



Jellinbah Coal Mine Mackenzie North Quarterly Air and Noise Report July – September 2024

PREPARED FOR
Jellinbah Mining Pty Ltd

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Abbreviations:

AARC	AARC Environmental Solutions Pty Ltd
AS	Australian Standard
AV	Adjustment Value
BAM	Beta-Attenuation Monitor
bg	background noise level
CV	Critical Value
dBA, dB(A)	Decibel measurement according to the “A” - weighted scale.
EA	Environmental Authority
EMM	EMM Consulting Pty Limited (EMM)
GDA94	Geodetic Datum of Australia 1994
Hz	Hertz
Jellinbah	Jellinbah Mining Pty Ltd
L ₁	Noise level which is exceeded for 1% of the measurement period
L ₁₀	Noise level which is exceeded for 10% of the measurement period
L ₉₀	Noise level which is exceeded for 90% of the measurement period
L _{Aeq}	Equivalent continuous ‘A-weighted’ sound
L _{Amin}	Minimum ‘A-weighted’ noise level
L _{A1,adj,15min}	‘A-weighted’ noise level which is exceeded for 1% of the 15-minute measurement period
L _{Aeq,adj,15min}	Equivalent Continuous Sound Level recorded over the 15-minute measurement period
m/s	metres per second
mg/m ² /day	milligrams per square metre per day
ML	Mining Lease
NATA	National Association of Testing Authorities
PM ₁₀	Particulate Matter with an aerodynamic diameter less than 10 micrometres (µm)
TARP	Trigger Action Response Plan

1 Executive summary

This quarterly analysis report for the Mackenzie North mine assesses the air quality and noise monitoring data during the July to September 2024 monitoring period. Air quality data was collected between June 6th and September 5th, 2024.

Jellinbah will continue to implement mitigation measures where required in response to elevated particulate matter, dust or noise levels, following the Air Quality and Noise management plans.

1.1 Air quality monitoring

Jellinbah monitors PM₁₀ dust impacts at sensitive receptors in real-time via the BAM unit. During this monitoring period, the BAM unit was located at Scrubee (July) and Tarcoola (August to September).

PM₁₀ dust data from the BAM unit indicated that exceedances over the EA limit of 50 µg/m³ were recorded during two days in September. The exceedances were investigated to determine any potential contribution from mining activities.

Dust deposition analysis was also completed for this monitoring period via the dust deposition gauges set up at various locations surrounding Mackenzie North. The results showed dust levels for insoluble solids at sensitive receptor monitoring sites J3 and J6 were below the EA limit.

1.2 Noise monitoring

Noise monitoring was conducted in August 2024 for the six-monthly noise monitoring assessment. The full noise assessment report is provided in Appendix A. The assessment determined that one measurement at Jellinbah 1 indicated a marginal L_{Aeq} exceedance of 1 dB; and three measurements at Jellinbah 1 indicated L_{Aeq} exceedances of 4 to 5 dB, and L_{A1} exceedances of 3 to 4 dB.

It is understood that there have not been any noise complaints since the last noise measurements were conducted in March 2024. Jellinbah has advised that the noise level exceedances were not due to operational emergencies, incidents or exceptions and therefore notification to the administering authority is not required.

In accordance with EA Condition E5 and the NMP, Jellinbah is to continue to implement noise abatement measures so that emissions of noise from the activity do not result in environmental nuisance.

2 Introduction

This report has been prepared by AARC Environmental Solutions (AARC) on behalf of Jellinbah Mining Pty Ltd (Jellinbah). The purpose of this report is to assess the quarterly air quality and noise monitoring data collected from monitoring locations in the vicinity of the Mackenzie North mining operations. The monitoring period for this quarterly assessment is between July and September 2024.

This report will investigate any instances where Environmental Authority (EA) limits (Schedule B: Air, and Schedule E: Noise and Vibration) and Noise Management Plan criteria have been exceeded during the reporting period. It will also outline any recommendations, where required, for mitigation measures to prevent elevated dust and noise levels. The Air Quality and Noise Management Plans, prepared by AARC for Jellinbah, are the primary guiding reports for monitoring outside of the EA conditions.

2.1 Project background

The Mackenzie North Mine is an extension of the Jellinbah Coal Mine project, north of the Mackenzie River. The Mackenzie North operational area consists of four mining leases (MLs): ML 70445, ML 70446, ML 70448, and ML 70449. The open-cut mine has replaced the production from the finished Jellinbah Plains pit, thus maintaining overall mine production rates at currently approved levels.

Activities that have occurred during the reporting period at the Mackenzie North Mine include:

- stripping and stockpiling of topsoil ahead of mining;
- overburden removal ahead of mining in the pit;
- mining of coal seams in pit;
- crushing and hauling of coal material; and
- progressive rehabilitation activities.

2.2 Sensitive receptors

Sensitive receptors are residences or commercial locations that have the potential to be impacted by air quality or noise impacts arising from the activities at Jellinbah Coal Mine. The key sensitive receptors for potential dust and noise emissions from Mackenzie North are listed in Table 1 and shown in Figure 1.

Table 1: List of Mackenzie North Sensitive Receptors

Name	Approximate Distance to Mackenzie North Mining Lease Area (km)	Easting (GDA94 Z55)	Northing (GDA94 Z55)
Jellinbah 1 (Old Jellinbah Homestead)	6	688715	7429754
Jellinbah 2 (Jellinbah Homestead)	8	697280	7439294
Tarcoola	10	704858	7434955
Scrubee	5	701434	7428272

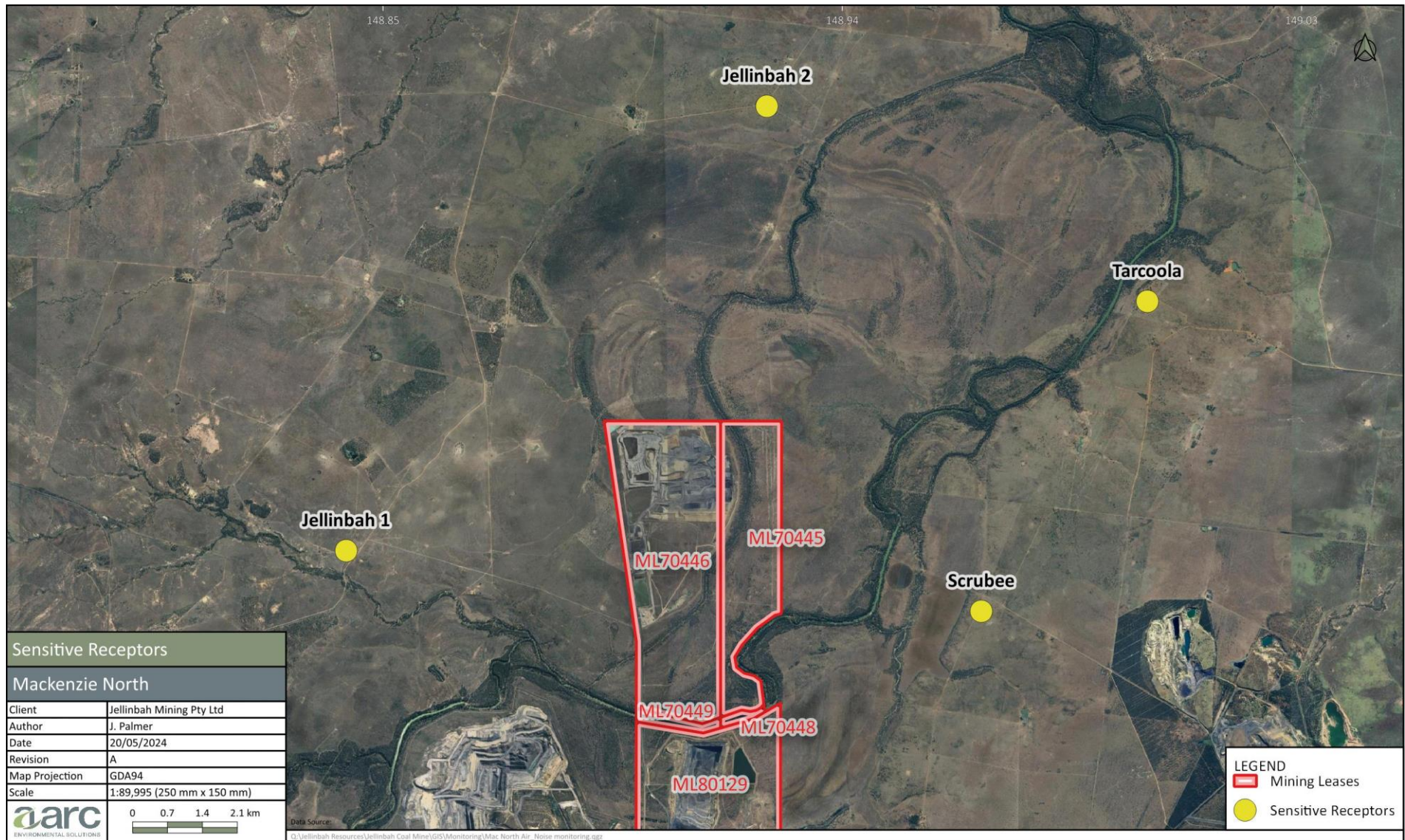


Figure 1: Mackenzie North sensitive receptors

3 Air quality monitoring

3.1 Beta-Attenuation Monitor (BAM)

3.1.1 Equipment and methodology

In late July 2020 Jellinbah commissioned and installed a solar-powered Beta-Attenuation Monitor (BAM) to monitor PM₁₀ dust levels at sensitive receptors surrounding the Mackenzie North Mine. BAM units are considered a ‘best-practice’ methodology to undertake monitoring for PM₁₀ dust and are considered more reliable than DustTrak units.

The BAM unit is solar-powered and mounted on a trailer to enable it to be moved regularly between the sensitive receptors. Using the BAM unit, Jellinbah can monitor PM₁₀ dust levels in real-time via an online portal. The unit has alarms set up to notify key personnel when dust levels are approaching, or exceeding, the limits defined in the EA or when adverse meteorological conditions are encountered (i.e. high wind speeds and when the wind is blowing in the direction of a sensitive receptor).

During the review period spanning between July and September 2024, the scheduled locations of the BAM were at Scrubee (July) and Tarcoola (August and September) in accordance with the monitoring schedule presented in

Table 2.

Table 2: *BAM Monitoring Schedule*

Month	Sensitive Receptor
January	Jellinbah 1
February	Jellinbah 1
March	Jellinbah 1
April	Jellinbah 2
May	Jellinbah 2
June	Scrubee
July	Scrubee
August	Tarcoola
September	Tarcoola
October	Jellinbah 2
November	Jellinbah 2
December	Jellinbah 1

The Air Quality Management Plan (AARC 2024) includes a proposed amendment to the BAM monitoring schedule based on a review of local prevailing wind directions and historical onsite and regional PM₁₀ level monitoring. On the basis of the dominating easterly wind direction and the PM₁₀ results, the recommended schedule includes rotationally moving the BAM unit at Jellinbah 1 and Jellinbah 2 sites as they are expected to be most affected by the mine. The periods at each location are as follows:

- September to February (Spring, Summer): Jellinbah 1 (west of mine)
- March to August (Autumn, Winter): Jellinbah 2 (north of mine)

The monitoring location may be modified in the future based on data collected, complaints received, or a change in prevailing meteorological conditions. The proposed schedule may be considered for future quarterly monitoring periods.

3.1.2 Meteorological station

Jellinbah operates a meteorological station at Mackenzie North that records rainfall, temperature, wind direction, and wind speed to identify periods when nearby sensitive receivers are at risk of elevated dust levels. Access to frequent and real-time meteorological data, with alarms set on the BAM unit, means that Jellinbah can quickly alter operations (if required) to reduce the potential for impacts at sensitive receptors, in accordance with the dust management Trigger Action Response Plan (TARP). Rainfall recorded during the monitoring period is shown in Figure 2.

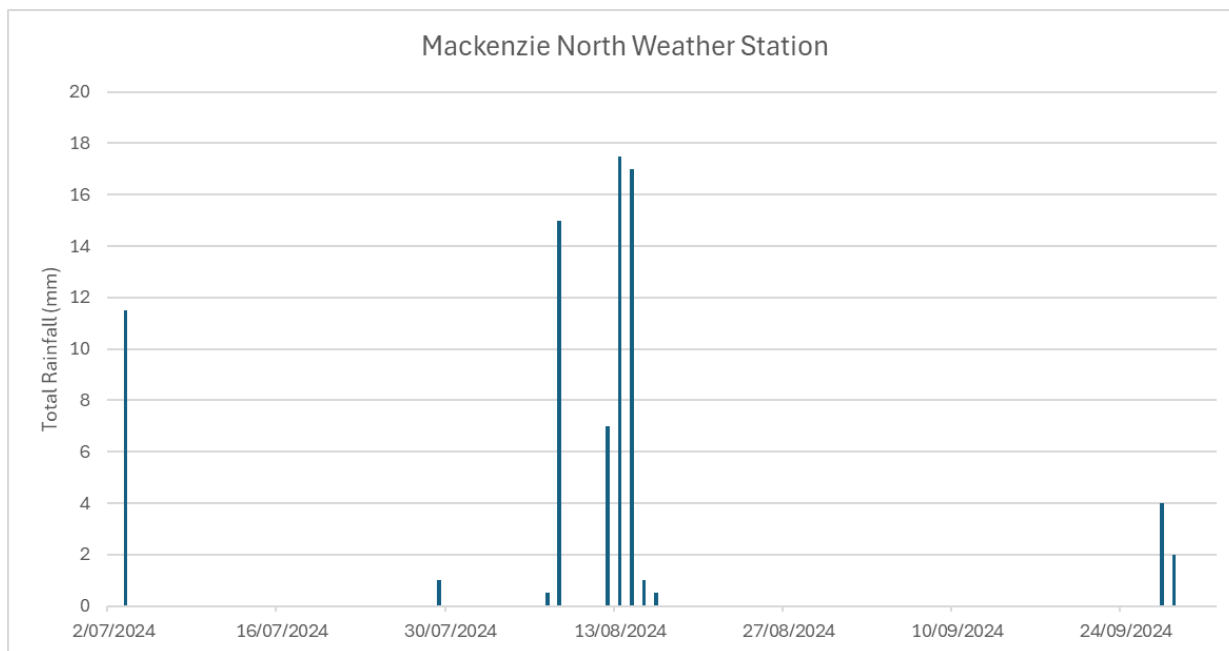


Figure 2: Daily rainfall (mm) from July to September 2024

3.1.3 PM₁₀ monitoring results

As per EA condition B3, the concentration of particulate matter with an aerodynamic diameter of less than 10 micrometres (µm) (PM₁₀) suspended in the atmosphere should not exceed 50 micrograms per cubic meter over a 24-hour averaging time at any sensitive receptor downwind of operations.

Monitoring data recorded hourly from 1st July to 30th September is presented in Figure 3. Among the recorded data, the 24-hr average particulate matter concentrations ranged between 1.5 to 71.1 µg/m³. An investigation into the exceeded results is included in section 3.1.3.1.

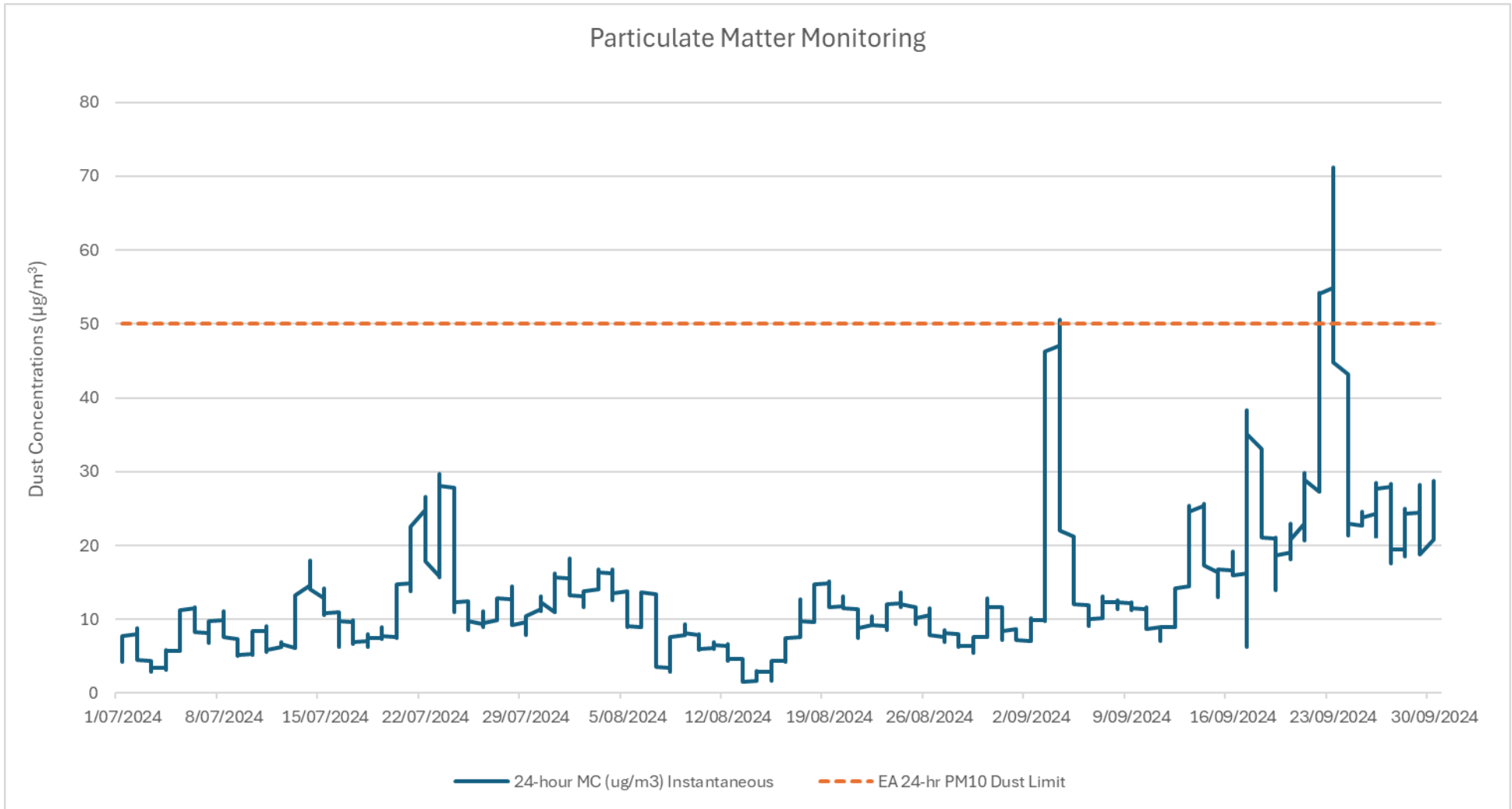


Figure 3: 24-hr average PM10 dust concentrations between July and September 2024

3.1.3.1 Investigation into PM₁₀ exceedance

Elevated PM₁₀ levels at sensitive receptor locations have been investigated in accordance with the Air Quality management plan. The Level 1 TARP response was also reviewed to determine appropriate management actions and mitigation measures if required.

Exceedances were observed in Figure 3 above the EA limit of 50 µg/m³ during the monitoring period. The exceedances occurred continuously from September 22nd at 22:00 (52.8 µg/m³) until September 23rd at 21:00 (53.9 µg/m³), peaking with the highest value recorded (71.1 µg/m³) on the 23rd between 14:00 and 15:00.

The wind direction, velocity and recurrence frequency are shown in Figure 4 for September. During this month, the prevailing winds were from the east-northeast to the east-southeast. The Tarcoola sensitive receptor where the BAM unit was sitting at the time of the monitoring is located northeast of the Mackenzie North mining operations and not downwind.

This supports the conclusion that the exceedance recorded at the sensitive receptor by the BAM unit is unlikely to have been caused by mining activities during this period. The elevated dust deposition at Tarcoola was more likely to have been caused by an extraneous source, such as local disturbance from adjacent land use activities.

Despite the average hourly wind not being in the direction of the sensitive receptor where the BAM was located (Tarcoola), the Level 1 alarm trigger conditions apply for short-term dust level spikes since dust levels exceeded the EA limit approaching a 24-hour period. Under the Level 1 TARP, real-time meteorological data, dust data, and visual dust levels on site should be monitored for signs of improvement following the continued implementation of mitigation measures.

It should be noted that elevated PM₁₀ levels rarely occur at Jellinbah, with the last 24-hour PM₁₀ exceedance occurring in October 2023. This indicates that management and mitigation measures are implemented effectively at Mackenzie North.

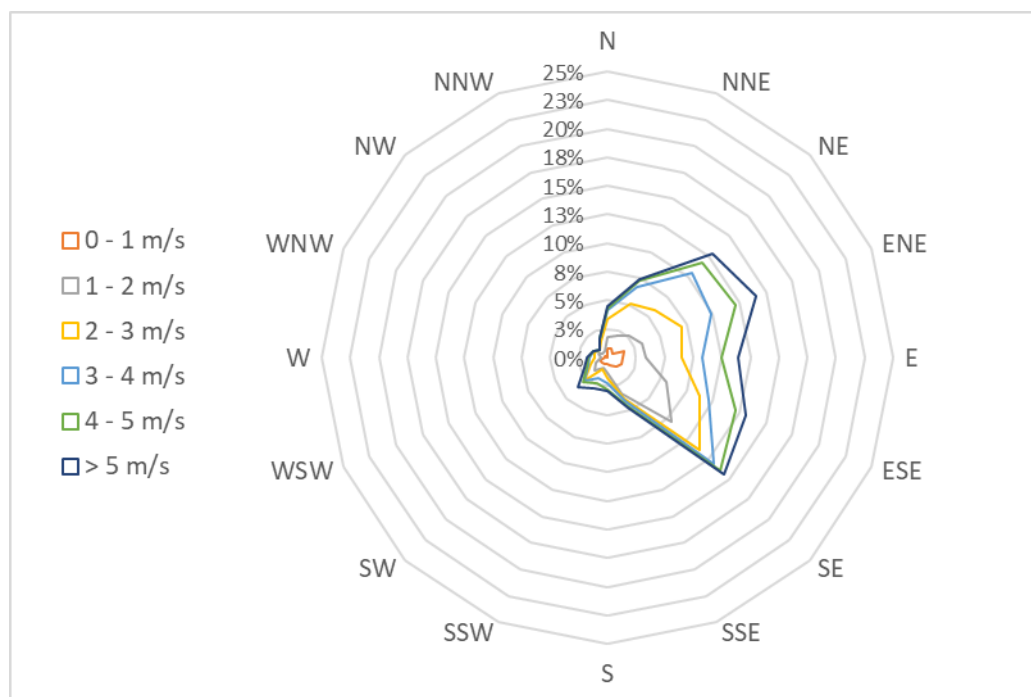


Figure 4: Wind rose graph from Jellinbah Mackenzie North station (September 2024).

3.2 Dust deposition monitoring

3.2.1 Equipment and methodology

Dust deposition monitoring has been undertaken at various locations surrounding the Mackenzie North Mine since February 2018. The dust deposition monitoring program monitors Jellinbah’s compliance with the EA, whereby Jellinbah must ensure that dust particulate emissions generated by mining activities do not exceed the limit specified in the EA (120 mg/m²/day, averaged over one month) at any sensitive receptor.

The dust deposition gauges/bottles are intended to collect larger dust fall out particles than what is collected with the BAM unit. The dust deposition bottles are collected approximately every 30 days and sent to a NATA accredited laboratory, where the samples are analysed for ash content, combustible matter, total soluble matter, total insoluble matter, and total solids, in order to assist in determining the potential source of dust emissions.

It is worth noting that as the dust deposition bottles are sent off and analysed on a monthly basis, it is difficult to implement immediate mitigation measures in response to a single elevated level of dust deposition. Jellinbah is able to implement mitigation measures if it becomes apparent that dust deposition levels are significantly elevated upon receiving the previous month’s data. This includes a review of the associated meteorological factors (such as wind direction) which may have since changed, potentially reducing the need for additional mitigation measures or significant changes to the current level of mitigation measures being applied.

Dust deposition monitoring locations surrounding Mackenzie North are listed in Table 3 and can be seen in Figure 5.

Table 3: Location of Mackenzie North dust deposition gauges

Site ID	Sensitive Receptor	Easting (GDA94 Z55)	Northing (GDA94 Z55)	Description
J2	-	696,930	7,434,336	Approximately 2km north of the Mackenzie North Mining Leases.
J3	Yes	688,933	7,429,662	Old Jellinbah Homestead (Jellinbah 1).
J4	-	691,714	7,429,806	Approximately 3km east of Old Jellinbah Homestead and J3.
J5	-	690,525	7,427,550	Approximately 3km south-east of Old Jellinbah Homestead and J3. Approximately 1km north of Curragh mine.
J6	Yes	697,497	7,439,274	Jellinbah Homestead (Jellinbah 2).
J7	-	699,159	7,429,044	Approximately 3km west of Scrubee (across Mackenzie River).
J8	-	696,412	7,429,438	Eastern side of Mackenzie River Anabranch (within the Mackenzie North Mining Leases (ML 70445)).

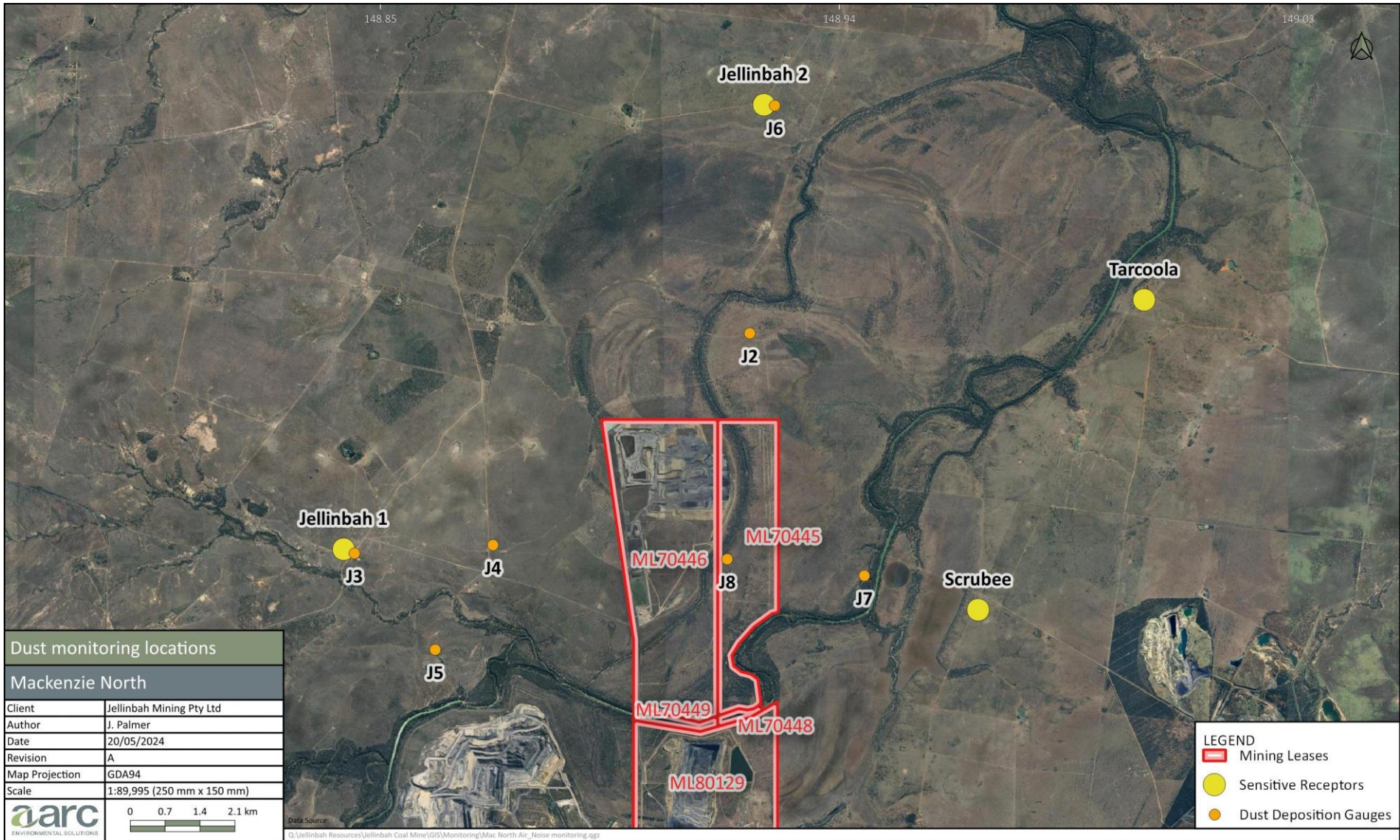


Figure 5: Mackenzie North dust deposition monitoring sites

3.2.2 Dust deposition monitoring results

Dust Deposition monitoring data collected for the locations in Table 3 during the reporting period can be seen in Figure 6. During the month of July, dust deposition samples were not collected due to wet weather; however, they were then collected in August. As such, Figure 6 shows the results for June to August together, then August to September based on the dates sampled. Dust bottles are collected mid-month and the last collection was on 5th September 2024.

Dust deposition gauges J3 and J6 monitor dust impacts at sensitive receptors. Results greater than the EA limit of 120 mg/m²/day identified at monitoring locations J3 and J6 may require management action. Dust deposition gauges J2, J4, J5, J7 and J8 are for interpretational purposes only and are not located at sensitive receptors. Elevated dust levels (>120 mg/m²/day) at J2, J4, J5, J7 and J8 are not considered exceedance events.

The dust deposition results in Figure 6 indicated no insoluble solids concentrations above the EA limit at any monitoring location.

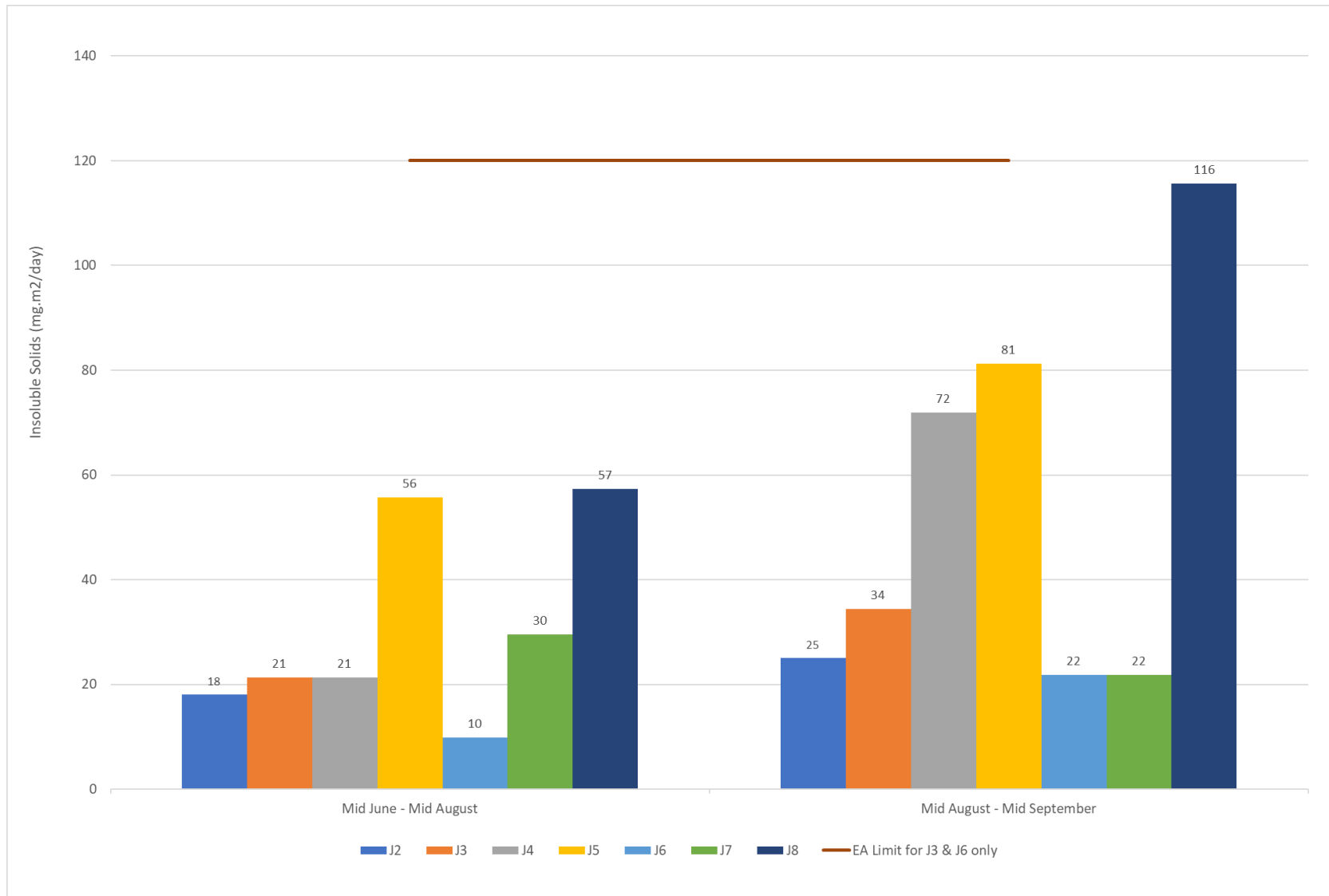


Figure 6: Dust deposition data recorded between the 06th of June 2024 and 5th of September 2024

4 Noise monitoring assessment

Noise monitoring was conducted by AARC on behalf of Jellinbah for the six-monthly noise monitoring assessment in August 2024. The purpose of this noise assessment was to investigate any exceedances of the EA noise limits in relation to the Mackenzie North mine. The assessment also considers the extent to which the mine operations contribute to noise levels in comparison to surrounding mines such as Curragh and Yarrabee. The full noise assessment report is provided in Appendix A.

Noise monitoring was conducted on the night of 8th to 9th August 2024 between 10:02 pm and 2:51 am. Measurements at Jellinbah 1 and 2 were conducted by an AARC field Engineer and measurements at Scrubee and Tarcoola were conducted by 4T Consultants.

The current noise monitoring methodology consists of attended noise monitoring at four (4) sensitive receptors, and simultaneous unattended noise logging at two (2) locations near the neighbouring mines to assist with noise source identification (as shown in Table 5 and Figure 7).

Table 4: Noise Monitoring Locations for January-March 2024 review period

#	Nearest receptor	Monitoring location	Coordinates (UTM) ¹	
			Easting (m)	Northing (m)
Sensitive locations				
A	Jellinbah 1 (Old Jellinbah Homestead)	Located beside the dirt track which merges with the dirt track between Jellinbah 1 and 2 sites. This site was chosen as representative of the homestead but removed from mechanical noise occurring at the homestead itself. Approximately 250 metres east of the homestead.	689016	7429800
B	Jellinbah 2 (Jellinbah Homestead)	Located beside the dirt track on the western side of the property, approximately 200 metres west of the nearest residence.	696996	7439286
C	Scrubee	Located on the northern side of an intersection of dirt tracks, approximately 400 metres east of the homestead.	701877	7428401
D	Tarcoola	Located on the southern side of an intersection of dirt tracks, approximately 850 metres south-east of the homestead.	705637	7434470
Additional monitoring locations				
L1	Curragh North Mine	Located in a triangular fenced site beside a dirt track, approximately 700 metres north of the Curragh North mine disturbance area. This site is accessed via a north-south track on the southern side of the dirt track between Mackenzie North mine and Jellinbah 1.	691165	7426631
L2	Yarrabee Mine	Located beside a bend in the dirt track leading to Scrubee homestead, approximately 900 metres west of the Yarrabee mine disturbance area.	703972	7426930

Note: 1: Recorded coordinates were indicated to be +/- 5 metres accuracy according to the phone GPS application

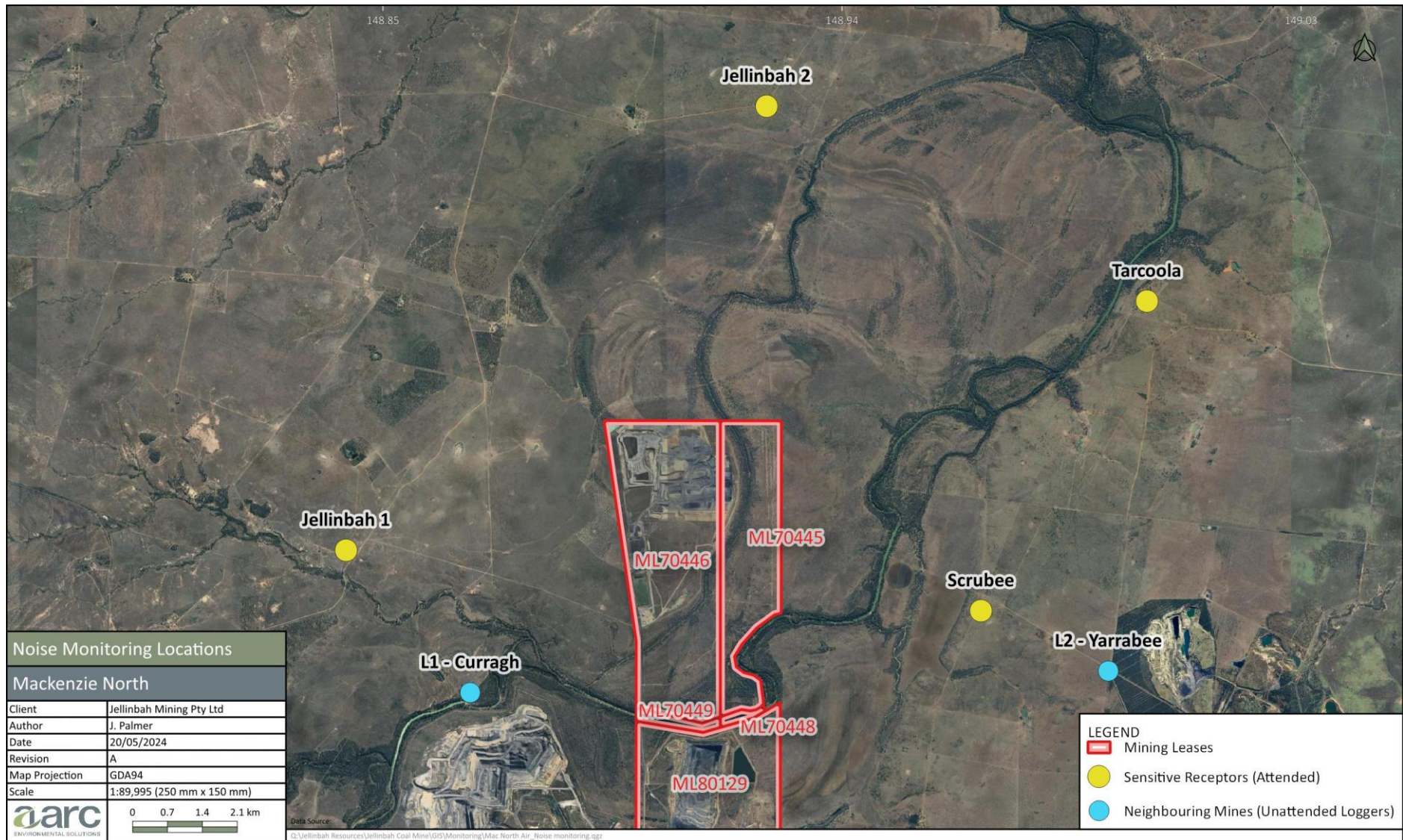


Figure 7: Mackenzie North noise monitoring site

4.1 Methodology

The noise monitoring methodology can be summarised for the monitoring period as follows:

- four (4) type 1 (as per Australian Standards) sound level meters with 1/3 octave centre band frequency and audio recording capabilities were used for the monitoring;
- measurements were undertaken during the night period to capture the noise environment while Jellinbah Mine is operating, and to minimise contamination by extraneous noise sources;
- unattended noise loggers were setup at two locations to assist with identifying the amount of contribution of mine noise from the Curragh and Yarrabee mines;
- multiple attended 15-minute noise measurements were completed at the following locations during the night-time period:
 - Jellinbah 1;
 - Jellinbah 2;
 - Scrubee; and
 - Tarcoola

All attended measurement data was analysed and tabulated alongside weather conditions obtained from the meteorological station at Mackenzie North. This station records rainfall, temperature, wind direction and wind speed to identify periods when nearby sensitive receivers are at risk of elevated noise levels.

4.2 Sensitive receptor noise limits

Sensitive receptor noise limits developed from the Jellinbah EA (Table E1) are shown in Table 5.

Table 5: Sensitive Receptor Noise Criteria

Sensitive Receptor Noise Criteria (dBA)						
Noise level dB(A) measured as:	Monday to Saturday			Sunday and Public Holidays		
	7am – 6pm	6pm – 10pm	10pm – 7am	9am – 6pm	6pm – 10pm	10pm – 9am
<i>L_{Aeq, adj, 15min}</i>	CV = 50 AV = 5	CV = 45 AV = 5	CV = 40 AV = 0	CV = 45 AV = 5	CV = 40 AV = 5	CV = 35 AV = 5
<i>L_{A1, adj, 15min}</i>	CV = 55 AV = 10	CV = 50 AV = 10	CV = 45 AV = 5	CV = 50 AV = 10	CV = 45 AV = 10	CV = 40 AV = 5

Note:

CV = critical value

AV = adjustment value

c) To calculate noise limits in Table E1:

i) If $bg < (CV - AV)$: Noise limit = $bg + AV$.

ii) If $(CV - AV) < bg < CV$: Noise limit = CV.

iii) If $bg > CV$: Noise limit = $bg = 0$.

d) In the event that measurement bg ($L_{A90, adj, 15min}$) is less than 30 dB(A), then 30 dB(A) can be substituted for the measured background level.

e) Bg = background noise level ($L_{A90, adj, 15min}$) measured over 3 – 5 days at the nearest sensitive receptor.

It is noted that the EA does not include fixed noise limits, but rather provides noise criteria where the limits are to be derived from background noise levels (i.e. noise levels measured in the absence of the mining noise). Background noise levels are reviewed in Noise Management Plan (NMP) (AARC 2023). On the basis of these background noise levels and the EA noise criteria in Table 5, the proposed limits presented in the NMP have been determined and are presented as follows in Table 6.

Table 6: Noise limits at a noise sensitive place

Sensitive Receptor Noise Criteria (dBA)						
Noise level dBA measured as:	Monday to Saturday			Sunday and Public Holidays		
	7am – 6pm	6pm – 10pm	10pm – 7am	9am – 6pm	6pm – 10pm	10pm – 9am
Jellinbah 1 (Old Jellinbah Homestead)						
L _{Aeq,adj,15min}	38	35	30	38	35	35
L _{A1,adj,15min}	43	40	35	43	40	35
Jellinbah 2 (Jellinbah Homestead)						
L _{Aeq,adj,15min}	35	35*	30	35	35*	35
L _{A1,adj,15min}	40	40*	35	40	40*	35
Scrubee						
L _{Aeq,adj,15min}	38	38*	30	38	38*	35
L _{A1,adj,15min}	43	43*	35	43	43*	35
Tarcoola						
L _{Aeq,adj,15min}	35	35*	30	35	35*	35
L _{A1,adj,15min}	40	40*	35	40	40*	35

Note: * these evening noise limits have been capped at day limits as discussed above.

The sensitive receptor noise limits apply to noise from Jellinbah mining activities only (as recorded at the relevant sensitive receptor), and not recorded total or cumulative noise levels. That is, extraneous noise, including noise from other mines, should be removed from noise measurement results prior to assessment against the EA noise criteria.

The following comments are provided regarding the calculated noise limits in Table 6:

- The L₁ noise limits are only 0 to 5 dB higher than the L_{eq} noise limits. The L₁ acoustic quality objectives within the Environmental Protection (Noise) Policy are 10 dB above the corresponding L_{eq} limits, and thus the L₁ limits are conservative with respect to the L_{eq} noise limits.
- The noise limits are to be adjusted ('adj') for tonality and impulsiveness. Generally, the noise from coal mines is not tonal or impulsive when considered over a 15-minute period, however, this will be considered further when monitoring results are presented.
- It is understood that the Land Court has generally enforced noise limits around 40 to 42 dBA L_{Aeq} in the daytime, and 35 dBA L_{Aeq} at night, and that these limits are commonly proposed for recent mining applications. Therefore, the EA noise criteria for this mine could be considered to result in conservative (strict) noise criteria, particularly for sensitive receptors that are not subject to cumulative noise impacts due to other nearby mines.

4.3 Attended noise monitoring results

The attended noise monitoring results, associated weather data, and the L_{eq} noise spectra associated with the measurements are detailed in Appendix A. The assessment considers eighteen (18) attended noise measurements across four (4) sites. The mining noise from Jellinbah was estimated after removing extraneous noise by filtering sound frequencies (e.g. removing higher frequencies affected by insect noise).

The L_{eq} and L_1 levels due to mining noise are listed in Table 7. Exceedances or potential exceedances are shaded blue.

Table 7: Summary assessment of mining noise levels

Location	Start time	Mining noise levels dBA		Jellinbah mining noise levels dBA		Mining noise limits dBA		Exceedance?		Weather (from onsite weather station)			
		L_{Aeq}	L_{A1}	L_{Aeq}	L_{A1}	L_{Aeq}	L_{A1}	L_{Aeq}	L_{A1}	Temp °C	RH%	Wind speed m/s	Wind dir'n deg
Jellinbah 1	10:02 PM	31	34	31	34	30	35	Yes, 1 dB	no	15	82	0.3	97
Jellinbah 1	10:21 PM	27	30	24	30	30	35	no	no	14	90	0.7	94
Jellinbah 1	10:40 PM	25	28	22	28	30	35	no	no	14	92	0.9	92
Jellinbah 2	11:29 PM	21	22	21	22	30	35	no	no	14	92	1.2	117
Jellinbah 2	11:47 PM	21	24	21	24	30	35	no	no	14	87	1.3	121
Jellinbah 2	12:07 AM	19	21	19	21	30	35	no	no	14	87	1.1	138
Jellinbah 1	12:53 AM	34	38	34	38	30	35	Yes, 4 dB	Yes, 3 dB	14	84	1.6	123
Jellinbah 1	01:11 AM	35	39	35	39	30	35	Yes, 5 dB	Yes, 4 dB	14	84	1.6	123
Jellinbah 1	01:28 AM	35	39	35	39	30	35	Yes, 5 dB	Yes, 4 dB	14	85	1.4	127
Scrubee	10:27 PM	31	35	NM ¹	NM ¹	30	35	no	no	14	90	0.7	94
Scrubee	10:57 PM	32	35	NM ¹	NM ¹	30	35	no	no	14	91	0.9	101
Scrubee	11:27 PM	29	34	NM ¹	NM ¹	30	35	no	no	14	92	1.2	117
Tarcoola	12:18 AM	NM ²	NM ²	NM ¹	NM ¹	30	35	no	no	14	88	1.1	141
Tarcoola	12:43 AM	NM ²	NM ²	NM ¹	NM ¹	30	35	no	no	14	84	1.3	128
Tarcoola	01:08 AM	NM ²	NM ²	NM ¹	NM ¹	30	35	no	no	14	85	1.8	127

Location	Start time	Mining noise levels dBA		Jellinbah mining noise levels dBA		Mining noise limits dBA		Exceedance?		Weather (from onsite weather station)			
		L _{Aeq}	L _{A1}	L _{Aeq}	L _{A1}	L _{Aeq}	L _{A1}	L _{Aeq}	L _{A1}	Temp °C	RH%	Wind speed m/s	Wind dir'n deg
Scrubee	01:54 AM	31	35	NM ¹	NM ¹	30	35	no	no	13	90	1.6	128
Scrubee	02:15 AM	29	34	NM ¹	NM ¹	30	35	no	no	13	86	1.2	129
Scrubee	02:36 AM	26	31	NM ¹	NM ¹	30	35	no	no	13	95	1.2	139

Note: ¹: Noise from Mackenzie North was inaudible or barely audible and was not measurable.

²: Mine noise was inaudible.

Overall, the assessment of the noise levels that were attended to resulted in the following outcomes:

- 14 of 18 measurements were compliant for both L_{Aeq} and L_{A1} parameters, with no exceedances.
- 1 measurement at Jellinbah 1 indicated a marginal L_{Aeq} exceedance of 1 dB.
- 3 measurements at Jellinbah 1 indicated L_{Aeq} exceedances of 4 to 5 dB, and L_{A1} exceedances of 3 to 4 dB.

4.3.1 Mine activities

Jellinbah Mining has provided figures in Appendix A, which show the equipment locations during the period of elevated noise levels (i.e., approximately midnight to 2 am). Jellinbah Mining noted that a dozer (DZ1240) and dump trucks were operating on the western side of the mining area, at a similar location to where the main mining noise was heard to originate by AARC.

4.4 Unattended noise monitoring

Unattended noise loggers are used to assist with determining the contribution of other mines to the overall mine levels in the attended noise measurements. The other mines being Curragh North mine to the west, nearer Jellinbah 1 and 2 receptors, and Yarrabee mine to the east, nearer Scrubee and Tarcoola receptors.

When mining noise levels determined from attended measurements are found to be compliant with the noise limits, it is unnecessary to provide the additional noise source analysis using unattended noise monitoring results. In this instance, the analysis has determined that mining noise levels do not comply with the noise limits, and therefore analysis of unattended noise monitoring is required.

The results in Appendix A demonstrated that from the two filtered noise levels lines in section 3.6 of Appendix A it can be determined that mine noise near Curragh mine increased during the night and was higher during the second set of measurements at Jellinbah 1.

Whilst the graph indicates an increasing Curragh noise level, at Jellinbah 1, the noise from Curragh was only audible in the first set of measurements. It was inaudible in the second set of measurements. Therefore, the increase in noise levels shown may be due to the more favourable meteorological conditions for noise propagation (rather than an increase in noise being generated by Curragh mine); and this change in meteorological conditions has increased noise from both Curragh and Jellinbah mines.

Noise from Yarrabee is not presented as it was not a contributing source to the excessive mine noise levels.

4.5 Conclusions and recommendations

It is understood that there have not been any recent noise complaints. Jellinbah has advised that the noise level exceedances were not due to operational emergencies, incidents or exceptions and therefore notification to the administering authority is not required.

In accordance with EA Condition E5 and the Noise Management Plan, Jellinbah is to continue to implement noise abatement measures so that emissions of noise from the activity do not result in further environmental nuisance. The following recommendations are proposed:

- Review meteorological conditions at time of exceedances and historically, to determine which conditions are more likely to result in exceedances. This information should be considered in conjunction with meteorological conditions noted in the NMP Trigger Action Response Plan (TARP).
- Review equipment utilisation across the night, to determine if there was an increase in equipment quantity, or whether equipment was moved to a location which would likely result in the higher noise levels measured later in the night. Review this data in comparison to future equipment expectations to understand potential future noise levels.
- As a result of the above reviews, propose and implement measures to reduce noise levels in accordance with the EA and NMP.

Appendix A. Noise Monitoring Assessment



Jellinbah Coal Mine

Mackenzie North

Six-Monthly Noise Monitoring – August 2024

PREPARED FOR
Jellinbah Mining Pty Ltd

November 2024

Document Control

Project Name:	Jellinbah Coal Mine
Report Title:	Six-monthly Noise Monitoring – August 2024
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Project Manager:	Stephen Pugh

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1 Introduction

AARC Environmental Solutions Pty Ltd (AARC) has been commissioned by Jellinbah Mining Pty Ltd to undertake a six-monthly noise monitoring assessment in relation to Mackenzie North Mine at Jellinbah (the Project). This report addresses the monitoring conducted in August 2024. This report will investigate any exceedances of Environmental Authority (EA) noise limits.

1.1 Historical results

Noise monitoring has been conducted on a regular basis since 2019, as summarised in Table 1.

Table 1: List of previous noise monitoring assessments

Monitoring date	Monitoring regime	Exceedances
2019 November	daytime attended measurements at 4 locations and 1-2 week logging at 4 locations	Nil
2020 September	daytime attended measurements at 4 locations and 4 week logging at 2 locations	Nil
2021 May	night attended measurements at 4 locations (no logging)	Potential exceedance at the sensitive receptor 'Jellinbah 2'
2022 February	night attended measurements at 2 locations and 1 week logging at 2 locations	Nil
2022 July	night attended measurements at 2 locations and 1-2 week logging at 3 locations	Nil
2023 February/ March	night attended measurements at 4 locations and overnight logging at 2 locations	Nil
2023 August	night attended measurements at 4 locations and overnight logging at 2 locations	Marginal (1 and 2 dB) exceedances at 'Jellinbah 1' and potential exceedances at 'Jellinbah 1' and 'Scrubee'
2024 March	night attended measurements at 4 locations and overnight logging at 2 locations	Marginal (1 and 2 dB) exceedances at 'Jellinbah 1'

A review of the past monitoring results indicates that exceedances, potential or otherwise, have been noted three times: in May 2021 at Jellinbah 2, in August 2023 at Jellinbah 1 and potentially Scrubee, and in March 2024 at Jellinbah 1.

The current noise monitoring methodology consists of attended noise monitoring at four (4) sensitive receptors, and simultaneous noise logging at two (2) locations near to the neighbouring mines to assist with noise source identification.

To aid in the understanding of the terms in this report a glossary is included in Appendix A.

1.2 Project Background

The Mackenzie North Mine is an extension of the Jellinbah Coal Mine, north of the Mackenzie River. The Mackenzie North Mine consists of four mining leases (MLs): ML 70445, ML 70446, ML 70448, and ML 70449. The Mackenzie North Mine has replaced the production from the currently inactive Jellinbah Plains pit, thus maintaining overall mine production rates at currently approved levels.

Activities that have occurred during the reporting period at the Mackenzie North Mine include:

- stripping and stockpiling of topsoil ahead of mining;
- overburden removal ahead of mining in the pit;
- mining of coal seams in pit; and
- crushing and hauling of coal material.

1.3 Sensitive Receptors

Sensitive receptors are residences or commercial locations which have the potential to be impacted by noise impacts arising from the activities at Jellinbah Coal Mine. The key sensitive receptors for potential noise emissions from Mackenzie North are listed in Table 2 and shown in Figure 1.

Table 2: List of Mackenzie North Sensitive Receptors

Name	Approximate distance to Mackenzie North Mining Lease Area (km)	Easting (GDA94 Z55)	Northing (GDA94 Z55)
Jellinbah 1 (Old Jellinbah Homestead)	6	688715	7429754
Jellinbah 2 (Jellinbah Homestead)	8	697280	7439294
Scrubee	5	701434	7428272
Tarcoola	10	704858	7434955

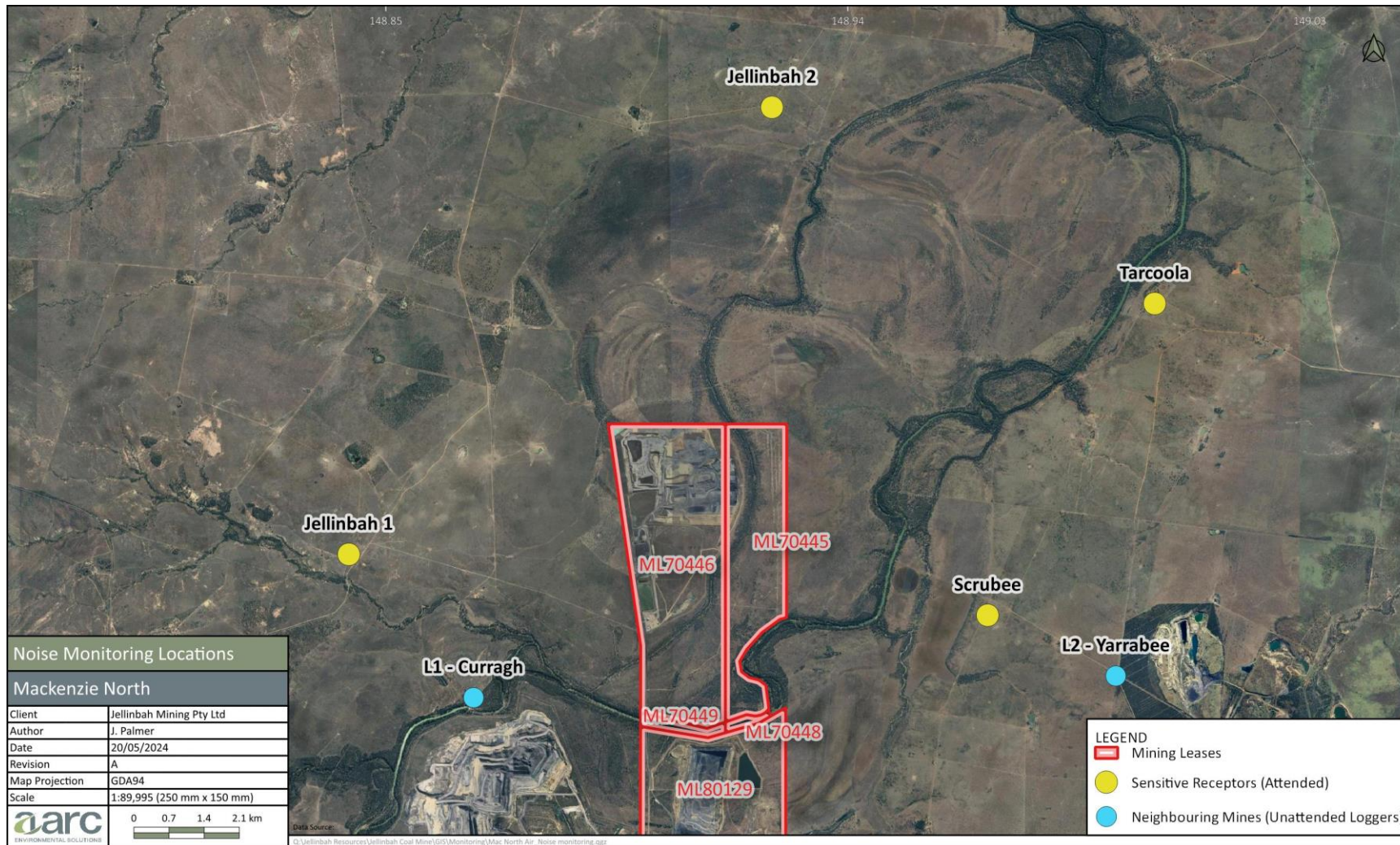


Figure 1: Mackenzie North noise monitoring sites

2 Legal obligations and acoustic criteria

2.1 Environmental Authority requirements

Environmental Authority EPML00516813 (the EA), issued on the 8th September 2022, authorises coal mining activities at the site. Section E of the EA deals specifically with noise, vibration, and air blast requirements. The noise nuisance related items are as follows.

E1 – The holder of this environmental authority must ensure that noise generated by the mining activities does not cause the criteria in Table E1 Noise limits at a noise sensitive place to be exceeded at a sensitive place or commercial place.

E2 – When requested by the administering authority, noise monitoring must be undertaken within a reasonable and practicable timeframe nominated by the administering authority to investigate any complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of the authorised officer) of environmental nuisance at any sensitive or commercial place, and the results must be notified within 14 days to the administering authority following completion of monitoring.

E3 – The method of measurement and reporting of noise levels must comply with the latest edition of the administering authority's Noise Measurement Manual.

E4 – If the environmental authority holder can provide evidence through monitoring that the limits defined in Table E1 Noise limits at a noise sensitive place, are not being exceeded then the holder is not in breach of condition E1. Monitoring must include a) $L_{A1,adj,15min}$; b) $L_{Aeq,adj,15min}$; and c) the level and frequency of occurrence of impulsive or tonal noise.

E5 – If monitoring indicates exceedance of the limits in Table E1 Noise limits at a noise sensitive place, then the environmental authority holder must: a) address the complaint including the use of appropriate dispute resolution if required; and b) immediately implement noise abatement measures so that emissions of noise from the activity do not result in further environmental nuisance.

E6 – The holder of this environmental authority must develop a Noise Management Plan prior to the commencement of mining activities within ML70445, ML70448 and ML70449.

E7 – The Noise Management Plan (as required under condition E6) must address, as a minimum, the following:

a) a procedure for routine monitoring of real time meteorological conditions (rainfall, temperature, wind direction and wind speed) at Mackenzie North to identify periods when nearby sensitive receivers are at risk of elevated noise levels;

b) implementation of a Trigger Action Response Plan, which will identify and initiate appropriate noise mitigation measures, for periods when adverse meteorological conditions combine with high mining intensity at Mackenzie North;

c) noise monitoring and recording on a regular basis (as defined within the Noise Management Plan) must include the following descriptor characteristics and matters: i) $L_{A1,adj,15min}$; ii) $L_{Aeq,adj,15min}$; ii) the level and frequency of occurrence of impulsive or tonal noise; and iii) atmospheric conditions including wind speed and direction, location, date and time of recording.

Table 3: EA Table E1: Noise limits at a noise sensitive place

Sensitive Receptor Noise Criteria (dBA)						
Noise level dB(A) measured as:	Monday to Saturday			Sunday and Public Holidays		
	7am – 6pm	6pm – 10pm	10pm – 7am	9am – 6pm	6pm – 10pm	10pm – 9am
<i>L_{Aeq, adj, 15min}</i>	CV = 50 AV = 5	CV = 45 AV = 5	CV = 40 AV = 0	CV = 45 AV = 5	CV = 40 AV = 5	CV = 35 AV = 5
<i>L_{A1, adj, 15min}</i>	CV = 55 AV = 10	CV = 50 AV = 10	CV = 45 AV = 5	CV = 50 AV = 10	CV = 45 AV = 10	CV = 40 AV = 5

Note:

CV = critical value

AV = adjustment value

c) To calculate noise limits in Table E1:

i) If $bg < (CV - AV)$: Noise limit = $bg + AV$.

ii) If $(CV - AV) < bg < CV$: Noise limit = CV.

iii) If $bg > CV$: Noise limit = $bg = 0$.

d) In the event that measurement $bg (L_{A90,adj,15min})$ is less than 30 dB(A), then 30 dB(A) can be substituted for the measured background level.

e) Bg = background noise level ($L_{A90,adj,15min}$) measured over 3 – 5 days at the nearest sensitive receptor.

It is noted that the EA does not include fixed noise limits, but rather provides noise criteria in Table E1 where the limits are to be derived from background noise levels (i.e. noise levels excluding mining noise).

Background noise levels are reviewed in the Jellinbah coal mine Noise Management Plan (NMP) (dated 25 September 2023). On the basis of these background noise levels and the EA noise criteria in Table 3, the proposed limits presented in the NMP have been determined and are presented as follows in Table 4.

Table 4: Noise limits at a noise sensitive place

Sensitive Receptor Noise Criteria (dBA)						
Noise level dBA measured as:	Monday to Saturday			Sunday and Public Holidays		
	7am – 6pm	6pm – 10pm	10pm – 7am	9am – 6pm	6pm – 10pm	10pm – 9am
Jellinbah 1 (Old Jellinbah Homestead)						
<i>L_{Aeq,adj,15min}</i>	38	35	30	38	35	35
<i>L_{A1,adj,15min}</i>	43	40	35	43	40	35
Jellinbah 2 (Jellinbah Homestead)						
<i>L_{Aeq,adj,15min}</i>	35	35*	30	35	35*	35
<i>L_{A1,adj,15min}</i>	40	40*	35	40	40*	35
Scrubee						
<i>L_{Aeq,adj,15min}</i>	38	38*	30	38	38*	35
<i>L_{A1,adj,15min}</i>	43	43*	35	43	43*	35
Tarcoola						
<i>L_{Aeq,adj,15min}</i>	35	35*	30	35	35*	35
<i>L_{A1,adj,15min}</i>	40	40*	35	40	40*	35

Note: * these evening noise limits have been capped at day limits as discussed above.

The sensitive receptor noise limits apply to noise from Jellinbah mining activities only (as recorded at the relevant sensitive receptor), and not recorded total or cumulative noise levels. That is, extraneous noise, including noise from other mines, should be removed from noise measurement results prior to assessment against the EA noise criteria.

The following comments are provided regarding the calculated noise limits in Table 4:

- The L_1 noise limits are only 0 to 5 dB higher than the L_{eq} noise limits. The L_1 acoustic quality objectives within the Environmental Protection (Noise) Policy are 10 dB above the corresponding L_{eq} limits, and thus the L_1 limits are conservative with respect to the L_{eq} noise limits.
- The noise limits are to be adjusted ('adj') for tonality and impulsiveness. Generally, the noise from coal mines is not tonal or impulsive when considered over a 15-minute period, however, this will be considered further when monitoring results are presented.
- It is understood that the Land Court has generally enforced noise limits around 40 to 42 dBA L_{Aeq} in the daytime, and 35 dBA L_{Aeq} at night, and that these limits are commonly proposed for recent mining applications. Therefore, the EA noise criteria for this mine could be considered to result in conservative (strict) noise criteria, particularly for sensitive receptors that are not subject to cumulative noise impacts due to other nearby mines.

2.2 Australian Standards and relevant guidelines

Noise monitoring has been conducted in accordance with relevant Australian Standards and Guidelines, including:

- AS1055: 2018 Acoustics – description and measurement of environmental noise; and
- the latest edition of the Queensland Noise Measurement Manual (NMM).

2.3 Noise Management Plan monitoring requirements

The Jellinbah coal mine NMP contains requirements for routine noise monitoring within Section 4.7, including:

- Noise monitoring to be undertaken on a regular 6-monthly basis.
- Attended noise monitoring is to be conducted at or near each of the four nominated sensitive receptors in Table 2.
- The attended monitoring should consist of multiple 15-minute measurements at each location between the period of 10pm and 5am.
- Unattended noise logging is to be conducted at two nominated locations near Curragh North and Yarrabee mines, over the period that attended noise monitoring is conducted.

Monitoring over the last two years has indicated that attended monitoring is the preferred method of routine compliance noise monitoring due to the need to isolate Jellinbah noise emissions from those generated by other nearby mines (Curragh and Yarrabee). The unattended monitoring is not to be assessed for compliance but rather is used to assist in determining noise source contribution in the attended noise monitoring results.

3 Noise monitoring assessment

3.1 Overview and Methodology

To quantify noise emissions from Jellinbah Mine, attended noise monitoring surveys of 15 minutes were completed at the four (4) locations as specified in the current NMP. Given that mining noise is often masked by local activities during the day and evening periods, the more stringent noise criteria for the night period and that site operations are relatively consistent in a 24-hour period, the monitoring targeted the night period. In this way, the contamination by extraneous noise sources is minimised.

Attended monitoring locations were selected based on proximity to the nearest homesteads, but not too close as to cause disturbance to residents when accessed at night-time, and sufficiently removed from noise generated at the homestead or surrounding area.

In addition to attended noise monitoring, unattended noise loggers were setup at two locations to assist with identifying the amount of contribution of mine noise from Curragh North mine (to west, nearer Jellinbah 1 and 2 receptors), and Yarrabee mine (to the east, nearer Scrubee and Tarcoola receptors).

3.2 Locations

Attended noise monitoring has been conducted at the four (4) sensitive receptors at Locations A to D and unattended noise logging has been conducted near the two neighbouring mines at Locations L1 and L2, as listed in Table 5 and shown on Figure 1.

Table 5: Attended noise monitoring locations

#	Nearest receptor	Monitoring location	Coordinates (UTM) ¹	
			Easting (m)	Northing (m)
Sensitive locations				
A	Jellinbah 1 (Old Jellinbah Homestead)	Located beside the dirt track which merges with the dirt track between Jellinbah 1 and 2 sites. This site was chosen as representative of the homestead but removed from mechanical noise occurring at the homestead itself. Approximately 250m east of the homestead.	689016	7429800
B	Jellinbah 2 (Jellinbah Homestead)	Located beside the dirt track on the western side of the property, approximately 200m west of the nearest residence.	696996	7439286
C	Scrubee	Located on the northern side of an intersection of dirt tracks, approximately 400m east of the homestead.	701877	7428401
D	Tarcoola	Located on the southern side of an intersection of dirt tracks, approximately 850m south-east of the homestead.	705637	7434470
Additional monitoring locations				
L1	Curragh North Mine	Located in a triangular fenced site beside a dirt track, approximately 700m north of the Curragh North mine disturbance area. This site is accessed via a north-south track on the southern side of the dirt track between Mackenzie North mine and Jellinbah 1.	691165	7426631
L2	Yarrabee Mine	Located beside a bend in the dirt track leading to Scrubee homestead, approximately 900m west of the Yarrabee mine disturbance area.	703972	7426930

Note: 1: Recorded coordinates were indicated to be +/- 5 metres accuracy according to the phone GPS application

Photos of monitoring locations L1 and L2 are included as Figure 2 and Figure 3.



Figure 2: Photo of noise monitoring equipment at Location L1 (near Curragh North mine)



Figure 3: Photo of noise monitoring equipment at Location L2 (near Yarrabee mine)

3.3 Equipment

Noise measurements have been undertaken with the equipment listed in Table 6.

Table 6: *Acoustic equipment for attended and unattended noise monitoring*

Item	Serial number	Calibration due date
Larson Davis 831 Type 1 sound level meter	2578	3/01/2025
Larson Davis 831 Type 1 sound level meter	3340	8/04/2026
Larson Davis 831 Type 1 sound level meter	3217	22/11/2025
Larson Davis CAL200 Type 1 acoustic calibrator	21716	26/09/2024
Norsonic NOR145	14529108	24/11/2024
Pulsar Model 105 Type 1 acoustic calibrator	96100	28/08/2024

3.4 Weather

The weather recorded by the field personnel and handheld weather meters, during the monitoring period, was fine with a cool temperature at night, and variable cloud cover. The wind varied between nil to light breeze.

The mines onsite weather station (Site 331422), for the night monitoring period (10:00 pm to 3:00 am), reported the following data:

- Temperature: 12 to 16 °C
- Relative humidity: 77 to 96%
- Wind speed (instantaneous): 0.3 to 1.8 m/s
- Wind direction (instantaneous): 35 (NE) to 141 (SE) degrees.

It is noted that the weather station reported winds from the east (81 to 105 degrees) between 10pm and 11:30pm, and then from the south-east (117 to 141 degrees) for the remainder of the night.

3.5 Attended noise monitoring results

Noise monitoring was conducted on the night of 8th to 9th August 2024 between 10:02 pm and 2:51 am. Measurements at Jellinbah 1 and 2 were conducted by a AARC field Engineer and measurements at Scrubee and Tarcoola were conducted by a 4T consultant.

The eighteen (18) attended noise monitoring results and associated weather data are summarised in Table 7.

Table 7: Attended noise monitoring results

Location	Start Time (Duration ¹)	Noise Levels dBA				Field notes on dominant noise sources (note: insects dominant on all measurements)	Weather (from onsite weather station)					Weather (observed) Cloud cover	Weather data acceptable ?
		L _{Aeq}	L _{A1}	L _{Aeq} (6.3Hz to 2kHz)	L _{Aeq} (6.3Hz to 630Hz)		Temp °C	RH%	Wind speed m/s	Wind dir'n deg	Rain mm		
Jellinbah 1	10:02 PM	31	34	31	31	Jellinbah mine dominant and estimated at ≤ 31 dBA	15	82	0.3	97	0	2/8	yes
Jellinbah 1	10:21 PM	27	31	27	26	Jellinbah and Curragh mines dominant at 27 dBA, and Jellinbah mine component estimated at 24 dBA	14	90	0.7	94	0	2/8	yes
Jellinbah 1	10:40 PM	25	29	24	24	Jellinbah and Curragh mines dominant at 25 dBA, and Jellinbah mine component estimated at ≤ 22 dBA	14	92	0.9	92	0	2/8	yes
Jellinbah 2	11:29 PM	21	23	19	17	Mine to south and local mechanical plant dominant at 21 dBA, and Jellinbah mine component estimated at < 21 dBA	14	92	1.2	117	0	2/8	yes
Jellinbah 2	11:47 PM	21	25	20	18	Mine to south, nearby animal and local mechanical plant dominant at 21 dBA, and Jellinbah mine component estimated at < 21 dBA	14	87	1.3	121	0	3/8	yes
Jellinbah 2	12:07 AM	19	22	18	16	Mine to south and local mechanical plant dominant at 19 dBA, and Jellinbah mine component estimated at < 19 dBA	14	87	1.1	138	0	3/8	yes
Jellinbah 1	12:53 AM	34	38	34	34	Jellinbah mine dominant and estimated at 34 dBA	14	84	1.6	123	0	4/8	yes

Location	Start Time (Duration ¹)	Noise Levels dBA				Field notes on dominant noise sources (note: insects dominant on all measurements)	Weather (from onsite weather station)					Weather (observed) Cloud cover	Weather data acceptable ?
		L _{Aeq}	L _{A1}	L _{Aeq} (6.3Hz to 2kHz)	L _{Aeq} (6.3Hz to 630Hz)		Temp °C	RH%	Wind speed m/s	Wind dir'n deg	Rain mm		
Jellinbah 1	01:11 AM	35	39	35	35	Jellinbah mine dominant and estimated at 35 dBA	14	84	1.6	123	0	4/8	yes
Jellinbah 1	01:28 AM	35	39	35	35	Jellinbah mine dominant and estimated at 35 dBA	14	85	1.4	127	0	3/8	yes
Scrubee	10:27 PM	31	37	31	30	Yarrabee mine and cattle dominant. Jellinbah mine inaudible.	14	90	0.7	94	0	3/8	yes
Scrubee	10:57 PM	32	45	32	26	Yarrabee mine and cattle dominant. Jellinbah mine inaudible.	14	91	0.9	101	0	3/8	yes
Scrubee	11:27 PM (9.5 mins)	29	39	29	26	Yarrabee mine and cattle dominant. Jellinbah mine inaudible.	14	92	1.2	117	0	3/8	yes
Tarcoola	12:18 AM (14.8 mins)	24	38	23	22	Cattle and operator dominant. Jellinbah mine inaudible.	14	88	1.1	141	0	2/8	yes
Tarcoola	12:43 AM	20	24	15	9	Cattle and operator dominant. Jellinbah mine inaudible.	14	84	1.3	128	0	2/8	yes
Tarcoola	01:08 AM	20	24	16	8	Cattle and operator dominant. Jellinbah mine inaudible or barely audible.	14	85	1.8	127	0	1/8	yes
Scrubee	01:54 AM (14.7 mins)	31	39	31	29	Yarrabee mine and cattle dominant. Jellinbah mine inaudible.	13	90	1.6	128	0	0/8	yes

Location	Start Time (Duration ¹)	Noise Levels dBA				Field notes on dominant noise sources (note: insects dominant on all measurements)	Weather (from onsite weather station)					Weather (observed) Cloud cover	Weather data acceptable ?
		L _{Aeq}	L _{A1}	L _{Aeq} (6.3Hz to 2kHz)	L _{Aeq} (6.3Hz to 630Hz)		Temp °C	RH%	Wind speed m/s	Wind dir'n deg	Rain mm		
Scrubee	02:15 AM	29	35	28	27	Yarrabee mine and cattle dominant. Jellinbah mine inaudible.	13	86	1.2	129	0	0/8	yes
Scrubee	02:36 AM	26	31	25	25	Yarrabee mine and cattle dominant. Jellinbah mine inaudible.	13	95	1.2	139	0	0/8	yes

Note: 1: Duration is 15.0 minutes unless listed in brackets.

The field notes in Table 7 indicate that mining (Jellinbah, Yarrabee or Curragh) was a contributing source in all but the three measurements at Tarcoola. Audio and spectral data suggests that mining noise was effectively negligible for those three measurements.

The measured noise levels are not considered to require an adjustment for tonality or impulsiveness.

The L_{Aeq} noise spectra associated with the measurements are shown in Figure 4 (for Jellinbah 1 and 2) and Figure 5 (for Scrubee and Tarcoola).

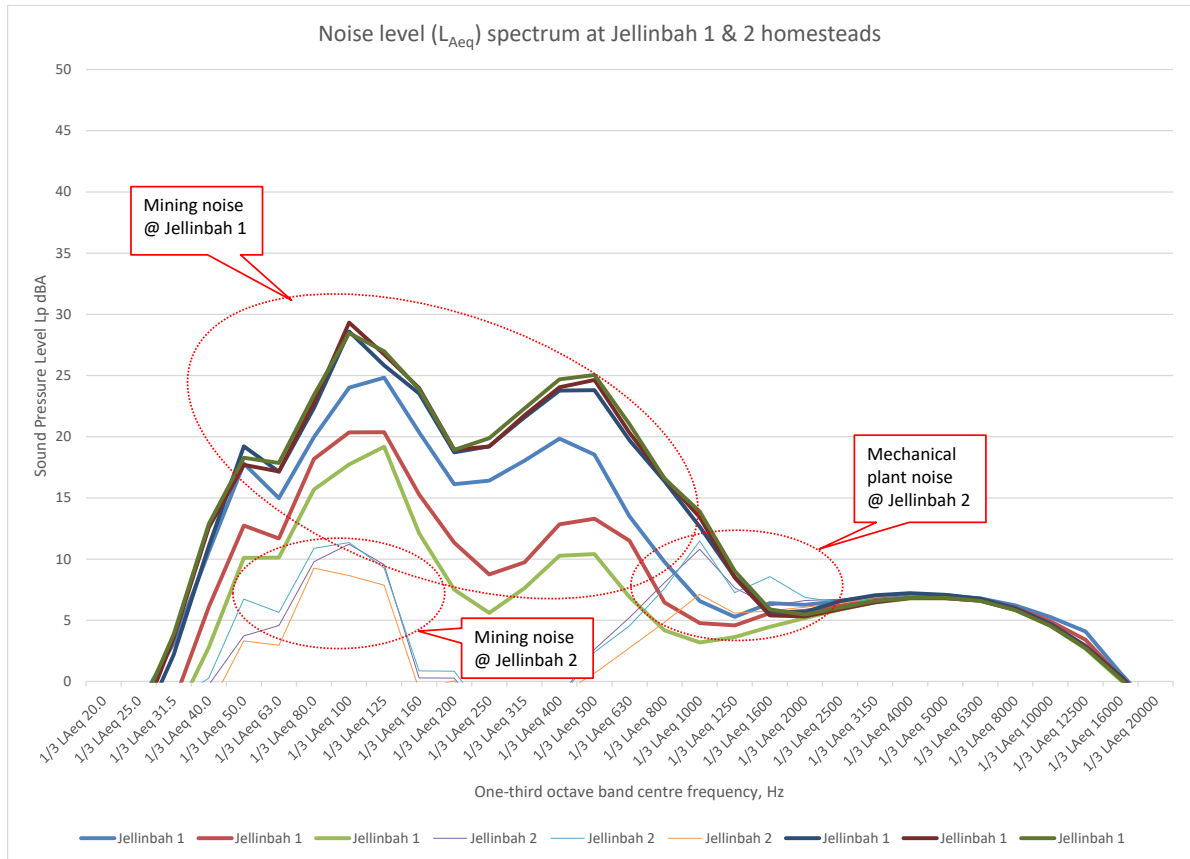


Figure 4: Noise spectra (L_{eq}) at Jellinbah 1 and 2

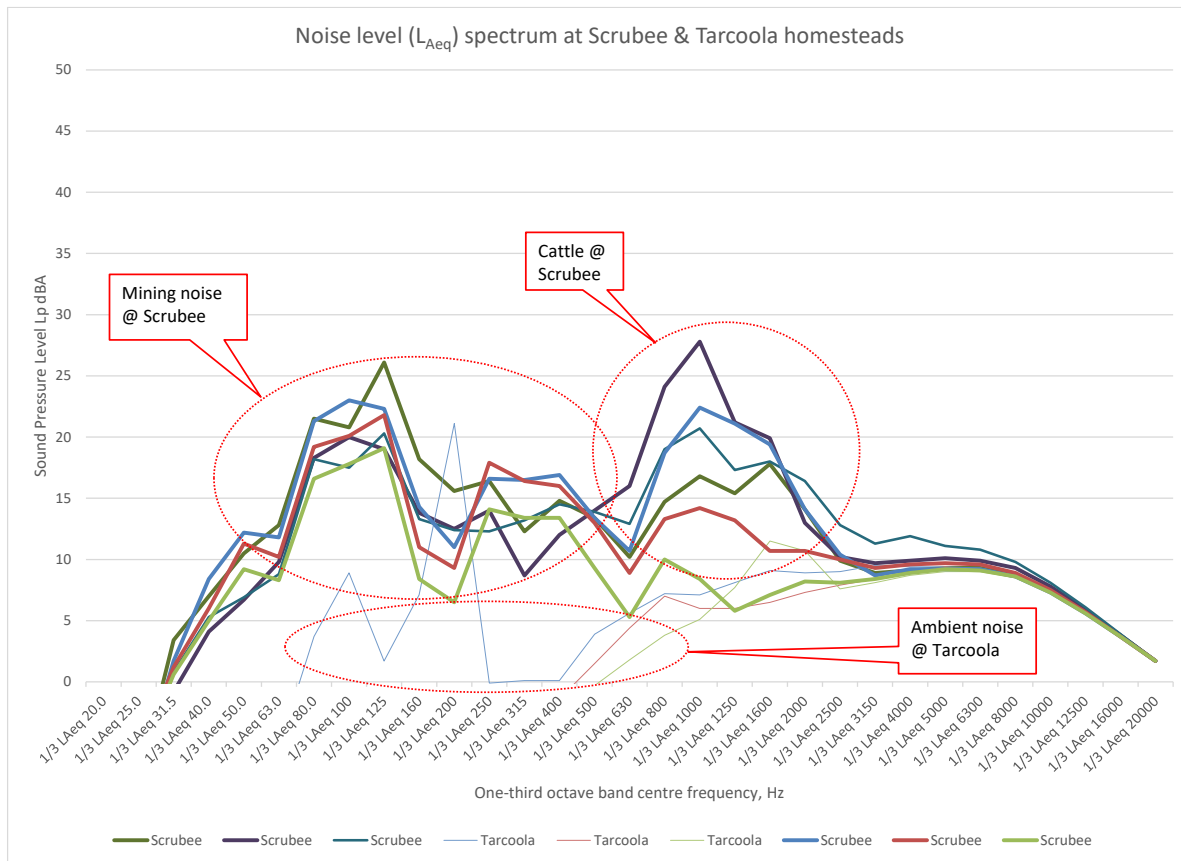


Figure 5: Noise spectra (L_{eq}) at Scrubee and Tarcoola

From Figure 4 and Figure 5 it can be seen that:

- Mining noise was particularly evident in the low frequencies, and this can be used in combination with observations by field staff, to determine the contribution of mine noise from Jellinbah mine.
- Noise from cattle was evident in multiple measurements.

3.5.1 Mining noise assessment

The observations from the field staff undertaking the noise measurements indicate that some L_{eq} and L_1 noise levels were significantly affected by extraneous noise, including cattle and noise from other (Curragh and Yarrabee) mines. Therefore, it is necessary to estimate the Jellinbah mining noise, by first removing the extraneous noise.

Removing extraneous noise has been undertaken by filtering sounds frequencies (e.g. removing higher frequencies affected by insect noise). In some instances, where Jellinbah mine is inaudible or not the dominant mine, it is not possible to accurately determine the noise level contribution of Jellinbah mine, and the mining noise level is labelled not measurable (NM).

If the loudest 1% of an attended 15-minute measurement is dominated by extraneous noise, then the corresponding L_1 noise level cannot be attributed to mining noise. It is possible to filter extraneous noise from the L_1 noise 1/3 octave band spectrum, but this does not result in the L_1 of mining noise. However, it can be stated that the L_1 due to mining noise is equal to or higher than the overall filtered L_1 level with extraneous noise removed.

The L_{eq} and L_1 levels due to mining noise are listed in Table 8 along with the weather data.

Table 8: Assessment of mining noise levels (exceedances or potential exceedances are shaded blue)

Location	Start time	Mining noise levels dBA		Jellinbah mining noise levels dBA		Mining noise limits dBA		Exceedance?		Weather (from onsite weather station)			
		L _{Aeq}	L _{A1}	L _{Aeq}	L _{A1}	L _{Aeq}	L _{A1}	L _{Aeq}	L _{A1}	Temp °C	RH%	Wind speed m/s	Wind dir'n deg
Jellinbah 1	10:02 PM	31	34	31	34	30	35	Yes, 1 dB	no	15	82	0.3	97
Jellinbah 1	10:21 PM	27	30	24	30	30	35	no	no	14	90	0.7	94
Jellinbah 1	10:40 PM	25	28	22	28	30	35	no	no	14	92	0.9	92
Jellinbah 2	11:29 PM	21	22	21	22	30	35	no	no	14	92	1.2	117
Jellinbah 2	11:47 PM	21	24	21	24	30	35	no	no	14	87	1.3	121
Jellinbah 2	12:07 AM	19	21	19	21	30	35	no	no	14	87	1.1	138
Jellinbah 1	12:53 AM	34	38	34	38	30	35	Yes, 4 dB	Yes, 3 dB	14	84	1.6	123
Jellinbah 1	01:11 AM	35	39	35	39	30	35	Yes, 5 dB	Yes, 4 dB	14	84	1.6	123
Jellinbah 1	01:28 AM	35	39	35	39	30	35	Yes, 5 dB	Yes, 4 dB	14	85	1.4	127
Scrubee	10:27 PM	31	35	NM ¹	NM ¹	30	35	no	no	14	90	0.7	94
Scrubee	10:57 PM	32	35	NM ¹	NM ¹	30	35	no	no	14	91	0.9	101
Scrubee	11:27 PM	29	34	NM ¹	NM ¹	30	35	no	no	14	92	1.2	117
Tarcoola	12:18 AM	NM ²	NM ²	NM ¹	NM ¹	30	35	no	no	14	88	1.1	141
Tarcoola	12:43 AM	NM ²	NM ²	NM ¹	NM ¹	30	35	no	no	14	84	1.3	128
Tarcoola	01:08 AM	NM ²	NM ²	NM ¹	NM ¹	30	35	no	no	14	85	1.8	127
Scrubee	01:54 AM	31	35	NM ¹	NM ¹	30	35	no	no	13	90	1.6	128

Location	Start time	Mining noise levels dBA		Jellinbah mining noise levels dBA		Mining noise limits dBA		Exceedance?		Weather (from onsite weather station)			
		L _{Aeq}	L _{A1}	L _{Aeq}	L _{A1}	L _{Aeq}	L _{A1}	L _{Aeq}	L _{A1}	Temp °C	RH%	Wind speed m/s	Wind dir'n deg
Scrubee	02:15 AM	29	34	NM ¹	NM ¹	30	35	no	no	13	86	1.2	129
Scrubee	02:36 AM	26	31	NM ¹	NM ¹	30	35	no	no	13	95	1.2	139

Note: ¹: Noise from Mackenzie North was inaudible or barely audible and was not measurable.

²: Mine noise was inaudible.

From Table 8 it can be seen that the measured noise levels indicated:

- 14 of 18 measurements were compliant for both L_{Aeq} and L_{A1} parameters, with no exceedances.
- 1 measurement at Jellinbah 1 indicated a marginal L_{Aeq} exceedance of 1 dB.
- 3 measurements at Jellinbah 1 indicated L_{Aeq} exceedances of 4 to 5 dB, and L_{A1} exceedances of 3 to 4 dB.

3.5.2 Mine activities

Jellinbah Mining has provided Figure 7 and Figure 8 in Appendix A2 which show the equipment locations during the period of elevated noise levels (i.e. approximately midnight to 2am). It was noted by Jellinbah Mining that a dozer (DZ1240) and dump trucks were operating on the western side of the mining area, at a similar location to where the main mining noise was heard to originate by AARC.

3.6 Unattended noise monitoring results

Unattended noise loggers are used to assist with determining the contribution of other mines to the overall mine levels in the attended noise measurements. The other mines being Curragh North mine to the west, nearer Jellinbah 1 and 2 receptors, and Yarrabee mine to the east, nearer Scrubee and Tarcoola receptors.

When mining noise levels determined from attended measurements are found to be compliant with the noise limits, it is not necessary to provide the additional noise source analysis using unattended noise monitoring results.

In this instance, the analysis has determined that mining noise levels exceed the noise limits on occasion, and therefore analysis of unattended noise monitoring is required.

The L_{eq} noise levels near Curragh mine in Figure 6. The green line in Figure 6 is not visible as it is covered by the blue line, and this has occurred because there was negligible insect noise.

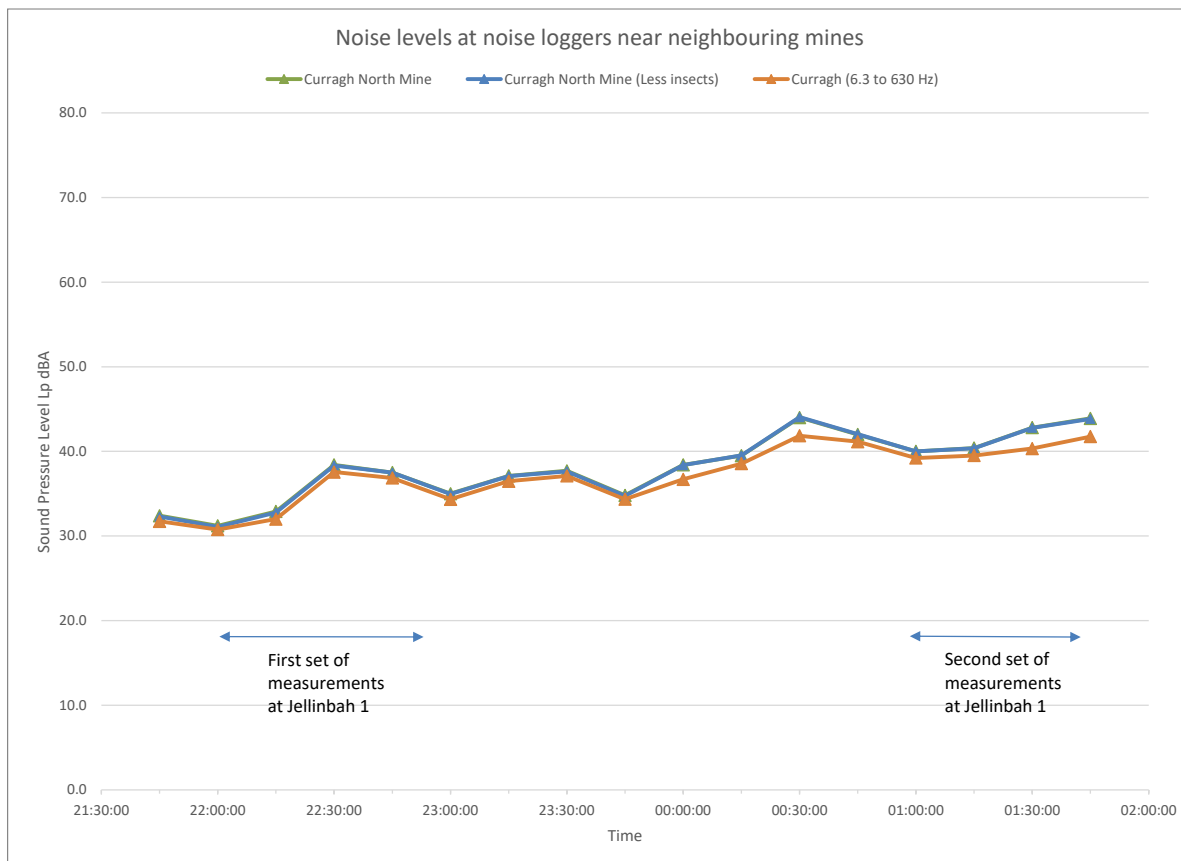


Figure 6: Noise levels (L_{eq}) near Curragh mine

From the two filtered noise levels lines in Figure 6 (i.e. blue and orange lines) it can be determined that mine noise near Curragh mine increased during the night and was higher during the second set of measurements at Jellinbah 1.

Whilst this graph indicates an increasing Curragh noise level, at Jellinbah 1, the noise from Curragh was only audible in the first set of measurements and was inaudible in the second set of measurements. Therefore, the increase in noise levels shown in Figure 6 may be due to the more favourable meteorological conditions for noise propagation (rather than an increase in noise being generated by Curragh mine); and this change in meteorological conditions has increased noise from both Curragh and Jellinbah mines.

Noise from Yarrabee is not presented as it was not a contributing source to the excessive mine noise levels.

4 Conclusions and recommendations

The August 2024 noise monitoring assessment has been completed for Mackenzie North coal mine. The assessment considers eighteen (18) attended noise measurements across four (4) sites on the night of 8th August 2024.

The assessment of the attended noise levels has determined the following results for the 18 attended noise measurements (refer Section 3.5.1):

- 14 of 18 measurements were compliant for both L_{Aeq} and L_{A1} parameters, with no exceedances.
- 1 measurement at Jellinbah 1 indicated a marginal L_{Aeq} exceedance of 1 dB.
- 3 measurements at Jellinbah 1 indicated L_{Aeq} exceedances of 4 to 5 dB, and L_{A1} exceedances of 3 to 4 dB.

It is understood that there have not been any noise complaints since the last noise measurements were conducted in March 2024.

Jellinbah has advised that the noise level exceedances were not due to operational emergencies, incidents or exceptions and therefore notification to the administering authority is not required.

In accordance with EA Condition E5 and the NMP, Jellinbah is to continue to implement noise abatement measures so that emissions of noise from the activity do not result in further environmental nuisance. The following recommendations are proposed:

- Review meteorological conditions at time of exceedances and historically, to determine which conditions are more likely to result in exceedances. This information should be considered in conjunction with meteorological conditions noted in the NMP Trigger Action Response Plan (TARP).
- Review equipment utilisation across the night, to determine if there was an increase in equipment quantity, or whether equipment was moved to a location which would likely result in the higher noise levels measured later in the night. Review this data in comparison to future equipment expectations to understand potential future noise levels.
- As a result of the above reviews, propose and implement measures to reduce noise levels in accordance with the EA and NMP.

A1 Terminology and descriptors

Table 9: Terminology and descriptors

Term or Descriptor	Definition
Noise	Noise is unwanted, harmful or inharmonious (discordant) sound. Noise usually includes vibration as well as sound.
Audible	Audible refers to a sound that can be heard. There are a range of audibility grades, varying from “barely audible”, “just audible” to “clearly audible” and “prominent”.
Ambient noise	The ambient noise level at a particular location is the overall environmental noise level caused by all noise sources in the area, both near and far, including all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc. Usually assessed as an energy average over a set time period ‘T’ ($L_{Aeq,T}$).
Decibel or dB	The decibel (dB) is a logarithmic scale that allows a wide range of values to be compressed into a more comprehensible range, typically 0 dB to 120 dB. Noise levels in decibels cannot be added arithmetically since they are logarithmic numbers. If one machine is generating a noise level of 50 dB, and another similar machine is placed beside it, the level will increase to 53 dB (from $10 \log_{10}(10^{(50/10)} + 10^{(50/10)})$) and not 100 dB. In theory, ten similar machines placed side by side will increase the sound level by 10 dB, and one hundred machines increase the sound level by 20 dB.
‘A’ frequency weighting	The ‘A’ frequency weighting roughly approximates to an equal loudness contour. The human loudness perception at various frequencies and sound pressure levels is equated to the level of 40 dB at 1 kHz. The human ear is less sensitive to low frequency sound and very high frequency sound than midrange frequency sound (i.e. 500 Hz to 6 kHz). Humans are most sensitive to midrange frequency sounds, such as a child’s scream. Sound level meters have inbuilt frequency weighting networks that very roughly approximates the human loudness response at low sound levels. It should be noted that the human loudness response is not the same as the human annoyance response to sound. Here low frequency sounds can be more annoying than midrange frequency sounds even at very low loudness levels. The ‘A’ weighting is the most commonly used frequency weighting for occupational and environmental noise assessments. However, for environmental noise assessments, adjustments for the character of the sound will often be required.
‘Z’ frequency weighting	The ‘Z’ (Zero) frequency weighting is 0 dB within the nominal 1/3 octave band frequency range centred on 10 Hz to 20 kHz. A Z-weighted noise level will be higher than the A-weighted noise level for the same noise source due to the different weightings.
Sound pressure level, L_p	The level of sound measured on a sound level meter and expressed in decibels (dB). Where $L_p = 10 \log_{10}(Pa/Po)^2$ dB (or $20 \log_{10}(Pa/ Po)$ dB) where Pa is the rms sound pressure in Pascal and Po is a reference sound pressure conventionally chosen is 20 μ Pa (20×10^{-6} Pa) for airborne sound. L_p varies with distance from a noise source.
Sound power level, L_w	The sound power level of a noise source is the inherent noise of the device. Therefore sound power level does not vary with distance from the noise source or with a different acoustic environment. $L_w = L_p + 10 \log_{10} 'a'$ dB, re: 1pW, (10-12 watts) where ‘a’ is the measurement noise-emission area (m^2) in a free field.
Free-field	In acoustics a free field is a measurement area not subject to significant reflection of acoustical energy. A free field measurement is typically not closer than 3.5 metres to any large flat object (other than the ground) such as a fence or wall or inside an anechoic chamber.
Frequency	The number of oscillations or cycles of a wave motion per unit time, the SI unit is the hertz (Hz). 1 Hz is equivalent to one cycle per second. 1000 Hz is 1 kHz.

Term or Descriptor	Definition
Loudness	The volume to which a sound is audible to a listener is a subjective term referred to as loudness. Humans generally perceive an approximate doubling of loudness when the sound level increases by about 10 dB and an approximate halving of loudness when the sound level decreases by about 10 dB.
Equivalent continuous sound level, L_{Aeq}	Many sounds, such as road traffic noise or construction noise, vary repeatedly in level over a period of time. Most modern sound level meters have an integrating/averaging electronic device inbuilt, which will display the energy time-average (equivalent continuous sound level - L_{Aeq}) of the 'A' frequency weighted sound pressure level. Because the decibel scale is a logarithmic ratio, the higher noise levels have far more sound energy, and therefore the L_{Aeq} level tends to indicate an average which is strongly influenced by short-term, high level noise events. Many studies show that human reaction to level-varying sounds tends to relate closer to the L_{Aeq} noise level than any other descriptor.
Statistical noise levels, L_n (e.g. L_1 , L_{10} , L_{90})	<p>Noise which varies in level over a specific period of time 'T' (standard measurement times are often 15-minute periods) may be quantified in terms of various statistical descriptors with some common examples:</p> <ul style="list-style-type: none"> • The noise level, in decibels, exceeded for 1 % of the measurement time period, is reference to as L_1. This may be used for describing short-term noise levels such as could cause sleep arousal during the night. • The noise level, in decibels, exceeded for 10 % of the measurement time period, is reference to as L_{10}. In most countries the L_{10} is measured over periods of 15 minutes and is used to describe the average maximum noise level. • The noise level, in decibels, exceeded for 90 % of the measurement time period, is reference to as L_{90}. In most countries the L_{90} is measured over periods of 15 minutes and is used to describe the average minimum or background noise level.
Background noise level, L_{90}	Total silence does not exist in the natural or built-environments, only varying degrees of noise. The Background Noise Level is the minimum repeatable level of noise measured in the absence of the noise under investigation and any other short-term noises such as those caused by all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc. It is quantified by the noise level that is exceeded for 90 % of the measurement period 'T' ($L_{A90,T}$). Background Noise Levels are often determined for the day, evening and night time periods where relevant. This is done by statistically analysing the range of time period (typically 15 minute) measurements over multiple days (often 7 days). For a 15-minute measurement period the Background Noise Level is set at the quietest level that occurs at 1.5 minutes.
Maximum noise level, L_{max}	The maximum sound pressure level measured with sound level meter over a time period. If referring to a calculated noise level it may be referring to an average maximum noise level, though this should be clear in the report text.
Minimum noise level, L_{min}	The minimum sound pressure level measured with sound level meter over a time period.

A2 Mine activities



Figure 7: Mine equipment at Mackenzie North (night of 8/08/2024, 12am to 2am)



Figure 8: Mine equipment (zoom) at Mackenzie North (night of 8/08/2024, 12am to 2am)