
Attended Noise Monitoring Locations

FIGURE 1

3.3 Myuna Colliery Operation

Measurements during all 2022 quarters were conducted during typical operational conditions for the Myuna Colliery. Operational activities on site included the following:

- Coal preparation plant.
- General surface operations i.e. deliveries, vehicle movements etc.
- Ventilation fan, compressors and staff and materials drift haulage.

4 Operator Attended Noise Monitoring Results

Results of the operator attended noise surveys conducted in 2022 at R1 through R8 are provided in **Table 5** to **Table 12**.

Ambient noise levels presented include all noise sources such as transport (roads, boats, and aircraft), fauna (insects, frogs, birds, and bats), the natural environment (wind in trees), domestic noises, other industrial operations as well as Myuna Colliery noise emissions.

Table 4 Operator Attended Noise Survey Results – R1

Period	Date/Start Time	Primary Noise Descriptor					Description of Noise
		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	
Day	30/03/2022 14:23	65	58	52	42	49	Ambient noise levels at this location are typically dominated by road traffic noise from Summerhill Drive during the day and evening. Myuna Colliery operations are generally inaudible to barely audible during the daytime due to traffic however typically becomes audible to clearly audible during the evening and night-time periods during lulls in road traffic noise and other extraneous noise. Various other noise sources are present including, residential noise, urban hum, birdsong and insects.
	09/06/2022 10:09	83	72	55	44	59	
	Six consecutive 15 minute measurements commencing 20/09/2022 10:06	67	59	51	37	48	
		72	61	51	36	49	
		69	62	53	37	50	
		66	58	50	38	47	
		67	61	52	41	50	
		70	60	52	40	49	
	28/11/2022 11:01	65	60	53	45	51	
Evening	30/03/2022 19:05	66	63	56	51	55	
	09/06/2022 19:05	63	56	49	43	47	
	Two consecutive 15 minute measurements commencing 20/09/2022 19:54	72	58	48	37	47	
		61	53	45	37	43	
	28/11/2022 19:46	65	55	46	38	45	
Night	31/03/2022 01:39	63	50	44	42	44	
	10/06/2022 01:41	55	44	40	37	38	
	Four consecutive 15 minute measurements commencing 20/09/2022 23:34	56	49	39	33	38	
		70	57	49	34	48	
		72	47	41	33	38	
		60	53	43	34	41	
	29/11/2022 01:44	49	46	37	33	36	

Table 5 Operator Attended Noise Survey Results – R2

Period	Date/Start Time	Primary Noise Descriptor					Description of Noise
		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	
Day	30/03/2022 14:04	72	65	61	41	57	Ambient noise levels at this location are typically dominated by road traffic noise from Summerhill Drive during the day and evening. Myuna Colliery operations are generally inaudible to barely audible during the daytime due to traffic however typically becomes audible to clearly audible during the evening and night-time periods during lulls in road traffic noise and other extraneous noise. Various other noise sources are present including, residential noise, urban hum, birdsong and insects.
	09/06/2022 09:50	82	66	61	43	57	
	Six consecutive 15 minute measurements commencing 20/09/2022 12:26	77	69	62	45	58	
		78	66	61	45	57	
		72	66	61	46	57	
		80	69	62	46	59	
		67	65	60	47	56	
		76	66	60	47	56	
	28/11/2022 13:03	75	70	62	39	58	
Evening	30/03/2022 18:46	68	65	58	46	55	
	09/06/2022 18:44	68	63	58	41	53	
	Two consecutive 15 minute measurements commencing 20/09/2022 19:15	70	63	57	39	52	
		67	62	55	41	51	
	28/11/2022 20:11	73	66	61	36	56	
Night	31/03/2022 01:20	63	56	45	41	45	
	10/06/2022 01:21	53	55	39	36	43	
	Four consecutive 15 minute measurements commencing 21/09/2022 01:01	61	40	38	34	37	
		64	56	42	35	43	
		66	54	40	35	42	
		63	53	42	34	42	
	29/11/2022 01:25	62	54	40	31	41	

Table 6 Operator Attended Noise Survey Results – R3

Period	Date/Start Time	Primary Noise Descriptor					Description of Noise
		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	
Day	30/03/2022 13:42	74	66	58	44	56	Ambient noise levels at this location were typically dominated by road traffic noise from Summerhill Drive and Wangi Road during the day, evening and night. Myuna Colliery operations were generally inaudible during all periods due to traffic, other industrial noise and extraneous noise sources. Various other noise sources were present including, residential noise, urban hum, birdsong and insects.
	09/06/2022 09:29	76	62	56	45	54	
	Six consecutive 15 minute measurements commencing 20/09/2022 10:11	68	59	53	37	49	
		66	59	52	39	49	
		73	63	53	38	52	
		63	58	54	40	49	
		71	61	54	40	51	
		77	61	55	40	51	
	28/11/2022 13:24	63	59	54	40	50	
Evening	30/03/2022 18:07	87	73	62	48	61	
	09/06/2022 18:23	67	59	54	46	51	
	Two consecutive 15 minute measurements commencing 20/09/2022 18:36	60	57	52	39	48	
		75	60	53	39	51	
	28/11/2022 20:39	64	50	55	48	53	
Night	31/03/2022 01:00	59	53	50	46	49	
	10/06/2022 01:00	58	51	43	40	42	
	Four consecutive 15 minute measurements commencing 21/09/2022 02:12	62	47	36	32	38	
		63	46	35	32	38	
		63	48	35	32	38	
		65	47	36	33	39	
	29/11/2022 01:03	53	49	37	34	37	

Table 7 Operator Attended Noise Survey Results – R4

Period	Date/Start Time	Primary Noise Descriptor					Description of Noise
		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	
Day	30/03/2022 15:22	80	75	69	50	65	Ambient noise levels at this location were typically dominated by road traffic noise from Wangi Road and Donnelly Road during the day, evening and night. Myuna Colliery operations were generally inaudible to barely audible during the daytime due to traffic however typically became audible and clearly audible during the evening and night-time periods during lulls in road traffic noise and other extraneous noise. Various other noise sources were present including, residential noise, wind in trees, birdsong and insects.
	09/06/2022 11:08	84	79	72	47	67	
	Six consecutive 15 minute measurements commencing 20/09/2022 12:00	85	80	73	42	68	
		86	80	73	42	68	
		86	80	73	43	67	
		86	80	72	44	68	
		87	80	71	42	68	
		84	80	73	46	68	
	28/11/2022 11:42	83	75	68	40	64	
Evening	30/03/2022 20:12	80	73	61	44	60	
	09/06/2022 20:03	79	74	65	43	61	
	Two consecutive 15 minute measurements commencing 20/09/2022 18:03	86	82	74	42	70	
		87	81	71	49	69	
	28/11/2022 18:05	87	81	72	43	69	
Night	31/03/2022 02:39	82	64	50	43	54	
	10/06/2022 02:40	76	55	43	38	48	
	Four consecutive 15 minute measurements commencing 20/09/2022 22:01	82	73	54	30	60	
		88	77	60	32	63	
		84	75	57	31	60	
		84	70	39	30	59	
	29/11/2022 03:27	82	64	42	35	55	

Table 8 Operator Attended Noise Survey Results – R5

Period	Date/Start Time	Primary Noise Descriptor					Description of Noise
		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	
Day	30/03/2022 15:04	80	74	68	48	64	Ambient noise levels at this location were typically dominated by road traffic noise from Donnelly Road during the day, evening and night. Myuna Colliery operations were generally inaudible to barely audible during the daytime due to traffic however typically became audible and clearly audible during the evening and night-time periods during lulls in road traffic noise and other extraneous noise. Various other noise sources were present including, residential noise, wind in trees, birdsong and insects.
	09/06/2022 10:49	82	80	68	43	65	
	Six consecutive 15 minute measurements commencing 20/09/2022 15:17	87	77	72	46	67	
		91	78	73	48	68	
		91	78	73	48	68	
		85	78	73	49	68	
		80	77	73	47	67	
		84	78	73	48	68	
	28/11/2022 11:23	78	74	69	44	64	
Evening	30/03/2022 19:51	80	73	63	42	60	
	09/06/2022 19:45	82	77	65	40	64	
	Two consecutive 15 minute measurements commencing 20/09/2022 18:45	82	76	63	50	63	
		81	76	65	47	63	
	28/11/2022 18:24	83	78	69	36	65	
Night	31/03/2022 02:20	80	68	50	40	56	
	10/06/2022 02:22	79	66	46	36	54	
	Four consecutive 15 minute measurements commencing 20/09/2022 23:11	81	75	52	33	60	
		78	71	49	36	56	
		80	68	48	36	55	
		76	57	44	33	50	
	29/11/2022 03:07	42	40	39	35	38	

Table 9 Operator Attended Noise Survey Results – R6

Period	Date/Start Time	Primary Noise Descriptor					Description of Noise
		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	
Day	30/03/2022 15:49	77	72	64	48	61	Ambient noise levels at this location were typically dominated by road traffic noise from Donnelly Road during the day, evening and night. Myuna Colliery operations were generally inaudible to barely audible during the daytime due to traffic however typically became audible and clearly audible during the evening and night-time periods during lulls in road traffic noise and other extraneous noise. Various other noise sources were present including, residential noise, wind in trees, birdsong and insects.
	09/06/2022 11:28	77	69	63	46	59	
	Six consecutive 15 minute measurements commencing 20/09/2022 17:06 27/09/2022 10:50	85	79	73	46	68	
		85	77	71	43	66	
		82	78	71	41	67	
		82	77	70	39	66	
		84	78	69	35	66	
		84	78	69	35	65	
	28/11/2022 12:01	80	68	61	39	58	
Evening	30/03/2022 20:30	77	65	58	42	55	
	09/06/2022 20:22	83	70	60	42	58	
	Two consecutive 15 minute measurements commencing 20/09/2022 19:21	82	76	62	36	62	
		85	78	66	38	65	
	28/11/2022 18:42	83	78	67	37	65	
Night	31/03/2022 03:00	68	57	45	40	46	
	10/06/2022 02:59	66	52	43	39	44	
	Four consecutive 15 minute measurements commencing 21/09/2022 00:30	78	64	45	38	52	
		57	46	43	36	40	
		81	66	45	34	55	
		78	58	42	35	49	
	29/11/2022 02:47	58	53	40	38	41	

Table 10 Operator Attended Noise Survey Results – R7

Period	Date/Start Time	Primary Noise Descriptor					Description of Noise
		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	
Day	30/03/2022 16:07	78	68	65	45	60	Ambient noise levels at this location were typically dominated by road traffic noise from Donnelly Road during the day, evening and night. Myuna Colliery operations were generally barely audible during the daytime due to traffic however typically became audible and clearly audible during the evening and night-time periods during lulls in road traffic noise and other extraneous noise. Various other noise sources were present including, residential noise, wind in trees, birdsong and insects.
	09/06/2022 11:46	78	70	63	46	59	
	Six consecutive 15 minute measurements commencing 27/09/2022 12:14	67	63	58	33	53	
		74	67	59	35	55	
		72	66	59	35	55	
		73	64	59	33	55	
		71	66	59	33	55	
		73	67	61	35	56	
	28/11/2022 12:19	68	66	61	48	57	
Evening	30/03/2022 20:49	68	62	48	43	49	
	09/06/2022 20:40	71	65	53	41	52	
	Two consecutive 15 minute measurements commencing 20/09/2022 20:20	67	62	55	32	50	
		72	63	55	34	52	
	28/11/2022 12:19	68	64	57	35	53	
Night	31/03/2022 02:27	59	57	53	41	50	
	10/06/2022 03:19	64	59	43	39	45	
	Four consecutive 15 minute measurements commencing 21/09/2022 01:41	61	47	35	27	36	
		63	57	36	28	41	
		59	54	36	28	39	
		52	39	32	28	31	
	29/11/2022 02:27	47	42	40	37	39	

Table 11 Operator Attended Noise Survey Results – R8

Period	Date/Start Time	Primary Noise Descriptor					Description of Noise
		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	
Day	30/03/2022 14:44	76	72	65	45	60	Ambient noise levels at this location were typically dominated by road traffic noise from Donnelly Road during the day, evening and night. Myuna Colliery operations were generally inaudible to barely audible during the daytime due to traffic however typically became audible and clearly audible during the evening and night-time periods during lulls in road traffic noise and other extraneous noise. Various other noise sources were present including, residential noise, wind in trees, birdsong and insects.
	09/06/2022 10:30	74	72	66	42	60	
	Six consecutive 15 minute measurements commencing 20/09/2022 14:20	80	74	67	45	63	
		83	74	68	47	63	
		81	75	68	45	64	
		78	73	68	47	63	
		83	74	68	48	64	
		87	74	68	46	64	
	28/11/2022 12:38	76	72	66	39	61	
Evening	30/03/2022 19:32	75	72	59	46	58	
	09/06/2022 19:25	73	67	57	42	57	
	Two consecutive 15 minute measurements commencing 20/09/2022 20:37	79	70	51	32	56	
		76	70	49	33	55	
	28/11/2022 19:23	84	74	64	38	61	
Night	31/03/2022 02:00	68	51	48	43	47	
	10/06/2022 02:02	46	39	37	35	36	
	Four consecutive 15 minute measurements commencing 20/09/2022 22:19	73	60	42	30	47	
		71	63	43	28	49	
		68	45	37	27	40	
		73	66	44	30	52	
	29/11/2022 02:06	42	37	34	31	32	

5 Performance Assessment

In accordance with the NRNMP and PA, the Myuna Colliery contribution can be estimated or calculated by the operator by noting measurable noise events and their source throughout each 15-minute noise monitoring period.

5.1 Quarter 1 2022

Results of the operator attended noise measurements compared with the relevant noise criteria contained in the NRNMP are given in **Table 11** and **Table 12**.

Table 11 Q1 – Performance Assessment – $L_{Aeq(15minute)}$

Location	Estimated Myuna Contribution dBA $L_{Aeq(15minute)}$			Noise Criteria dBA $L_{Aeq(15minute)}$			Compliance		
	Day	Eve	Night	Day	Eve	Night	Day	Eve	Night
R1	I/A[1]	I/A[1]	33	35	35	35	Yes	Yes	Yes
R2	I/A[1]	I/A[1]	I/A[1]	35	35	35	Yes	Yes	Yes
R3	<30	I/A[1]	I/A[1]	35	35	35	Yes	Yes	Yes
R4	<30	36	37	35	40	38	Yes	Yes	Yes
R5	<30	34	34	37	42	39	Yes	Yes	Yes
R6	31	37	37	37	42	39	Yes	Yes	Yes
R7	33	38	38	37	42	39	Yes	Yes	Yes
R8	I/A[1]	34	35	37	42	39	Yes	Yes	Yes

Note 1. I/A = Inaudible

Table 12 Q1 – Performance Assessment – $L_{A1(1minute)}$

Location	Myuna Colliery dBA $L_{A1(1minute)}$	Noise Criteria dBA $L_{A1(1minute)}$	Compliance
R1	35	45	Yes
R2	I/A[1]	45	Yes
R3	I/A[1]	45	Yes
R4	39	49	Yes
R5	36	49	Yes
R6	39	49	Yes
R7	40	49	Yes
R8	38	49	Yes

Note 1: I/A = Inaudible

Results of the Q1 assessment show that no non-compliances were recorded throughout the noise monitoring period.

5.2 Quarter 2 2022

Results of the operator attended noise measurements compared with the relevant noise criteria contained in the NRNMP are given in **Table 13** and **Table 14**

Table 13 Q2 – Performance Assessment – $L_{Aeq(15minute)}$

Location	Estimated Myuna Contribution dBA $L_{Aeq(15minute)}$			Noise Criteria dBA $L_{Aeq(15minute)}$			Compliance		
	Day	Eve	Night	Day	Eve	Night	Day	Eve	Night
R1	30	34	35	35	35	35	Yes	Yes	Yes
R2	27	32	34	35	35	35	Yes	Yes	Yes
R3	I/A[1]	I/A[1]	<30	35	35	35	Yes	Yes	Yes
R4	<25	33	35	35	40	38	Yes	Yes	Yes
R5	<25	31	32	37	42	39	Yes	Yes	Yes
R6	<30	35	36	37	42	39	Yes	Yes	Yes
R7	30	36	38	37	42	39	Yes	Yes	Yes
R8	<30	33	34	37	42	39	Yes	Yes	Yes

1. I/A = Inaudible

Table 14 Q2 – Performance Assessment – $L_{A1(1minute)}$

Location	Myuna Colliery dBA $L_{A1(1minute)}$	Noise Criteria dBA $L_{A1(1minute)}$	Compliance
R1	37	45	Yes
R2	38	45	Yes
R3	<30	45	Yes
R4	38	49	Yes
R5	35	49	Yes
R6	38	49	Yes
R7	43	49	Yes
R8	37	49	Yes

1. I/A = Inaudible

Results of the Q2 assessment show that no non-compliances were recorded throughout the noise monitoring period.

5.3 Quarter 3 2022

Results of the operator attended noise measurements compared with the relevant noise criteria contained in the NRNMP are given in **Table 15** and **Table 16**.

Table 15 Q3 – Performance Assessment – $L_{Aeq(15minute)}$

Location	Estimated Myuna Contribution dBA $L_{Aeq(15minute)}$			Noise Criteria dBA $L_{Aeq(15minute)}$			Compliance		
	Day	Eve	Night	Day	Eve	Night	Day	Eve	Night
R1	I/A[1]	I/A[1]	I/A[1]	35	35	35	Yes	Yes	Yes
R2	I/A[1]	I/A	<25	35	35	35	Yes	Yes	Yes
R3	I/A[1]	30	32	35	35	35	Yes	Yes	Yes
R4	I/A[1]	I/A[1]	I/A[1]	35	40	38	Yes	Yes	Yes
R5	I/A[1]	I/A[1]	I/A[1]	37	42	39	Yes	Yes	Yes
R6	I/A[1]	I/A[1]	I/A[1]	37	42	39	Yes	Yes	Yes
R7	I/A[1]	I/A[1]	I/A[1]	37	42	39	Yes	Yes	Yes
R8	I/A[1]	I/A[1]	I/A[1]	37	42	39	Yes	Yes	Yes

Note 1. I/A = Inaudible

Table 16 Q3 – Performance Assessment – $L_{A1(1minute)}$

Location	Myuna Colliery dBA $L_{A1(1minute)}$	Noise Criteria dBA $L_{A1(1minute)}$	Compliance
R1	I/A[1]	45	Yes
R2	<25	45	Yes
R3	33	45	Yes
R4	I/A[1]	49	Yes
R5	I/A[1]	49	Yes
R6	I/A[1]	49	Yes
R7	I/A[1]	49	Yes
R8	I/A[1]	49	Yes

Note 1. I/A = Inaudible

Results of the Q3 assessment show that no non-compliances were recorded throughout the noise monitoring period.

5.4 Quarter 4 2022

Results of the operator attended noise measurements compared with the relevant noise criteria contained in the NRNMP are given in **Table 17** and **Table 18**.

Table 17 Q4 – Performance Assessment – $L_{Aeq(15minute)}$

Location	Estimated Myuna Contribution dBA $L_{Aeq(15minute)}$			Noise Criteria dBA $L_{Aeq(15minute)}$			Compliance		
	Day	Eve	Night	Day	Eve	Night	Day	Eve	Night
R1	I/A[1]	I/A[1]	35[2]	35	35	35	Yes	Yes	Yes
R2	I/A[1]	<30	29	35	35	35	Yes	Yes	Yes
R3	I/A[1]	I/A[1]	30	35	35	35	Yes	Yes	Yes
R4	<30	33	35	35	40	38	Yes	Yes	Yes
R5	I/A[1]	31	38[2]	37	42	39	Yes	Yes	Yes
R6	33	32	38	37	42	39	Yes	Yes	Yes
R7	<25	36	39[2]	37	42	39	Yes	Yes	Yes
R8	I/A[1]	I/A[1]	30	37	42	39	Yes	Yes	Yes

Note 1. I/A = Inaudible

Note 2. Inclusive of +2 dB modifying factor

Table 18 Q4 – Performance Assessment – $L_{A1(1minute)}$

Location	Myuna Colliery dBA $L_{A1(1minute)}$	Noise Criteria dBA $L_{A1(1minute)}$	Compliance
R1	34	45	Yes
R2	30	45	Yes
R3	31	45	Yes
R4	37	49	Yes
R5	40	49	Yes
R6	40	49	Yes
R7	40	49	Yes
R8	31	49	Yes

Results of the Q4 assessment show that no non-compliances were recorded throughout the noise monitoring period.

6 Conclusion

Quarterly noise monitoring for the Myuna Colliery has been completed throughout 2022 in accordance with the NRNMP.

Operator attended noise monitoring was conducted at eight (8) locations in order to determine the noise contributions of Myuna Colliery with the relevant criteria. No non-compliances were recorded throughout any of the noise monitoring periods. Myuna Colliery was therefore found to have achieved compliance with the relevant noise criteria during all monitoring periods throughout 2022.

APPENDIX A

Acoustic Terminology

1. Sound Level or Noise Level

The terms 'sound' and 'noise' are almost interchangeable, except that 'noise' often refers to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure. The human ear responds to changes in sound pressure over a very wide range with the loudest sound pressure to which the human ear can respond being ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or LP are commonly used to represent Sound Pressure Level. The symbol LA represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2 x 10^{-5} Pa.

2. 'A' Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an 'A-weighting' filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4,000 Hz), and less sensitive at lower and higher frequencies. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dB or 2 dB in the level of a sound is difficult for most people to detect, whilst a 3 dB to 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels.

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120	Heavy rock concert	Extremely noisy
110	Grinding on steel	
100	Loud car horn at 3 m	Very noisy
90	Construction site with pneumatic hammering	
80	Kerbside of busy street	Loud
70	Loud radio or television	
60	Department store	Moderate to quiet
50	General Office	
40	Inside private office	Quiet to very quiet
30	Inside bedroom	
20	Recording studio	Almost silent

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as 'linear', and the units are expressed as dB(lin) or dB.

3. Sound Power Level

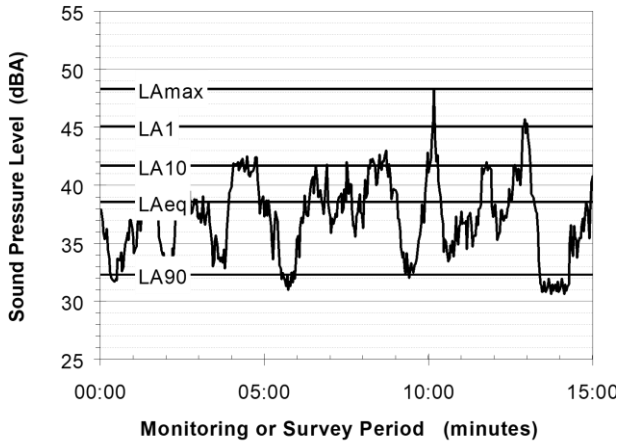
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 10^{-12} W.

The relationship between Sound Power and Sound Pressure is similar to the effect of an electric radiator, which is characterised by a power rating but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4. Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels LAN, where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the LA1 is the noise level exceeded for 1% of the time, LA10 the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

LA1 The noise level exceeded for 1% of the 15 minute interval.

LA10 The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

LA90 The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

LAeq The A-weighted equivalent noise level (basically, the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

5. Frequency Analysis

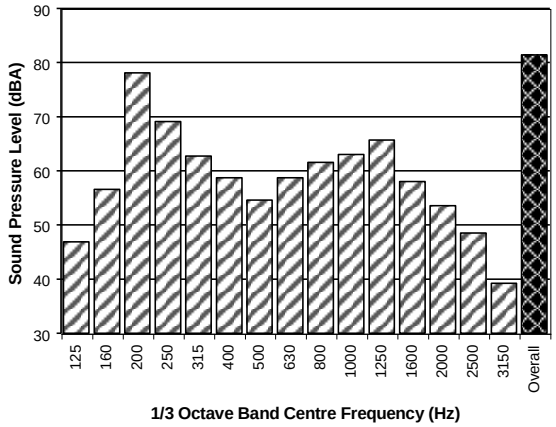
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (three bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



6. Annoying Noise (Special Audible Characteristics)

A louder noise will generally be more annoying to nearby receivers than a quieter one. However, noise is often also found to be more annoying and result in larger impacts where the following characteristics are apparent:

- **Tonality** - tonal noise contains one or more prominent tones (ie differences in distinct frequency components between adjoining octave or 1/3 octave bands), and is normally regarded as more annoying than 'broad band' noise.
- **Impulsiveness** - an impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.
- **Intermittency** - intermittent noise varies in level with the change in level being clearly audible. An example would include mechanical plant cycling on and off.
- **Low Frequency Noise** - low frequency noise contains significant energy in the lower frequency bands, which are typically taken to be in the 10 to 160 Hz region.

7. Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of 'peak' velocity or 'rms' velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as 'peak particle velocity', or PPV. The latter incorporates 'root mean squared' averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements (ie vertical, longitudinal and transverse).

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/Vo), where Vo is the reference level (10^{-9} m/s). Care is required in this regard, as other reference levels may be used.

8. Human Perception of Vibration

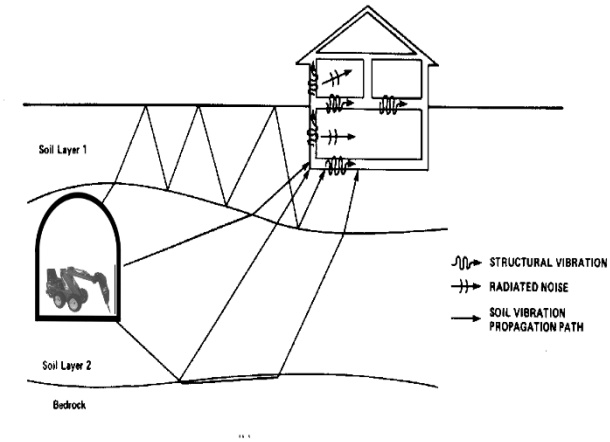
People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as 'normal' in a car, bus or train is considerably higher than what is perceived as 'normal' in a shop, office or dwelling.

9. Ground-borne Noise, Structure-borne Noise and Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed 'structure-borne noise', 'ground-borne noise' or 'regenerated noise'. This noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of ground-borne or structure-borne noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

The following figure presents an example of the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



The term 'regenerated noise' is also used in other instances where energy is converted to noise away from the primary source. One example would be a fan blowing air through a discharge grill. The fan is the energy source and primary noise source. Additional noise may be created by the aerodynamic effect of the discharge grill in the airstream. This secondary noise is referred to as regenerated noise.

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APPENDIX 2 - 2022 Ecological Monitoring Report – Swamp Sclerophyll Forest on Coastal Floodplains EEC

ENDANGERED ECOLOGICAL COMMUNITY MONITORING: MYUNA COLLIERY

2022 Annual Monitoring

151834
1
25 August 2022

rpsgroup.com

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
1	Client Review	Jess Graham	Chris Wellington	Chris Wellington	13/12/2022
2	Client Review	Jess Graham	Chris Wellington	Chris Wellington	10/01/2023

Approval for issue

Chris Wellington  13 December 2022

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Appendix A Species List

1 INTRODUCTION

Centennial Coal Myuna (Centennial) engaged RPS Australia East Pty Ltd (RPS) to undertake the annual monitoring of an endangered ecological community (EEC) at Myuna Colliery as per the requirements specified in the Northern Operations Regional Biodiversity Management Plan (BMP) (Centennial Coal 2019) and Myuna Colliery site specific BMP. The monitoring area is shown in **Figure 1**.

1.1 Background

The consent conditions issued for the approved Myuna Coal – Modification 1 (MP_10-0080 MOD1) requires the annual monitoring of Riparian Melaleuca Swamp Woodland (MU 42); vegetation forming part of the *Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin* and *South East Corner Bioregions* EEC listed under the *Biodiversity Conservation Act* 2016 (BC Act). Monitoring specifications are described in the Northern Operations Regional and Myuna Colliery BMPs.

Baseline monitoring was undertaken by Hunter Land Management in 2015. Since then, ongoing monitoring has been carried out by RPS (2016, 2017, 2020 and 2021) and Umwelt (2018 and 2019). Initial monitoring methodology was carried out under the BioBanking Assessment Methodology (BBAM), which was made redundant in 2018 and replaced by the Biodiversity Assessment Methodology (BAM). All monitoring data collected after 2018 has occurred in accordance with plot methods specified in the BAM.

1.2 Objective

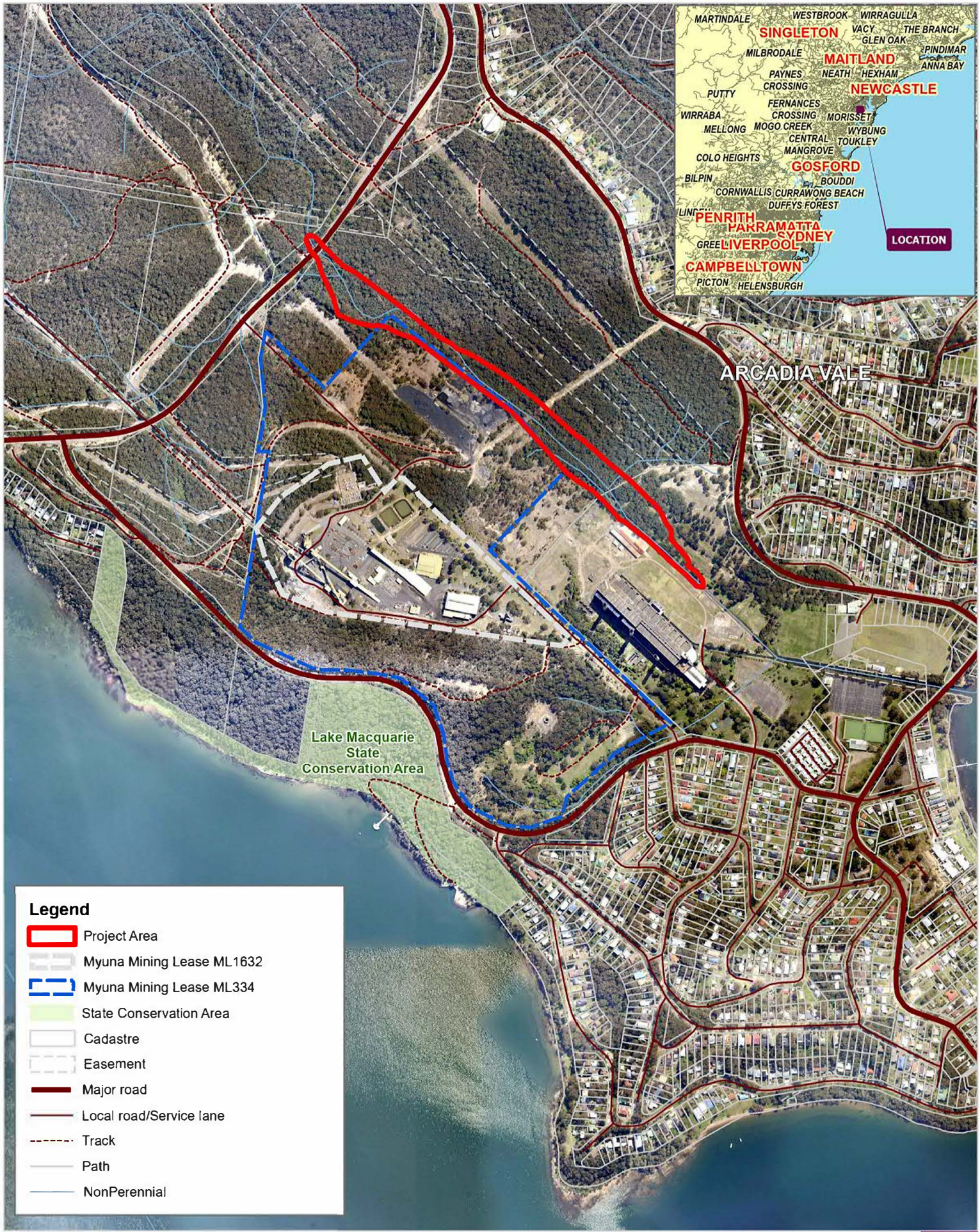
The annual EEC monitoring program has the purposes of addressing Conditions 28 (c) and (d) of the approved MP_10-0080 MOD1, which are reproduced below for convenience:

28(c) have a particular focus on measures that would be implemented over the life of the mine to protect and enhance the Swamp Sclerophyll Forest on Coastal Floodplains endangered ecological community near Wangi Creek; and

28(d) include a detailed description of the measures that would be implemented over the life of the mine to ensure that native vegetation and habitat within the surface facilities sites (particularly the Swamp Sclerophyll Forest on Coastal Floodplains endangered ecological community near Wangi Creek) are properly managed, including procedures for:

- *weed management (both control and suppression);*
- *protection and enhancement of native vegetation and habitat;*
- *feral animal control;*
- *fire management (including asset protection zones); and*
- *management of public access.*

The purpose of the monitoring is to determine if there is any measurable change in the health or condition of *Swamp Sclerophyll Forest on Coast Floodplains* EEC and *Callistemon linearifolious (*Netted bottlebrush); a species listed as vulnerable under the BC Act. Where change is detected, and is deemed to be a negative change, this monitoring report will inform Myuna Coal of the possible reasons for change and provide recommendation for the management of these changes.



SITE LOCATION

CLIENT: Centennial
PROJ: AU213005459
LOCATION: Myuna

DATA SOURCES
Centennial, RPS, NSWSS,

MAP: Site Location Map
VERSION: A
DATE EXPORTED: 6/12/2022
TECHNICIAN: Natalie.Wood

0 50 100 150 200 250 300 350 m

SCALE 1:10,000
A4 SIZE / Projection: GDA2020 MGA Zone 56

N

FIGURE 1

PROJECT PATH: S:\Centennial\All Jobs\5459 - 151834 - Myuna EEC Monitoring 2022\10 - Drafting\Arcgis Map Documents\Eco\AU213005459_ReportFigures.aprx

2 METHODOLOGY

2.1 Overview

Monitoring works performed for the 2022 reporting period were undertaken on 5 December 2022 by Mr Will Vile (Ecologist) and Miss Jess Graham (Graduate Ecologist). Monitoring was performed in two vegetation management areas (VMAs) reflective of observed health classes (RPS 2016), which are listed below:

- VMA 1: MU42 in moderate/good_high condition; and
- VMA 2: MU42 in moderate/good_medium condition.

Details of these monitoring sites along with description of methodology are outlined in the following section.

2.2 Monitoring Sites

Sites have been monitored annually since 2015. In 2019, monitoring sites were permanently marked with a star picket at the start and end point of each transect as a recommendation of Umwelt (2018). As mentioned in 2019 Ecological Monitoring Report (EMP), some alterations were made to ensure all transects were kept within the Vegetation Management Area (VMA). Alterations included slightly adjusting the bearing of the plots in a way that allows transects to remain within the VMA. However, start points of each transect remain in the same location as original placement in 2015.

Umwelt (2018) also recommended increasing the number of photo monitoring points at each monitoring site. Prior to 2018, only three photos were taken; from the north-east corner of the plot, and the start and end of each transect. The new method requires photos to be taken at each corner of the plot, facing inwards, and at the start and end of the transect. For consistency, RPS has conducted the 2022 monitoring in accordance with methods and recommendations provided by Umwelt in previous monitoring efforts.

2.3 Biodiversity Assessment Methodology (BAM)

At each of the three permanent monitoring locations BAM was utilised to assess ecosystem composition, structure, and function. This involves estimating the vegetation composition, structure, and function to determine the vegetation integrity. The method used to measure these attributes is detailed in (OEH, 2017) and summarised in **Table 1**.

Table 1: BAM growth form groups and attributes

Growth form groups used to assess composition and structure (20 x 20 m plot)	Attributes used to assess function (20 x 50 m plot)
a) Tree	a) Number of large trees
b) Shrub	b) Tree regeneration
c) Grass and grass like	c) Tree stem size class
d) Forb	d) Total length of fallen logs
e) Fern	e) Litter cover (Five 1 m^2 sub-plots)
f) Other	f) High threat exotic vegetation cover
	g) Hollow bearing trees

Biometric plots (20 x 50 m) were established, marking the start and end points of the transect using GPS and permanent pegs. The dimensions of the standard biometric plot are shown in **Figure 2**.

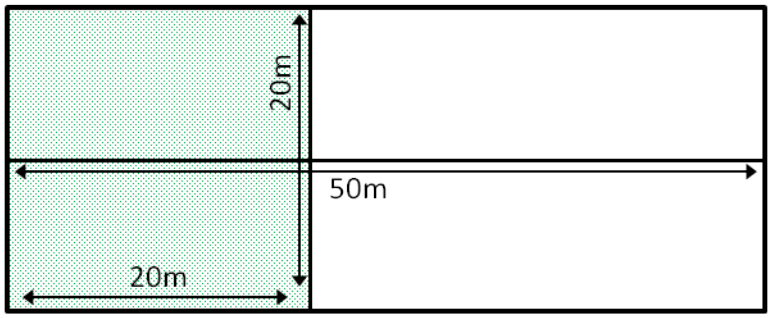


Figure 2 Biometric plot dimensions

2.4 Photo Monitoring

Photo monitoring was carried out at each of the monitoring sites. Photos were used to identify any observable changes in vegetation condition over time.

Six photos were taken at each monitoring site. One photo at each corner of the 20m x 20m floristic plot, and one photo at the start and end of the transect. All photos are compared to images from 2018 onwards (due to change in methodology) to identify any changes in vegetation condition or landscape variations.

Permanent photo monitoring locations were installed using wooden stakes. During the 2020 Monitoring event, photo monitoring locations were re-labelled to reflect their position in relation to the plot. These changes are outlined in **Table 2**. Confirmation of these orientation amendments can be found in **Table 2.** The updated orientations of the photo monitoring corners were utilised during the 2022 monitoring event.

Table 2: Photo monitoring location orientation amendments

2018	2019	2020
Plot 1		
North-East Corner	No matching photograph taken	North-east Corner, Matching 2018 photograph location
	Labelled as north-east	South-east Corner
	South-east Corner	South-west Corner
	South-west Corner	North-west Corner
Plot 2		
	North-east Corner	South-east Corner
	North-west Corner	North-east Corner
	South-east Corner	South-west Corner
	South-west Corner	North-west Corner
Plot 3		
	North-east Corner	South-east Corner
	North-west Corner	North-east Corner
	South-east Corner	South-west Corner
	South-west Corner	North-west Corner

2.5 Threatened Ecological Community Monitoring

Data collected for composition, structure and function parameters outlined in **Section 2.3** will be compared against benchmark data for the corresponding Plant Community Type (PCT) (OEH, 2020). This will be used to assess the condition of the EEC.

2.6 Groundwater Dependant Ecosystem Monitoring

The *Swamp Sclerophyll Forest on Coastal Floodplains* EEC occurring within the site is representative of a ground water dependant ecosystem (GDE) (RPS, 2017) and was quantitatively monitored using methods outlined in **Section 2.3** and **2.5.** Data collected for floristic composition, structure and function parameters will be compared against benchmark data for the corresponding PCT**.** The PCT found throughout this site is 1649 Smooth-barked Apple - Red Mahogany - Swamp Mahogany - *Melaleuca sieberi* heathy swamp woodland of coastal lowlands.

2.7 *Callistemon linearifolious* (Netted Bottlebrush) Monitoring

As a continuation of the threatened species monitoring carried out by Umwelt in 2019 nine *C.linearifolius* were attempted to be relocated and a condition score assigned. Condition scores were allocated via a visual assessment of the individual and height of the individuals was also recorded. Health categories utilised to assign condition scores to individuals are outlined in **Table 3.**

Table 3: Visual health assessment categories

Category of Shrub Health	
Healthy	No signs of dieback or leaf loss
Slightly stressed	Minimal dieback through the presence of few small dead branches on otherwise healthy shrubs
Stressed	Reductions in leaf size or leaf loss, discolouration, canopy thinning, or dead branches with some level of die back
Near Dead	Brown leaves, fine branches, and thin canopy
Dead	Absence of leaves, fine branches, or bark

Umwelt, 2019

3 RESULTS

3.1 Weather

A summary of the weather data for the 12-month period (i.e., December 2021 to November 2022) preceding the 2022 monitoring event, along with historical monthly data (1862 to 2022) (BoM, 2021), is outlined in **Table 4**. Long term weather patterns (December 2019 to November 2022) are outlined in **Figure 3.** The data was obtained from Newcastle Nobbys Signal Station AWS (61055), located approximately 28km north of the monitoring sites.

Mean maximum monthly temperatures were generally higher for the preceding 12-month period. The same trend was observed in mean minimum monthly temperatures. Six months of the preceding 12-month period recorded mean monthly rainfall below the historical mean.

Table 4: Summary of weather data

Month	Mean Maximum Monthly Temperature	Mean Minimum Monthly Temperature	Total Monthly Rainfall	Historical Mean Maximum Monthly Temperature	Historical Minimum Mean Monthly Temperature	Historical Total Monthly Rainfall
Dec-21	24.7	19.2	27.8	24.9	18.1	79.4
Jan-22	24.9	20.8	45	22	19.3	88.4
Feb-22	25.4	19.6	177.2	22	19.4	106.9
Mar-22	24.3	19.3	160.8	21	18.3	119.7
Apr-22	23.4	16.6	130	17.2	15.4	115.6
May-21	20.9	13.4	151	14.2	12	114.5
Jun-22	17.6	9.4	45	13.1	9.8	117.8
Jul-22	17.4	10.1	247.4	10.4	8.5	92.9
Aug-22	18.5	10.7	48.8	11.1	9.3	72
Sep-22	19.3	13	82.2	20.3	11.5	71.6
Oct-22	21.7	15.4	32.8	22.2	14.1	73.2
Nov-22	22.5	15.8	32.8	23.6	16.2	71.5
Total	**-**	**-**	**1180.8**	**-**	**-**	**1118.0**

Historical weather data 1862 – 2022

Green = above average statistics

Red = below average statistics

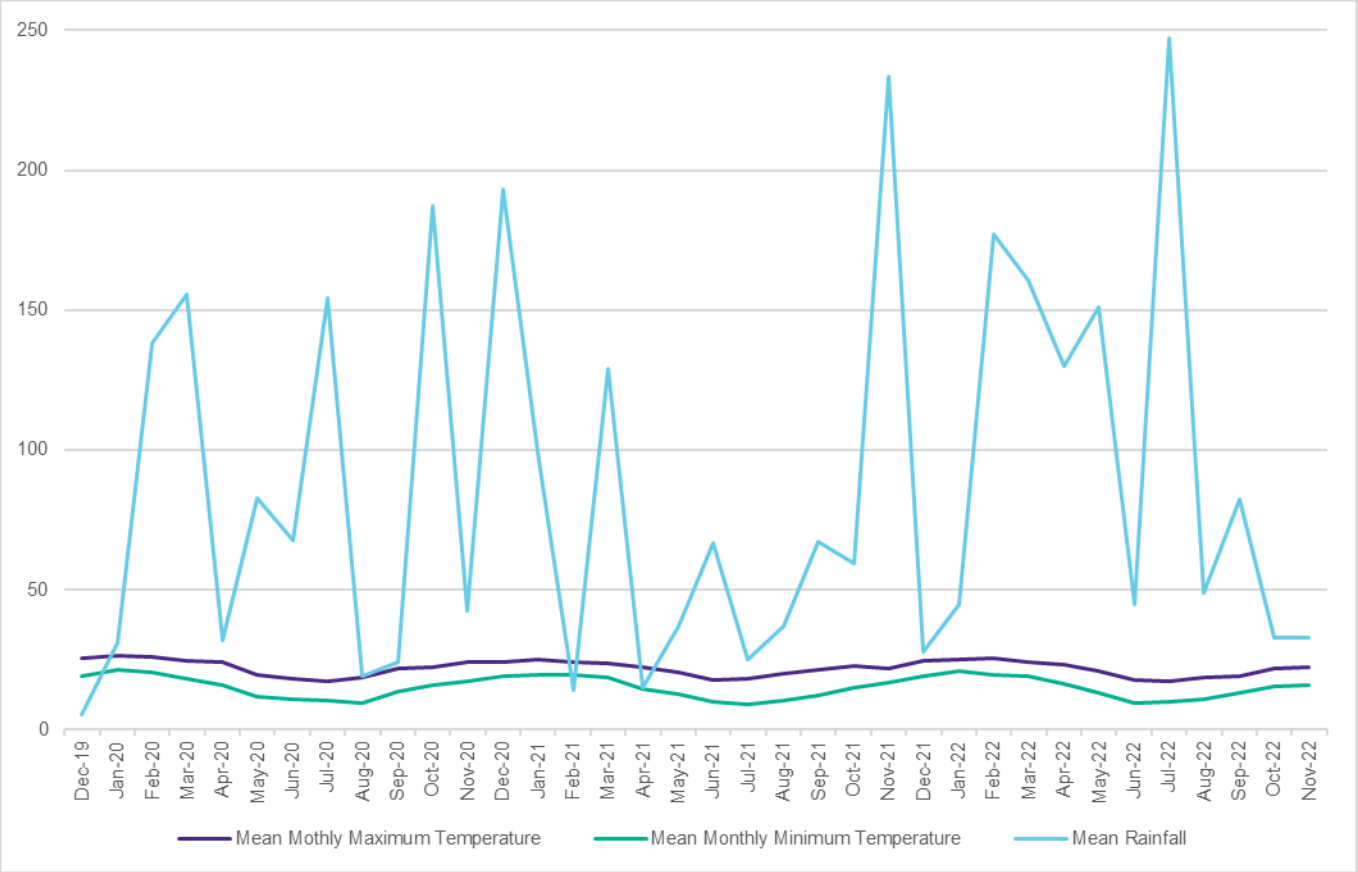


Figure 3 **Long term weather patterns (December 2019 to November 2022) preceding the 2022 monitoring event**

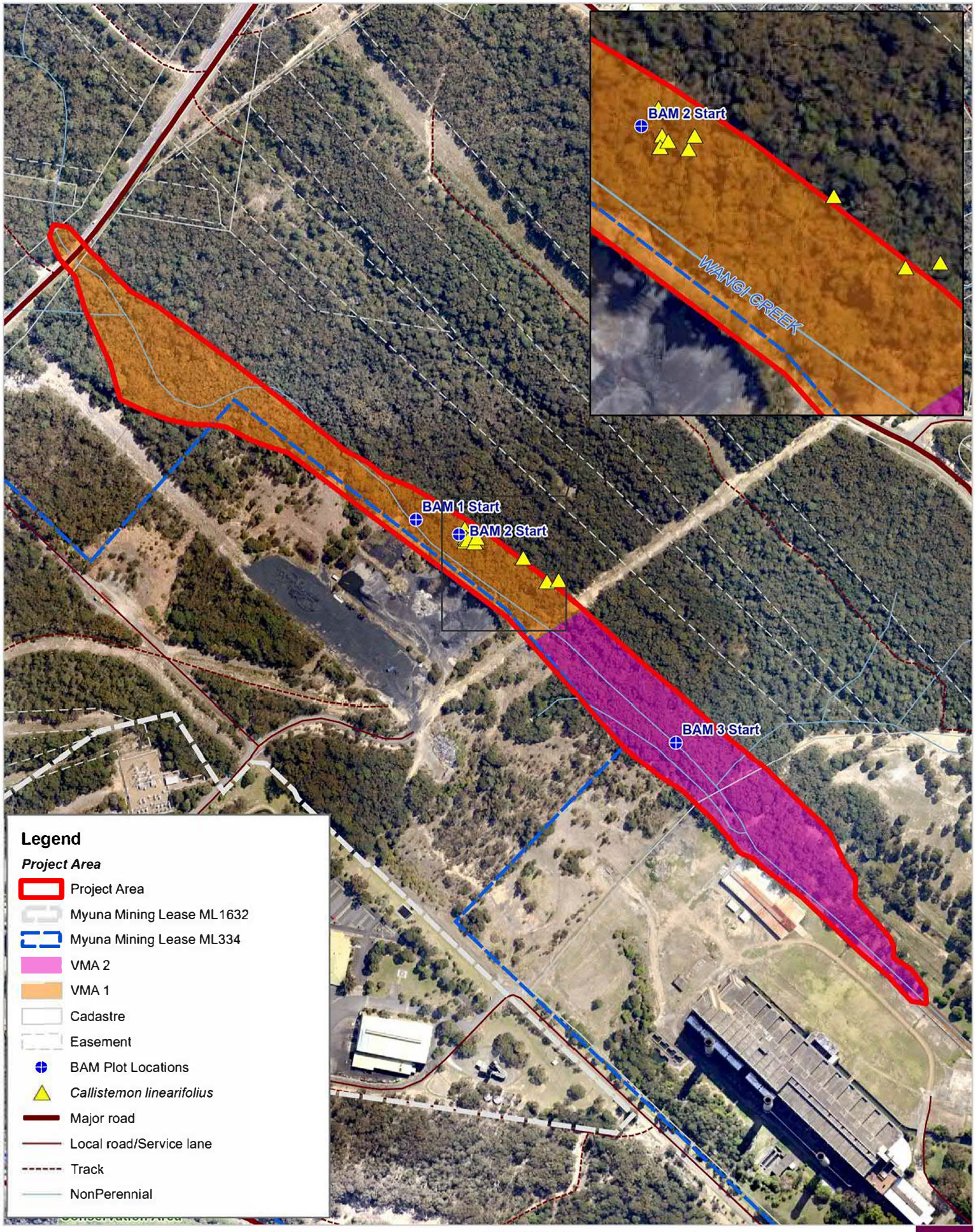
3.2 Floristic Monitoring

Data collected during the 2022 monitoring effort was compared to Umwelt's 2019 and RPS 2020 and 2021 data. As mentioned above, as BAM was introduced in 2018, any data collected prior to 2018 was recorded under BBAM and is therefore unable to be used as a direct comparison with data from 2018 onwards.

To fulfil EEC and GDE monitoring, a comparison of attributes found throughout all plots, were to be compared to BAM benchmark conditions. This requires a PCT to be assigned to the vegetation community throughout the site. Umwelt had previously assigned PCT 1649: Smooth-barked Apple - Red Mahogany - Swamp Mahogany - *Melaleuca sieberi* heathy swamp woodland of coastal lowlands to the vegetation community found at both VMA sites. PCT 1649 is present in two IBRA Bioregions, NSW North Coast and Sydney Basin. Benchmarks from the Sydney Basin bioregion were employed. To allow for consistent comparison across years, these PCT benchmarks have been used for the 2022 EEC and GDE data analysis.

3.2.1 VMA 1

VMA 1 consists of two plots of high condition native vegetation (**Figure 4**). These plots are in locations which had historically experienced relatively high levels of water inundation due to rainfall events. This inundation appeared to be a low energy influx, with minimal deposition of vegetative debris and unconsolidated material. The following section reports on data collected from the 2022 monitoring event. There were no visual indicators of mining related activities or impacts (i.e., subsidence or ponding).



LOCATION OF MONITORING SITES

CLIENT: Centennial
PROJ: AU213005459
LOCATION: Myuna

DATA SOURCES
Centennial, RPS, NSWSS,

MAP: Monitoring Site
VERSION: A
DATE EXPORTED: 6/12/2022
TECHNICIAN: Natalie.Wood

0 50 100 150 m

SCALE 1:4,501
A4 SIZE / Projection: GDA2020 MGA Zone 56

N

FIGURE 3

PROJECT PATH: S:\Centennial\All Jobs\5459 - 151834 - Myuna EEC Monitoring 2022\10 - Drafting\Arcgis Map Documents\Eco\AU213005459_ReportFigures.aprx

3.2.1.1 Plot 1

3.2.1.1.1 Floristic Analysis

Tree canopy comprises *Angophora costata* (Sydney Red Gum), *Eucalyptus robusta* (Swamp Mahogany), *Glochidion ferdinandi* (Cheese Tree), with *E. robusta* being the most dominant canopy species. The shrub layer was dominated by *Melaleuca linariifolia* (Flax-leaved Paperbark) and *Pittosporum undulatum* (Sweet Pittosporum). Less dominant mid stratum species include *Breynia oblongifolia* (Coffee Bush), *Leptospermum polygalifolium* (Tantoon) and *Polyscias sambucifolia* (Elderberry Panax). Dominant species recorded within the understory include *Gahnia clarkei* (Tall Saw-sedge) and *Dianella caerulea var. producta*. Species observed in Plot 1 are provided in **Appendix A.**

A total of 40 species were recorded, with 33 of these being native (**Table 5**).

Table 5: Plot 1 summary statistics – year on year native and introduced flora species richness

Year	Number of native flora species (per cent of total)	Number of introduced flora species (per cent total)	Total number of flora species
2022	33 (82.5)	7 (17.5)	40
2021	37 (82.2)	8 (17.6)	45
2020	29 (76)	9 (24)	38
2019	32 (78)	9 (22)	41
2018	45 (83)	9 (17)	54
2017**	35 (97)	1 (3)	36
2016**	30 (97)	1 (3)	31
2015*	-	-	-
Mean species richness (ex 2022)			40.8±8.0 SE
Mean introduced species richness (ex 2022)			6.2±4.0 SE
Mean native species richness (ex 2022)			34.7±5.9 SE
Range in native species richness (ex 2022)			29 - 45

* No floristic data collected in 2015 (HLM)

** Floristic data collected according to BBAM (RPS)

A total of seven exotic species were recorded within Plot 1. Four of these exotic species were recorded as High Threat Weeds (HTW) under BAM (OEH, 2017) and two species are listed as a Weed of National Significance (WoNS) (Commonwealth of Australia, 2017). **Table 6** lists exotics species and associated listings.

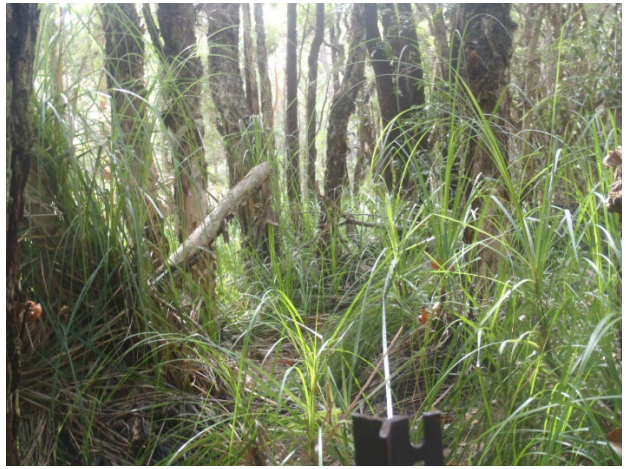
Table 6: Exotic species and associated listing

Scientific Name	Common Name	WoNS	HTW
Ageratina adenophora	Crofton Weed		YES
Conyza spp.			
Lantana camara	Lantana	YES	YES
Rubus fruticosus	Blackberry complex		
Senecio madagascariensis	Fireweed	YES	YES
Senna pendula var. glabrata			YES
Vicia spp.	Vetch		

3.2.1.1.2 Photo Monitoring

Photographs at specified monitoring points over the last 3 years are shown in **Table 7.**

Table 7: Plot 1 – photo monitoring points

		
2020 – Transect Start	2021 – Transect Start	2022 Transect Start
		
2020 – Transect End	2021 – Transect End	2022 – Transect End

2020 – North-east Corner

2021 - North-east Corner

2022 - North-east Corner

2020 – South-west Corner

2021 – South-west Corner

2022 – South-west Corner

2020 – South-east Corner

2021 - South-east Corner

2022- South-east Corner

2020 – North-west Corner

2021 – North-west Corner

2022 – North-west Corner

A comparison of images captured at the photo monitoring locations displays minimal variation in vegetation composition and structure, with any changes likely to be attributed to seasonal variations, or a change in camera positioning. Care will be taken in 2023 to ensure photos are lined up correctly.

3.2.1.2 Plot 2

3.2.1.2.1 Floristic Analysis

Tree canopy comprises *Allocasuarina littoralis* (Black She-Oak), *Angophora costata* (Sydney Red Gum), *Eucalyptus robusta* (Swamp Mahogany), *Eucalyptus resinifera* (Red Mahogany) and *Glochidion ferdinandi* (Cheese Tree), with *A. costata, E. resinifera* and *E. robusta* being the most dominant canopy species. The shrub layer was dominated by *Melaleuca linariifolia* (Flax-leaved Paperbark), *Leptospermum polygalifolium* (Tantoon) and *Exocarpos cupressiformis* (Cherry Ballart). Less dominant mid stratum species include *Dodonaea triquetra* (Large-leaf Hop-bush), *Banksia spinulosa* (Hairpin Banksia) and *Callistemon linearifolius* (Netted Bottle Brush) which is listed as vulnerable under the BC Act. Dominant species recorded within the understory include *Gahnia clarkei* (Tall Saw-sedge), *Entolasia stricta* (Wiry Panic), and *Pteridium esculentum* (Bracken). Species observed in Plot 2 are provided in **Appendix A.**

A total of 39 species were recorded, with 35 of these being native (**Table 8**).

Table 8: Plot 2 summary statistics – year on year native and introduced flora species richness

Year	Number of native flora species (per cent of total)	Number of introduced flora species (per cent total)	Total number of flora species
2022	**39 (89.7)**	**4 (10.3)**	**39**
2021	46 (93.9)	3 (6.1)	49
2020	45 (96)	2 (4.3)	47
2019	32 (82)	7 (18)	39
2018	39 (93)	3 (7)	42
2017**	36 (90)	4 (10)	40
2016**	30 (81)	1 (3)	37
2015*	-	-	-
Mean species richness (ex 2022)			42.3±4.7 SE
Mean introduced species richness (ex 2022)			3.3±2.1 SE
Mean native species richness (ex 2022)			38±6.6 SE
Range in native species richness (ex 2022)			30 - 46

* No floristic data collected in 2015 (HLM)

** Floristic data collected according to BBAM (RPS)

A total of four exotic species were recorded within Plot 2. **Table 9** lists exotics species and associated listings. Two species are listed as a Weed of National Significance (WoNS) (Commonwealth of Australia, 2017). *Lantana camara* and *R. fruticosus* are listed as a priority weed in the Hunter Local Land Services Region (New South Wales Government, 2017) under the *Biosecurity Act* 2017.

Table 9: Exotic species and associated listing

Scientific Name	Common Name	WoNS	HTW
Lantana camara	Lantana	YES	
Rubus fruticosus	Blackberry complex	YES	
Senna pendula var. glabrata			
Vicia spp.	Vetch		

3.2.1.2.2 Photo Monitoring

Photographs at specified monitoring points over the last 3 years are shown in **Table 10**.

Table 10: Plot 2 – photo monitoring points

		
2020 – Transect Start	2021 – Transect Start	2022 – Transect Start
		
2020 – Transect End	2021 – Transect End	2022 – Transect End

2020 – South-east Corner

2021 – South-east Corner

2022 – South-east Corner

2020 – South-west Corner

2021 - South-west Corner

2022 - South-west Corner

2020 – North-east Corner

2021 – North-east Corner

2022 – North-east Corner

2020 – North-west Corner

2021 – North-west Corner

2022 – North-west Corner

A comparison of images captured at the photo monitoring locations displays minimal variation in vegetation composition and structure, with any changes likely to be attributed to seasonal variations, or a change in camera positioning. Care will be taken in 2023 to ensure photos are lined up correctly.

3.2.2 VMA 2

VMA 2 consisted of one plot (Plot 3) of medium condition vegetation (**Figure 4**). Plot 3 exhibited increased number of exotic species within and surrounding the plot. The were no visual indicators of mining related activities or impacts (i.e., subsidence or ponding).

3.2.2.1 Plot 3

3.2.2.1.1 Floristic Analysis

Tree canopy comprises *Eucalyptus robusta* (Swamp Mahogany) and *Glochidion ferdinandi* (Cheese Tree). The shrub layer was dominated by *Melaleuca linariifolia* (Flax-leaved Paperbark), *Pittosporum undulatum* (Sweet Pittosporum), Native peach (*Trema tomentosa*) and *Ficus coronata* (Sandpaper Fig). Dominant species recorded within the understory include *Calochlaena dubia* (Rainbow Fern), Binung (*Christella dentata*), *Gahnia clarkei* (Tall Saw-sedge), *Oplismenus imbecillis*, and *Viola hederacea* (Ivy-leaved Violet). Species observed in Plot 3 are provided in **Appendix A.**

A total of 35 species were recorded, with 27 of these being native. This is the second highest native species count recorded in six years of monitoring (**Table 11**).

Table 11: Plot 3 summary statistics – year on year native and introduced flora species richness

Year	Number of native flora species (per cent of total)	Number of introduced flora species (per cent total)	Total number of flora species
2022	**27 (77.1)**	**8 (22.9)**	**35**
2021	30 (71.4)	12 (28.6)	42
2020	26 (68)	12 (31.6)	38
2019	25 (78)	7 (22)	32
2018	22 (65)	11 (32)	34
2017**	22 (73)	8 (27)	30
2016**	23 (72)	9 (28)	32
2015*	-	-	-
Mean species richness (ex 2022)			34.7±4.5 SE
Mean introduced species richness (ex 2022)			9.8±2.1 SE
Mean native species richness (ex 2022)			24.7±3.1 SE
Range in native species richness (ex 2022)			22 - 30

* No floristic data collected in 2015 (HLM)

** Floristic data collected according to BBAM (RPS)

A total of eight exotic species were recorded within Plot 3. Three of these exotic species are HTW under BAM (OEH, 2017). **Table 12** lists exotics species and associated listings.

Table 12: Exotic species and associated listing

Species Name	Common Name	WoNS	HTW
Ageratina adenophora	Crofton Weed		YES
Cirsium vulgare	Spear Thistle		
Ehrharta erecta	Panic Veldtgrass		YES
Rubus fruticosus	Blackberry complex	YES	
Senna pendula var. glabrata			YES
Solanum mauritianum	Wild Tobacco Bush		
Solanum nigrum	Black-berry Nightshade		
Verbena bonariensis	Purpletop		

3.2.2.1.2 Photo Monitoring

Photographs at specified monitoring points over the last 3 years are shown in **Table 13**.

Table 13: Plot 3 – photo monitoring points

		
2020 – Transect Start	2021 – Transect Start	2022 – Transect Start
		
2020 – Transect End	2021 – Transect End	2022 – Transect End

2020 – South-east Corner

2021 – South-east Corner

2022 – South-east Corner

2020 – South-west Corner

2021 – South-west Corner

2022 – South-west Corner

2020 – North-east Corner

2021 – North-east Corner

2022 – North-east Corner

2020 – North-west Corner

2021 – North-west Corner

2022 – North-west Corner

A comparison of images captured at the photo monitoring locations displays minimal variation in vegetation composition and structure, with any changes likely to be attributed to seasonal variations.

3.3 Endangered Ecological Community and Ground-water Dependant Ecosystem

A comparison of data collected since 2018 against PCT 1649 benchmarks are outlined in **Table 14.**

Table 14: Comparison of habitat attributes against PCT benchmark

Attribute	Benchmark	2018	2019	2020	2021	2022
VMA 1						
Composition						
Tree richness	4	5	5	5	4	5
Shrub richness	9	13	14	11	12	9
Grass & grass-like richness	7	8	11	7	9	8
Forb richness	6	8	7	8	5	5
Fern richness	2	3	3	2	4	3
Other richness	5	6	8	6	9	6
Exotic Richness	NA	6	10	6	6	6
High Threat Weed Richness	NA	3	8	4	1	2
Structure						
Tree cover	27	75	33	35	30	39
Shrub cover	19	63	74	39	37	35
Grass & grass-like cover	51	91	57	36	35	51
Forb cover	3	9	1	1	1	4
Fern cover	2	16	0	0	1	1
Other cover	3	8	1	1	2	2
Function						
Total length of fallen logs	44	9	27	18	26	1
Litter cover	44	81	84	67	60	69
No. of large trees (per 0.1ha)	5	0	0	1	0	1
VMA 2						
Composition						
Tree richness	4	2	2	2	2	2
Shrub richness	9	7	6	5	6	5
Grass & grass-like richness	7	4	4	7	4	6
Forb richness	6	7	6	7	9	8
Fern richness	2	1	2	1	4	1
Other richness	5	1	5	4	5	5
Exotic Richness	NA	11	7	12	12	8
High Threat Weed Richness	NA	4	4	4	3	2
Structure						
Tree cover	27	65	40.3	51	41	32
Shrub cover	19	37.6	30.7	32.3	17	24

Grass & grass-like cover	51	71	40.3	10.5	6	34
Forb cover	3	3.3	0.7	1.7	4	9
Fern cover	2	1	0.2	0.1	1	4
Other cover	3	0.5	0.6	0.6	1	6
Function						
Total length of fallen logs	44	27	41	51	35	8
Litter cover	44	84	43	97.6	72	71
No. of large trees (per 0.1ha)	5	0	5	3	1	8

Green = above benchmark, Red = below benchmark, Orange = equal to benchmark

Results from Plots 1 and 2 in VMA 1 were averaged to compare with Plot 3 found in VMA 2. Results for VMA 1 were generally above the PCT benchmark. Attributes that fell below the PCT benchmark include forb richness, grass and grass like cover, fern cover, other cover, total length of fallen logs and number of large trees. All of these except forb cover were repeated triggers from 2021.

Results from VMA 2 were mostly above the PST benchmark with tree, shrub, fern and grass & grass-like richness, grass & grass-like cover and total length of fallen logs falling below benchmark. Some substantial observations could be made in the reductions in grass and grass like cover over the last two years, with cover being 71%, 40.3%, 10.5% and 6% in 2018, 2019, 2020 and 2021 respectively. Conversely, cover in 2022 recorded a slight rise at 34%, which was still below the benchmark.

3.4 *Callistemon linearifolius* (Netted Bottlebrush) Monitoring

A comparison of the health of *C. linearifolius* is outlined in **Table 15**. A total of eight *C. linearifolius* were relocated during the 2021 monitoring event. Umwelt had initially marked and tagged nine individuals. One individual (150) was unable to be relocated. Individuals appeared to have been impacted by heavy water flow during the 2020 monitoring event, with some individuals having broken branches resulting from the accumulation of debris around their stems. Individual 157 was unable to be located during the 2022 survey. In the 2023 monitoring event the site will be stringently searched for individual 157, and if it is unable to be found it will be assumed that this individual has died and/or been washed away during a flooding event. Five out of seven individuals surveyed recorded signs of no change in condition from the previous year. The other two individuals showed a decline in condition from the previous year. As per the recommendations from 2021, two additional *C. linearifolius* individuals (individuals 159 and 160) were surveyed to allow for more rigorous analysis of condition of the population within the EEC.

Table 15: *C. linearifolius* height and condition

	2019		2020		2021		2022	
Plant I.D.	Height (m)	Condition	Height (m)	Condition	Height (m)	Condition	Height (m)	Condition
150	2.3	Healthy	-	-	-	-	-	-
151	2.15	Healthy	2.3	Slightly stressed*	2.3	Slightly Stressed*	2.2	Slightly stressed**
152	1.7	Healthy	1.7	Slightly stressed*	1.7	Slightly Stressed*	1.6	Stressed**
153	1.03	Healthy	1.0	Slightly stressed*	1.0	Healthy	1.1	Healthy
154	0.45	Healthy	0.9	Slightly stressed**	0.9	Healthy	1.2	Healthy
155	1.9	Healthy	2.3	Healthy	2.3	Healthy	2.2	Healthy
156	1.12	Slightly stressed	2.0	Slightly stressed	2.0	Slightly Stressed	1.8	Slightly stressed**
157	2.0	Healthy	2.0	Slightly stressed**	2.0	Healthy	-	Unable to be located

158	1.72	Healthy	1.6	Healthy	1.6	Healthy	1.85	Slightly stressed**
159	-	-	-	-	-	-	1.6	Healthy
160	-	-	-	-	-	-	2.0	Healthy

*Broken stem, **Browning leaves/ dieback. Red indicates decline in condition, Green indicates no change, or increased condition.

Additional morphological and reproductive attributes (i.e., leaf growth, presence of flowers or fruit) were recorded to assess the condition of *C. linearifolius.* These attributes are outlined in **Table 16**.

Table 16: Additional condition assessment attributes

Plant I.D.	New leaf Growth (Y/N)	Flowers (Y/N)	Fruit (Y/N)
151	N	N	Y
152	Y	N	Y
153	Y	N	N
154	Y	N	N
155	Y	N	Y
156	N	N	Y
157	Y	N	N
158	Y	N	Y
159	Y	Y	N
160	Y	Y	N

Fruit – refers to the presence of fruit from the previous year

4 DISCUSSION

Section 3 presents the results from the 2022 EEC Monitoring event for comparison with data collected by Umwelt in 2018 and 2019. Data collected prior to these monitoring events was collected under BBAM and was therefore not directly comparable.

Plot 1 of VMA 1 recorded an above average total count of native species since 2015 (33 species), with a corresponding native percent of total species being 82.5%. This was slightly lower than the previous monitoring event. Total number of exotic species observed numbered seven, a reduction of one species since the previous monitoring event. Similarly, the percent of total exotics species was effectively unchanging with values of 17.6% and 17.5% for 2021 and 2022 respectively. Attributes that fell below the BAM benchmark for PCT 1649 include shrub richness, forb richness, tree cover, grass & grass-like cover, forb cover, fern cover, other cover, total length of fallen logs and number of large trees.

Plot 2 of VMA 1 recorded the third highest number of native species since 2015 (39 species), with a reduction of the precent total of native species from 93.9% in 2021 to 89.7% in 2022. Total count of exotic species had increased from three species in 2021 to four species in 2022. Similarly, the percent total of exotic species increased from 6.1% in 2021 to 10.3% in 2022. Attributes that fell below the PCT benchmark include fern richness, other richness, fern cover, total length of fallen logs and number of large trees.

The comparison of vegetation and habitat attributes against PCT benchmarks for VMA 1 recorded negligible variations in exceedances from the previous monitoring event. Results for VMA 1 were generally above the PCT benchmark. Most of the values below the benchmark were repeated triggers from 2021. Whilst slight variation was recorded in floristic data, photo monitoring shows vegetation and habitat composition to be relatively similar to previous monitoring results.

Plot 3 of VMA 2 recorded the second highest native species count since monitoring began (27 species). There was also an increase in percent total of native species throughout the plot between the 2021 and 2022 monitoring events (71.4% to 77.1% respectively). Total exotic species was lower than the previous monitoring event (8 species compared to 12 species in 2021). A slight reduction in percent total of exotics species was observed between the 2021 and 2022 monitoring events (28.6% and 22.9% respectively). Vegetation and habitat attributes were mostly above the corresponding PCT benchmark. Previous monitoring events have also outlined elevated exotic species presence in the plot. This is likely a consequence of initial condition of the plot and subsequent management over time.

Variations in species composition and structure could be influenced by several variables including:

- High water flow moving vegetative material and sediments throughout the creek line, transporting potential weed propagative material and removing lower stratum habitat features and vegetation;
- Seasonal variation in weather patterns influencing the occurrence of some species; and
- Potential variations in plot location (particularly at the edges of the plots).

The reduced condition of *C. linearifolius* individuals can be primarily attributed to impacts related to heavy water flow experienced within the riparian zone during the 2020 monitoring event. During the 2022 monitoring event, signs of stabilisation for individuals was observed with new leaf growth present on most individuals.

Results from the 2022 EEC monitoring indicate no immediate impacts of concern on PCT 1649: *Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and Southeast Corner Bioregions EEC* from mining related activities. Floristic data and comparisons of habitat attributes have remained relatively constant to prior monitoring events, with any slight variations likely attributed to variables unrelated to mining operations.

4.1 Recommendations

The incursion of exotic species is evident in both VMAs and has the potential to negatively impact the overall condition of the EEC. Of most concern is VMA 1, which currently is regarded to be in ‘high’ condition. VMA 2 has constantly fallen below PCT benchmark and recorded higher levels of exotic species. As this VMA is only regarded as ‘moderate’ condition, resilience to weed incursion and associated impacts is not as high. The observed increase in exotic species percentage cover over time indicates that weed species recruitment in these VMAs will continue if not appropriately managed.

The following recommendations aim to maintain the integrity of the EEC and improve study design and repeatability:

- It is recommended that ongoing weed management plan occur, with primary focus on those species that have the highest percent cover of the plot and are listed as high threat weeds. Species lists outlining target species can be found in **Appendix A**; and
- Sample size of the *C. linearifolius* should be further increased to allow for more rigorous analysis of condition of the population within the EEC. An increase in sample size would assist in mitigating any impacts associated in the potential loss of individuals from environmental factors (i.e., flooding).

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Appendix A
Species List

				Plot 1		Plot 2		Plot 3	
Scientific Name	**Exotic**	**Common Name**	**HTW**	**Cover**	**Abundance**	**Cover**	**Abundance**	**Cover**	**Abundance**
Acacia longifolia				1	2				
Ageratina adenophora	*	Crofton Weed	YES	0	2			2	50
Allocasuarina torulosa		Forest Oak				3	6		
Angophora costata		Sydney Red Gum		5	5	20	10		
Austrostipa pubescens						0	2		
Banksia serrata		Old-man Banksia				0	10		
Banksia spinulosa		Hairpin Banksia				2	5		
Blechnum cartilagineum		Gristle Fern		0	15				
Breynia oblongifolia		Coffee Bush		0	10	0	2	0	5
Callistemon linearifolius		Netted Bottle Brush				1	7		
Calochlaena dubia		Rainbow Fern		0	15	2	40	5	50
Carex spp.				0	5			0	5
Cayratia clematidea		Native Grape						0	25
Centella asiatica		Indian Pennywort		0	10				
Christella dentata		Binung						4	50
Cirsium vulgare	*	Spear Thistle						0	3
Clematis aristata		Old Man's Beard						0	15
Conyza spp.	*			0	10				
Cymbidium spp.						0	5		
Dampiera spp.						0	10		
Desmodium varians		Slender Tick-trefoil		0	5			0	5
Dianella caerulea var. producta				0	10	3	50	0	20
Dichondra repens		Kidney Weed						2	500
Dioscorea transversa		Native Yam		0	2				
Dodonaea triquetra		Large-leaf Hop-bush		0	25	0	15		
Ehrharta erecta	*	Panic Veldtgrass	YES					15	3,000
Entolasia marginata		Bordered Panic						1	50
Entolasia stricta		Wiry Panic		0	25	15	500		
Eucalyptus resinifera		Red Mahogany				3	2		
Eucalyptus robusta		Swamp Mahogany		15	10	25	15	30	15
Eucalyptus sclerophylla		Hard-leaved Scribbly Gum		1	2				
Exocarpos cupressiformis		Cherry Ballart				2	1		
Ficus coronata		Creek Sandpaper Fig						3	20
Gahnia clarkei		Tall Saw-sedge		45	300	35	300	4	50
Geitonoplesium cymosum		Scrambling Lily		0	15				
Gleichenia dicarpa		Pouched Coral Fern		0	5				
Glochidion ferdinandi		Cheese Tree		3	5	3	10	2	10
Gonocarpus teucrioides		Germander Raspwort				0	50		
Goodenia heterophylla						1	200		
Hydrocotyle peduncularis								1	200
Imperata cylindrica		Blady Grass		0	10				
Juncus spp.								1	15
Kunzea spp.						0	2		
Lantana camara	*	Lantana	YES	1	10	0	15		

Lastreopsis microsora		Creeping Shield Fern		0	3					
Lepidosperma laterale		Variable Sword-sedge				0	5			
Leptospermum polygalifolium		Tantoon		1	1	5	20			
Lindsaea linearis		Screw Fern				1	40			
Lindsaea microphylla		Lacy Wedge Fern		0	3					
Livistona australis		Cabbage Palm		0	2					
Lobelia gibbosa		Tall Lobelia						0	15	
Lobelia purpurascens		Whiteroot		0	5	0	25			
Lomandra longifolia		Spiny-headed Mat-rush		1	10					
Lomandra obliqua						0	25			
Melaleuca linariifolia		Flax-leaved Paperbark		30	25	15	20	10	15	
Microlaena stipoides		Weeping Grass		1	25	2	25	3	200	
Oplismenus imbecillis				1	200			25	3,000	
Oxalis perennans				0	15			0	10	
Pandorea pandorana		Wonga Wonga Vine		0	5					
Parsonsia straminea		Common Silkpod		0	10	0	25	1	50	
Pittosporum undulatum		Sweet Pittosporum		10	20	2	10	10	40	
Poa spp.						0	2			
Polyscias sambucifolia		Elderberry Panax		1	15	0	15			
Rubus fruticosus	*	Blackberry complex		0	10	0	5	0	10	
Senecio madagascariensis	*	Fireweed	YES	0	5					
Senna pendula var. glabrata	*			1	5	0	25	1	25	
Sigesbeckia orientalis		Indian Weed						0	10	
Solanum mauritianum	*	Wild Tobacco Bush						0	3	
Solanum nigrum	*	Black-berry Nightshade						0	5	
Themeda triandra						2	25			
Trema tomentosa		Native Peach						1	10	
Verbena bonariensis	*	Purpletop						0	10	
Veronica plebeia		Trailing Speedwell						0	10	
Vicia spp.	*	Vetch		0	5	0	2			
Viola hederacea		Ivy-leaved Violet				2	100	5	1,000	
Xanthorrhoea spp.						1	2			

* Exotic Species

High Threat Weeds (HTW)


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