NOISE IMPACT ASSESSMENT FOR NIGHTTIME OVERBURDEN HAULAGE OPERATIONS AT RED HILL QUARRY

HEIDELBERG MATERIALS

Rpt01-AU03332-Rev1-20 Apr 2026

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Item	Page	Section	Comments

** Use after Rev. 0*

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EXECUTIVE SUMMARY

Heidelberg Materials are proposing to undertake nighttime haulage operations at their Red Hill quarry.

The proposed operations will involve the use of an excavator to load overburden into haul trucks in the Red Hill Quarry. The trucks will travel along an existing haul road to a tipping location within the lowered area of the old Herne Hill Quarry and return to the loading point. A wheeled loader may also be used within the Herne Hill Quarry area.

The nearest noise sensitive receivers lie to the west of the proposed operations, at the base of the Darling Scarp.

Ambient noise levels have been monitored for a period of three weeks at a location representative of the nearest noise sensitive receivers. The monitored levels demonstrate low levels of ambient noise during nighttime hours, unaffected by noise emissions from industrial or other noise emitting premises. The low levels of ambient noise suggest that any intrusive or dominant characteristics in noise emissions from the proposed operations have the potential to be perceivable at some receivers.

The equipment proposed for the nighttime operations is currently in use at the Red Hill quarry as part of their daytime operations. Sound power levels for the relevant equipment have been measured on site and used as input to a noise model developed for the nighttime operations.

Noise modelling has demonstrated that predicted noise levels from the nighttime operations are at least 5 dB below the applicable noise limits (Assigned Levels) at the nearest receivers. The modelling also showed that the most significant noise emitters were haul trucks travelling on the haul road.

Haul trucks travelling along the haul road are likely to exhibit tonal noise characteristics which cannot be practically removed but are unlikely to exhibit impulsiveness or modulation. Therefore, an adjustment of 5 dB must be added to the predicted noise levels to account for the possibility of tonality being evident at the nearest receivers. Since predicted noise levels are more than 5 dB below the Assigned Levels at the receivers, the adjusted levels remain below the Assigned Levels.

It is concluded that the proposed nighttime haulage operations can comply with Environmental Protection (Noise) Regulations.

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1 INTRODUCTION

This report presents a noise impact assessment for the proposed nighttime overburden haulage operations at Red Hill Quarry.

1.1 Heidelberg's Current Operations at Red Hill Quarry

Heidelberg's Red Hill quarry produces concrete aggregates, road building materials, rail ballast and rock products for the Perth metropolitan area and surrounding regional communities. The quarry is located at Lot 11, Toodyay Road, Red Hill near the edge of the Darling Scarp on the eastern outskirts of the Perth metropolitan area.

Operations at the quarry include blasting and ore extraction, crushing, screening, stockpiling and sales activities (trucking). Crushing and pit operations are currently limited to no later than 8 pm, Monday to Saturday, excluding public holidays. It is proposed to amend operating hours for tertiary crushing from 8pm to 10pm.

1.2 Description of Proposed Nighttime Operations

The proposed nighttime operations will involve the use of an excavator to load overburden into haul trucks in the stripping area. The trucks will travel along an existing haul road to a tipping location within the lowered area of the old Herne Hill Quarry and return to the loading point. A wheeled loader may also be used within the Herne Hill Quarry area.

The proposed equipment includes:

- 3 x Komatsu HD605 haul trucks;
- 1 x Komatsu HD465 haul truck;
- 1 x Komatsu PC800 excavator; and
- 1 x Caterpillar 990K wheeled loader.

All items are currently in use at the Red Hill Quarry during daytime operations.

No rock breaking, drilling or explosives will be used during the nighttime haulage operations. Crushing will occur on the tertiary until 10pm only.

The current development approval allows for tertiary crushing until 8pm Monday to Saturday, excluding public holidays. The development application which accompanies this Noise Impact Assessment, also seeks to extend the hours of operation for tertiary crushing until 10pm Monday to Saturday, excluding public holidays. The proposed extended hours of operation of the tertiary crushing (until 10pm Monday to Saturday, excluding public holidays) does not impact upon the conclusions of this report.

Figure 1-1 shows the stripping area, haul road and tipping locations.

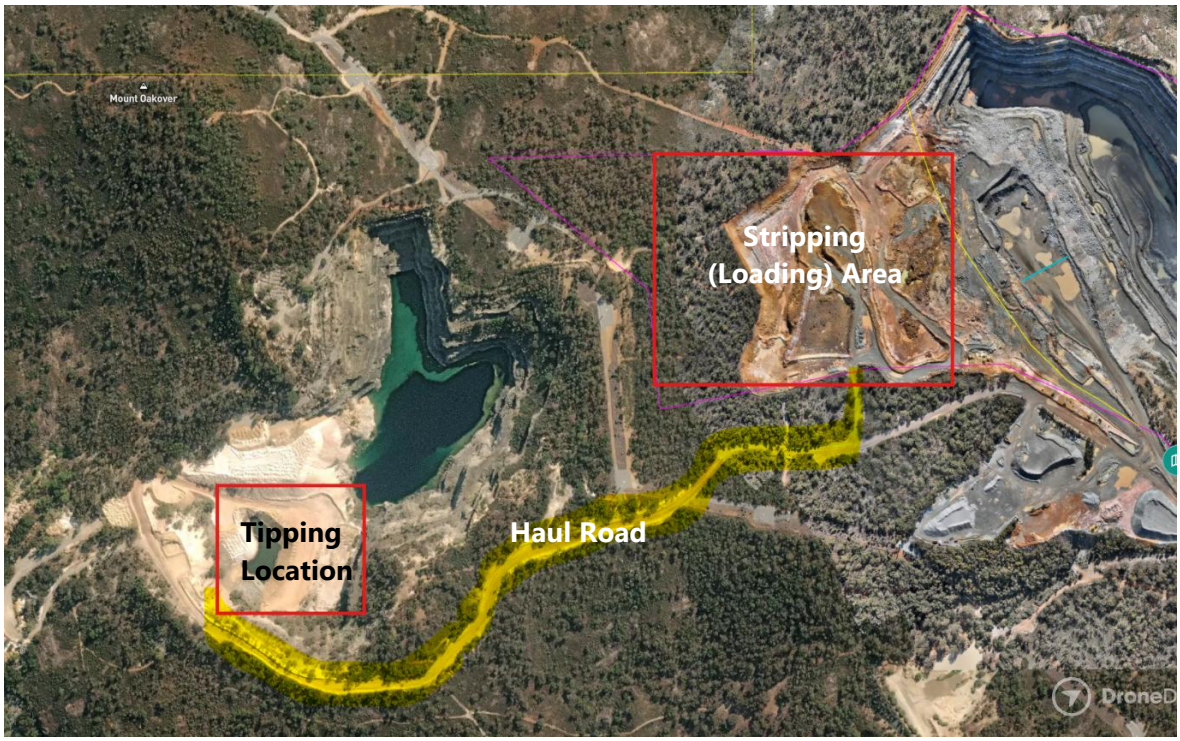


Figure 1-1 : Location of Overburden Haulage Activities

1.3 Nearest Noise Sensitive Receivers

The nearest noise sensitive receivers are approximately 800m to the west of the proposed tipping location, at the base of the Darling Scarp.

Figure 1-2 shows the locations of the nine nearest noise sensitive receivers (R1 – R9).



Figure 1-2 : Noise Sensitive Receivers

1.4 Scope of Assessment

This assessment only considers noise from the proposed nighttime haulage operations. Daytime and evening activities are excluded because it is not anticipated that these will extend beyond 10pm on any day.

The proposed nighttime operations do not require any construction work.

2 NOISE CRITERIA

Noise management in Western Australia is implemented through the *Environmental Protection (Noise) Regulations 1997* (the Regulations) which operate under the *Environmental Protection Act 1986*. The Regulations specify the prescribed standard for noise emissions in terms of Assigned Levels which are the highest noise levels that can be received at noise-sensitive premises, commercial and industrial premises. Table 2-1 presents the Assigned Levels. Noise emitted from a premises must not cause, or significantly contribute[1] to, a level of noise which exceeds the Assigned Levels.

Assigned Levels have been set differently for noise sensitive premises, commercial premises, and industrial premises. For noise sensitive premises, e.g. residences, an "influencing factor" is incorporated into the assigned noise levels. The influencing factor depends on land use zonings within circles of 100 m and 450 m radius from the noise receiver, including:

- the proportion of industrial land use zonings;
- the proportion of commercial zonings; and
- the presence of major or secondary roads.

For noise sensitive residences, the time of day also affects the assigned levels.

The regulations define three types of Assigned Level:

- L_{Amax} Assigned Level means a noise level which is not to be exceeded at any time;
- L_{A1} Assigned Level which is not to be exceeded for more than 1% of the representative assessment period[2]; and
- L_{A10} Assigned Level which is not to be exceeded for more than 10% of the representative assessment period.

[1] A noise emission is taken to significantly contribute to a level of noise if the noise emission exceeds a value which is 5 dB below the Assigned Level.

[2] The representative period means a period of time not less than 15 minutes and not exceeding 4 hours.

Table 2-1 : Assigned Levels

Type of premises receiving noise	Time of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: highly sensitive area	0700 to 1900 hours Monday to Saturday	45 + Influencing factor	55 + Influencing factor	65 + Influencing factor
	0900 to 1900 hours Sunday and public holidays	40 + Influencing factor	50 + Influencing factor	65 + Influencing factor
	1900 to 2200 hours all days	40 + Influencing factor	50 + Influencing factor	55 + Influencing factor
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	35 + Influencing factor	45 + Influencing factor	55 + Influencing factor
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80
Commercial premises	All hours	60	75	80
Industrial premises	All hours	65	80	90

2.1 Influencing Factors and Nighttime Assigned Levels for Selected Receptors

All selected receivers are located on land zoned as rural.

The land on Lot 11 (owned by Heidelberg), between the Herne Hill Quarry and the selected receivers to the west is designated for conservation and rehabilitation and the proposed haulage operations are more the 450m from any of the receivers. Therefore, the quarry does not contribute to any influencing factors at the receivers.

A precast concrete business operates at 218 Campersic Road which is classed as an industrial premises (See Figure 2-1). The premises is within 450m of (but further than 100m from) receivers R6, R7, R8 and R9. This results in an influencing factor of 1 dB at receivers R7, R8 and R9. (The influencing factor at R6 is less than 0.5 dB and would, therefore, be rounded to zero.)



Figure 2-1 : Industrial Premises Within 450m of Selected Receivers

There are no major or secondary roads within 450m of any of the selected receivers.

Accounting for the land uses described above, the nighttime[3] assigned levels (including influencing factors) at the selected receivers are presented in Table 2-2

Table 2-2 : Nighttime Assigned Levels at Selected Receivers

Receivers	Assigned Level (dB)		
	L_{A10}	L_{A1}	L_{Amax}
R1 – R6	35	45	55
R7 - R9	36	46	56

The L_{A10} Assigned Level is the most significant for this study since this is representative of continuous noise emissions from the proposed haulage operations.

2.2 Adjustments for Intrusive Characteristics

Received noise levels from the proposed operations must be adjusted if the noise exhibits intrusive or dominant characteristics which cannot be reasonably or practicably removed, i.e. if

[3] 2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays

the noise is impulsive (e.g. banging), tonal (e.g. whining noise having a defined pitch) or modulating (e.g. noise which varies cyclically in either pitch or amplitude). Table 2-3 presents the adjustments required when intrusive or dominant characteristics cannot be reasonably and practicably removed. The adjusted noise levels must now comply with the Assigned Levels. Regulation 9 sets out objective tests to assess whether the noise is taken to be free of these characteristics.

Table 2-3 : Adjustments for Intrusive or Dominant Noise Characteristics

Adjustment where noise emission is not music. These adjustments are cumulative to a maximum of 15 dB		
Where tonality is present	**Where modulation is present**	**Where impulsiveness is present**
+5 dB	+5 dB	+10 dB

3 ASSESSMENT METHODOLOGY

The assessment methodology includes the following:

- Determination of ambient noise levels to:
    - quantify the existing noise environment prior to commencement of the proposed nighttime haulage activities;
    - determine whether any intrusive characteristics associated with the proposed activities are likely to be evident at the nearest noise sensitive receivers; and
    - identify potential noise limit exceedances resulting from cumulative effects of existing ambient noise and noise from the proposed operations.
- Measurement of sound power levels of the equipment proposed for nighttime operations;
- Computational noise modelling of the proposed nighttime operations to predict noise levels at the nearest noise sensitive receivers under worst-case operating and weather conditions;
- Comparison of predicted levels with ambient levels;
- Comparison of predicted levels with noise criteria, including adjustments for intrusive characteristics where appropriate and considering potential cumulative effects; and
- Provision of recommendations for noise management.

3.1 Measurement of Ambient Noise Levels

Noise levels were logged for a 3-week period at a location representative of the nearest noise sensitive receivers. The monitoring was in accordance with Clause 6 of AS 1055:2018 *Acoustics – Description and measurement of environmental noise* and included periods representative of the quietest ambient noise.

A sample period of 15 minutes was used to determine L_{A1}, L_{A10}, L_{Aeq} and L_{A90} noise levels. The Slow Time Weighting was used for statistical levels.

Meteorological data for the monitoring period was obtained from a local weather station.

3.2 Determination of Equipment Sound Power Levels

Sound power levels were determined for the mobile equipment proposed for the night-time operations. The measurements were recorded at the Red Hill Quarry site.

Static sound power levels were undertaken using the methodology described in AS ISO 6393:2019 *Earth-moving machinery – Determination of sound power level – Stationary test conditions.*[4] Measurements were recorded for low and high idle operating conditions.

Drive-by sound power levels were undertaken using the methodology described in ISO AS 6395:2019 *Earth-moving machinery – Determination of sound power level – Dynamic test conditions*.

3.3 Noise Modelling

3.3.1 Noise Model Program

A computational noise model has been developed for the proposed nighttime haulage operations using SoundPLAN noise modelling software which has been previously accepted by WA Department of Water and Environmental Regulation (DWER) as appropriate for environmental noise prediction.

The inputs required in SoundPLAN are noise source data, barriers/screens, ground topographical and absorption type data, assessed meteorological conditions and receiver point locations.

The model has been used to generate predicted noise contours for the area surrounding the Red Hill Quarry and to predict noise levels at the nearest noise sensitive receivers.

The model does not include noise emissions from any sources other than those associated with nighttime overburden haulage operations. Noise emissions from neighbouring industrial sources, road traffic, aircraft, animals, domestic sources, etc. are excluded from the modelling.

3.3.2 Noise Model Algorithm

SoundPLAN provides a range of published noise propagation prediction algorithms that can be selected by the user. The CONCAWE[5,6] prediction algorithms are recommended by the WA Department of Water and Environment Regulation (DWER) Draft Guideline[7] and were selected for the noise modelling.

[4] The methodology specifies six measurement positions, four at 1.5m above ground and two at 11.4m above ground. For safety and practicality reasons, the elevated positions were omitted.

[5] CONCAWE (Conservation of Clean Air and Water in Europe) was established in 1963 by a group of oil companies to carry out research on environmental issues relevant to the oil industry.

[6] *The propagation of noise from petroleum and petrochemical complexes to neighbouring communities,* CONCAWE Report 4/81, 1981

[7] *Draft Guideline on Environmental Noise for Prescribed Premises*, May 2016, DWER2015/001319, Department of Water and Environment Regulation

3.3.3 Selection of Meteorological Conditions

SoundPLAN calculates predicted noise levels for defined meteorological conditions. In particular, the following variables are included in the prediction algorithms and will affect the predicted noise level: temperature; Pasquill stability (temperature inversion); relative humidity; wind speed; and wind direction.

The default night-time meteorological conditions as suggested by the WA DWER Draft Guideline have been used to determine the worst-case overall predicted noise levels and to generate noise contours (see Table 3-1).

Table 3-1 : Noise Model Meteorological Inputs for Worst-Case Conditions

Period	Temperature	Pasquill Stability	Wind speed	Wind Direction	Relative Humidity
Night	15°C	Pasquill Stability F	3 m/s	Worst-case (source to receiver)	50%

3.3.4 Ground Topography, Buildings and Barriers

Detailed topographical information derived from a LIDAR[8] scan was provided by Heidelberg and imported directly into the acoustic model.

There are no significant buildings or barriers to sound propagation (other than the intervening topography and bunding captured by the LIDAR scan) between the proposed operations and the nearest noise sensitive receivers.

A moderately absorptive ground (ground factor 0.6) is assumed in the acoustic model for sound propagation over the land surrounding the Red Hill Quarry. A less absorptive ground factor of 0.2 has been assumed for the disturbed ground within the quarries.

3.3.5 Noise Modelling Scenario

In order demonstrate worst-case noise impacts, the operational scenario described below (and depicted in Figure 3-1) has been developed:

- 1 x excavator in the Red Hill Quarry;
- 4 x haul trucks operating:
    - one at low idle being filled by the excavator at the Red Hill Quarry;

[8] LIDAR - Light Detection and Ranging

- two driving on the haul road between the Red Hill and Herne Hill Quarries. The locations selected for the trucks represent high points on the haul road between the quarries;
- one at high idle unloading in the Herne Hill Quarry; and

- 1 x loader operating in the Herne Hill Quarry.



Figure 3-1 : Worst-case Noise Modelling Scenario

Symbol	Equipment
	Komatsu PC800 excavator
	Komatsu HD605 haul truck
	Komatsu HD465 haul truck
	Caterpillar 990K wheeled loader

4 NOISE MEASUREMENT RESULTS

4.1 Noise Monitoring Equipment

Brüel & Kjaer sound level meters were used to undertake noise measurements. The instruments used meet the requirements of Schedule 4 of the Regulations, including Type 1 meters as specified in AS IEC 61672.1-2004, and 1/3 octave band filters as specified in AS/NZS 4476:1997.

The meters were field calibrated prior to starting measurements and on completion of measurements using GRAS 42AG reference sound source. A list of equipment used is given in Table 4-1.

Table 4-1 : Measurement and Calibration Equipment used for Noise Measurements

Type	Make	Model	Serial Number
SLM	Brüel & Kjaer	2270	2746573
SLM	Brüel & Kjaer	2270	3000267
Calibrator	GRAS	42AG	279379

Copies of current NATA approved laboratory calibration certificates for the equipment are attached in APPENDIX C.

4.2 Ambient Noise Levels

Ambient noise levels were recorded at a location representative of the nearest noise sensitive receivers to the west of the proposed nighttime haulage operations, as shown in Figure 4-1



Figure 4-1 : Noise Monitoring Location

Noise levels were monitored for the 3-week period between 17 December 2025 and 7 January 2026. This period included times and conditions representative of the quietest ambient noise in the area, including several public holidays and periods when wind speeds were low.

Charts presenting the ambient noise levels throughout monitoring period are provided in APPENDIX A and demonstrate the following:

- There was a strong correlation between wind speed and measured noise levels;
- There was no obvious diurnal cycle of noise levels which suggests minimum influence from traffic noise or other commercial or industrial activities;
- The quietest ambient L_{A90} noise levels, recorded under low wind conditions, were typically between 20 dB(A) – 30 dB(A).

4.3 Equipment Sound Power Levels

Sound power levels were determined from measurements recorded during a site visit on 10 December 2025.

Overall equipment sound power levels are presented in Table 4-2. Octave band sound power levels are provided in APPENDIX B.

Table 4-2 : Equipment Sound Power Levels

Vehicle Type	Make and Model	Operating Condition	Sound Power Level dB(A)
Haul Truck	Komatsu HD605	Stationary Low Idle	98.6
		Stationary High Idle	106.2
		Drive-by	111.3
Haul Truck	Komatsu HD465	Drive-by	115.5
Wheel Loader	Caterpillar 990K	High Idle	109.0
Excavator	Komatsu PC800	Stationary High Idle	105.7

5 NOISE LEVEL PREDICTIONS

The noise levels predicted for the worst-case scenario described in section 3.3.5 are presented in Table 5-1 which also includes the nighttime Assigned Levels for each receiver. Noise contours for the study area are presented in Figure 5-1.

Table 5-1 : Predicted Noise Levels

Receiving Location	LA10 Assigned Level dB(A)	Predicted Noise Level dB(A)
R1	35	18.6
R2	35	13.7
R3	35	14.0
R4	35	21.0
R5	35	20.2
R6	35	23.7
R7	36	18.9
R8	36	24.4
R9	36	29.8

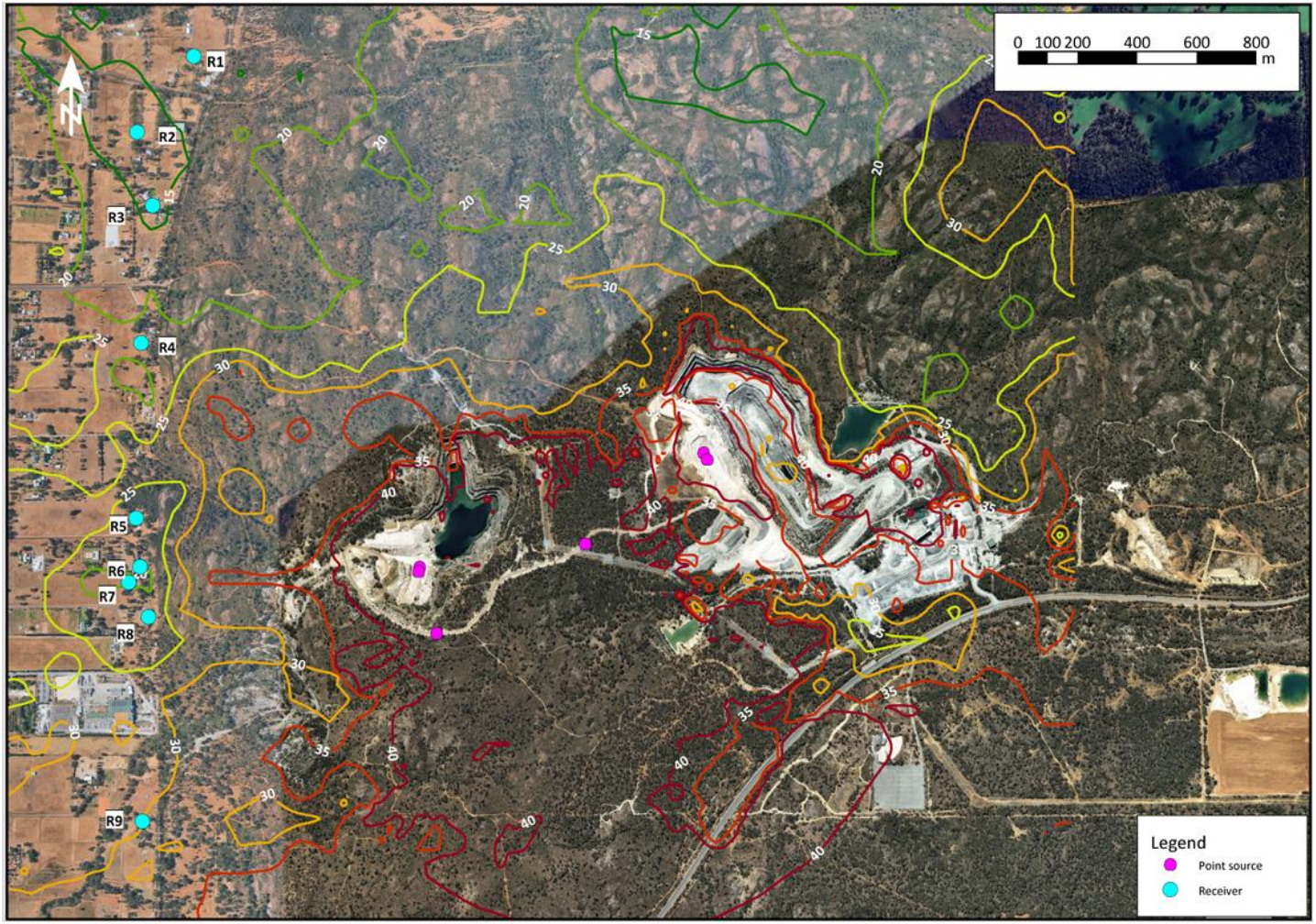


Figure 5-1 : Noise Contours

5.1 Noise Source Ranking

Table 5-2 presents in ranked order the individual contributions of each noise source to receiver R9 which has the highest overall predicted noise level.

Table 5-2 : Noise Source Contributions at R9

Noise Source	Predicted Noise Level dB(A)
HD605 haul truck driving on haul road	28.7
HD465 haul truck driving on haul road	22.7
990K Loader at high idle in Herne Hill Quarry	13.6
HD605 at high idle in Herne Hill Quarry	10.0
PC800 Excavator at high idle in Red Hill Quarry	3.4
HD605 haul truck at low idle in Red Hill Quarry	< 0

The source ranking above demonstrates that haul trucks travelling on the haul road are most significant noise emitters. Noise emissions from equipment operating within the quarries is effectively shielded by the intervening topography.

6 NOISE IMPACT ASSESSMENT

6.1 Emergence and Cumulative Noise Impacts

Predicted noise levels at the nearest receivers are below, or at similar levels to, the lowest recorded ambient noise levels due to the shielding provided by the local topography.

The low levels of ambient noise in the vicinity of the nearest noise sensitive receivers demonstrate that there are no other industries or other noise emitting premises which would significantly contribute to cumulative noise emissions.

6.2 Intrusive or Dominant Characteristics

It is demonstrated in section 5.1 that it is haul trucks travelling along the haul road that dominate predicted noise levels at the most affected receiver, R9. Trucks travelling on haul roads are unlikely to exhibit impulsive or modulating noise characteristics. However, if audible above ambient noise, noise emissions from the haul trucks are likely to exhibit tonality. Tonality from haul trucks cannot be practicably removed and, therefore, an adjustment of 5 dB is required to the predicted noise levels when assessing compliance with the Assigned Levels. (See section 6.4.)

6.3 Noise Management Recommendations

No specific noise control or noise management measures are required for the proposed operations to achieve compliance with Regulations provided that the number and types of equipment operating are as assessed in the representative worst-case operating scenario described in 3.3.5.

If alternative haul trucks are used, noise emissions should not exceed the measured sound power levels used in the noise modelling and presented in section 4.3.

6.4 Compliance Assessment

As demonstrated in Table 5-1, predicted noise levels for worst-case conditions are more than 5 dB below the Assigned Levels at all selected receivers. Therefore, even when predicted levels are adjusted by adding 5 dB for potential tonality, the adjusted levels are below the Assigned Levels demonstrating that the proposed operations can comply with the Regulations.

7 CONCLUSION

It is concluded that the proposed nighttime haulage operations can comply with Environmental Protection (Noise) Regulations without noise control or noise management measures provided that the sound power levels of the haul trucks travelling along the haul road do not exceed those measured and considered in the noise modelling.

The extended hours of operation of the tertiary crushing to 10pm remain within the evening period defined in the Regulations. Since the current development approval allows operations up to 8pm, which is also within the evening period, there is no change to the noise limits applicable to these tertiary crushing operations.

APPENDIX A AMBIENT NOISE LEVEL CHARTS

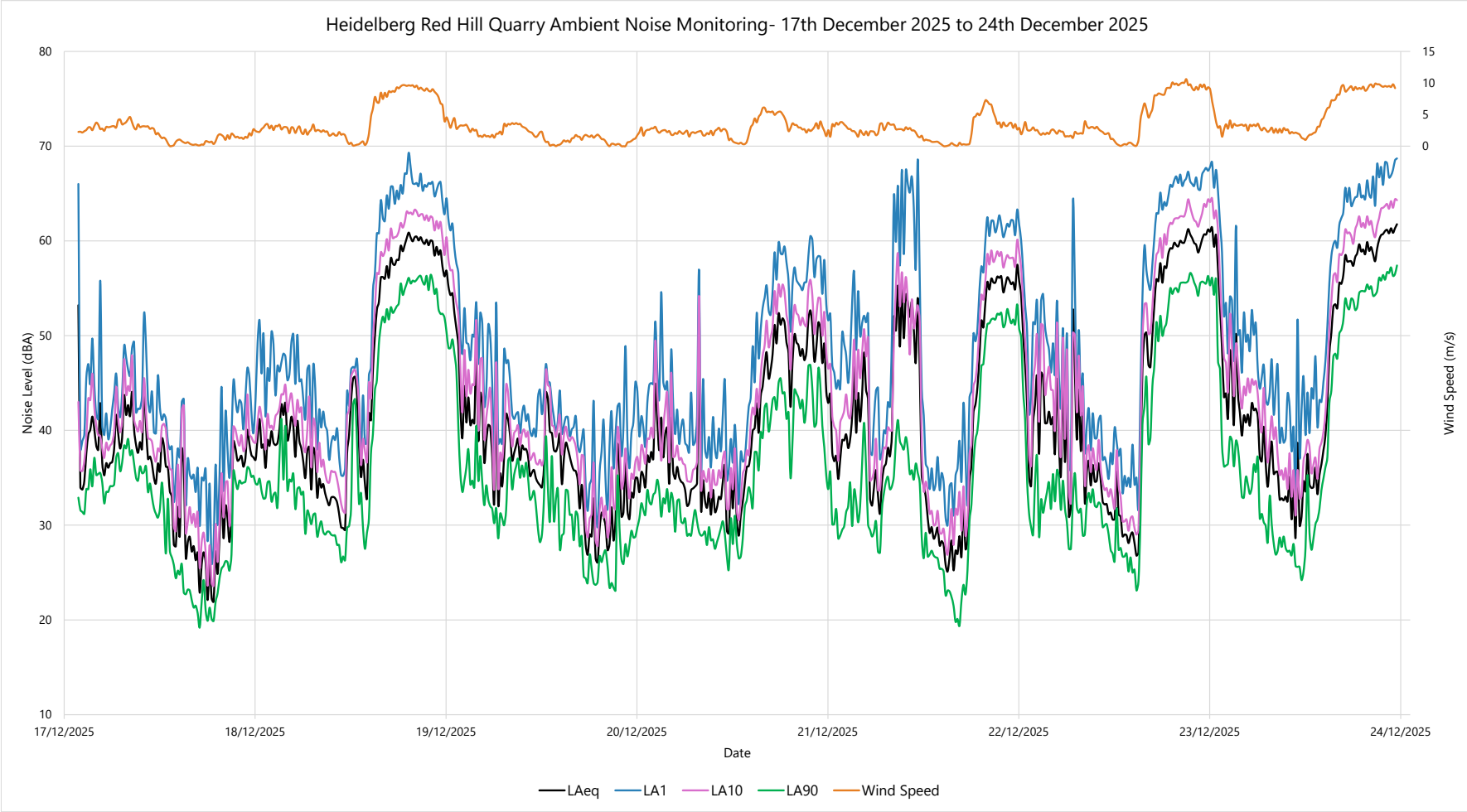


Figure A-1 Ambient Noise Monitoring Week 1

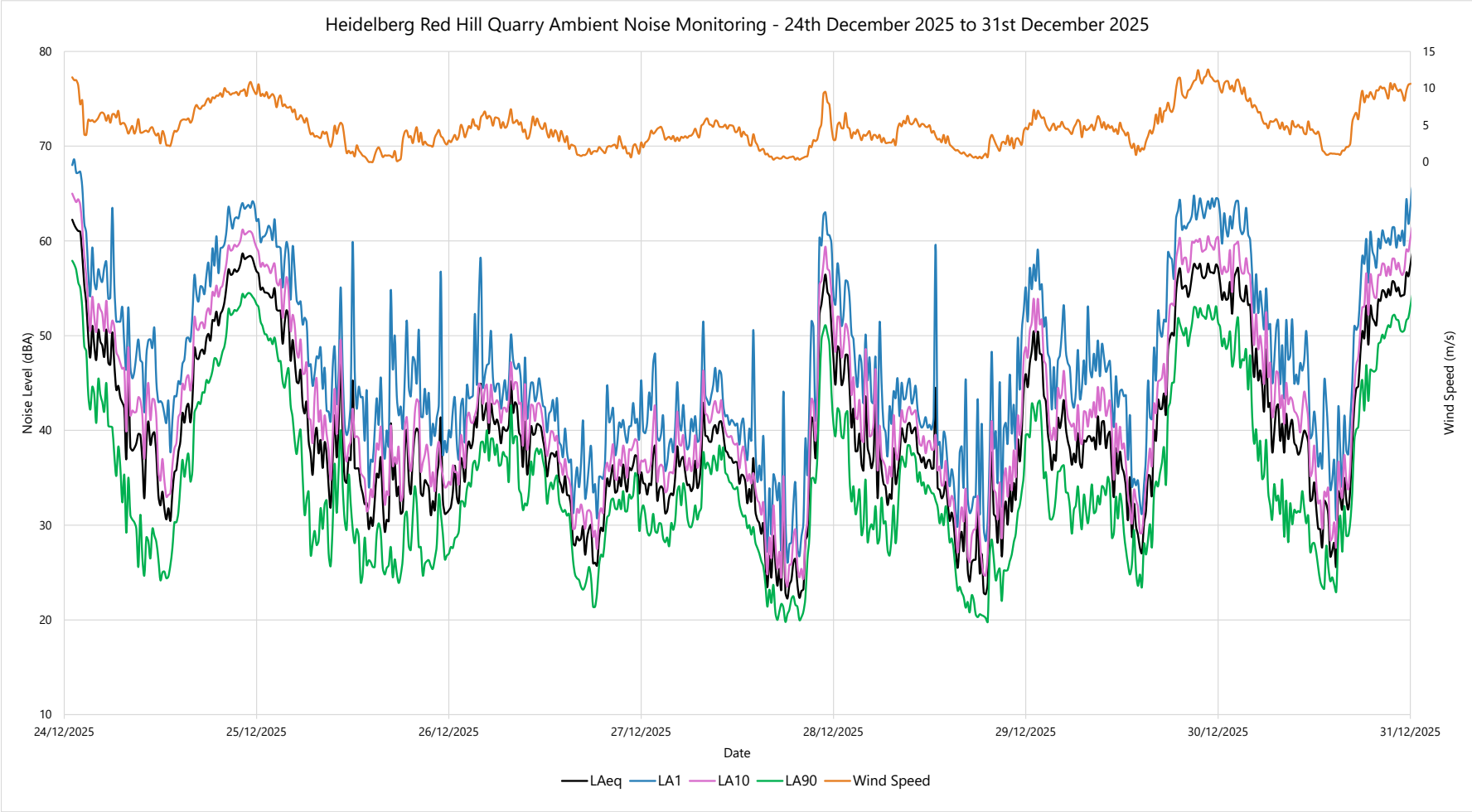


Figure A-2 Ambient Noise Monitoring Week 2

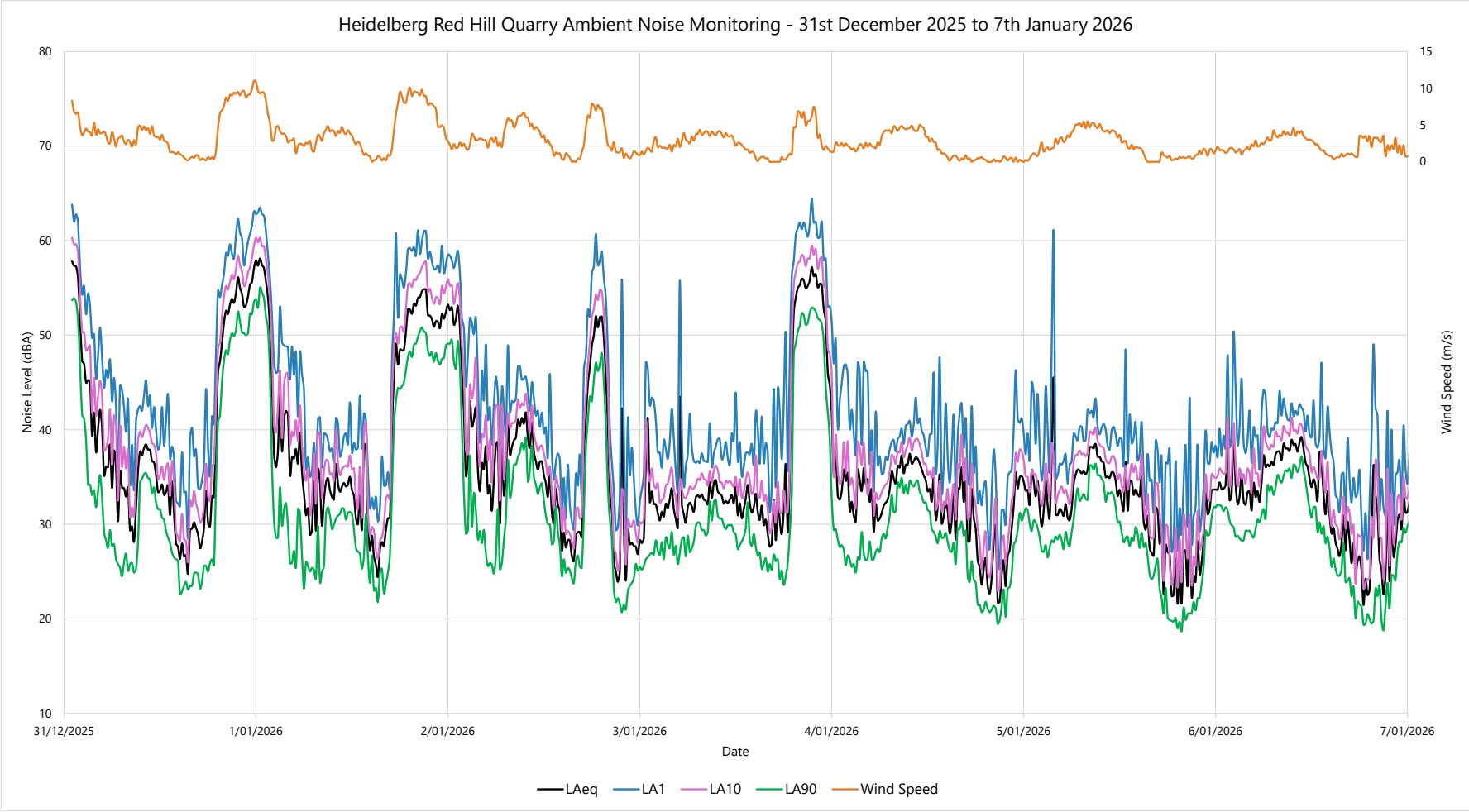


Figure A-3 Ambient Noise Monitoring Week 3

APPENDIX B NOISE SOURCE DETAILS

Noise Source	Location	Coordinates		Height (m)	Sound Power Level (dB) at 1/1-Octave Band Centre Frequency (Hz)									Overall dB(A)
		Easting	Northing		31.5	63	125	250	500	1k	2k	4k	8k	
HD605 haul truck driving	Haul Road	411659.27	6477696.82	2	107	109	106	104	108	108	103	100	91	111.3
HD465 haul truck driving	Haul Road	412158.28	6477996.24	2	105	115	127	114	111	109	109	103	94	115.5
990K Loader at high idle	Herne Hill Quarry	411602.12	6477918.44	2	98	112	114	101	104	106	101	91	83	109.0
HD605 at high idle	Herne Hill Quarry	411598.06	6477903.54	2	105	102	105	102	102	101	100	95	88	106.2
PC800 Excavator at high idle	Red Hill Quarry	412555.02	6478302.07	2	100	110	111	108	103	99	96	91	84	105.7
HD605 haul truck at low idle	Red Hill Quarry	412567.22	6478278.90	2	102	99	98	92	94	94	93	86	77	98.6

APPENDIX C CALIBRATION CERTIFICATES

NVMS

Certificate of Calibration – Sound Level Meter

Report Reference:	SLM/25/04/011(R)	**Date of calibration:**	14/04/2025

Client: Wood Australia Pty Ltd
Address: 240 St Georges Terrace, Perth, WA, 6000

Sound Level Meter:	Brüel & Kjær 2270	**Microphone:**	Brüel & Kjær 4189
Meter Serial No:	2746573	**Microphone Serial No:**	1820674
Meter Class:	1	**Preamplifier:**	Brüel & Kjær ZC-0032
Hardware Version:	4	**Preamplifier Serial No:**	19336
Software Version:	4.7.5	**Filters:**	Integral Octave & 1/3 Octave Band
Channel/s tested:	N/A		

Procedures from AS/NZS IEC 61672.3:2019 were used to perform periodic tests.

Clause 10	Indication at the calibration check frequency	**Complied**
Clause 11	Self-generated noise	**Checked**
Clause 12	Acoustical tests of frequency weighting	**Complied**
Clause 13	Electrical tests of frequency weightings	**Complied**
Clause 14	Frequency and time weighting at 1kHz	**Complied**
Clause 15	Long-Term stability	**Complied**
Clause 16	Level linearity on the reference level range	**Complied**
Clause 17	Level linearity including level range control	**N/A**
Clause 18	Toneburst response	**Complied**
Clause 19	Peak C sound level	**Complied**
Clause 20	Overload indication	**Complied**
Clause 21	High-Level Stablilty	**Complied**

Where the instrument includes an Octave Band or 1/3 Octave Band Filter Set, performance characteristics were checked against the requirements of the following clauses of AS/NZS4476:1997:

Clause 4.4, 5.3	Relative Attenuation	**Complied**

This Replacement Report SLM/25/04/011(R) supersedes the original report SLM/25/04/011 to correct a typographic error in the sound level meter classification. The Serial number of the Pre- Amplifier should be 19336 and not 19335. This error has no bearing on the Original Calibration Results or it's validity.

Primary test equipment:
Bruel & Kjaer type 4226 multifunction calibrator S/N 2831080
Agilent Technologies HP33120A Waveform generator S/N US36006913

Environmental conditions – start of test: 24.3 deg C, 101.5 kPa, 51.2 %RH
Environmental conditions – end of test: 24.5 deg C, 101.2 kPa, 49.2 %RH

The sound level meter submitted for testing has successfully completed the Class 1 periodic tests of AS/NZS IEC 61672.3:2019, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with AS/NZS IEC 61672.2:2019, to demonstrate that the model of sound level meter fully conformed to the requirements in AS/NZS IEC 61672.1:2019, the sound level meter submitted for testing conforms to the Class 1 requirements of AS/NZS IEC 61672.1:2019.

The results of the tests, calibrations and/or measurements included in this document are traceable to the International System of Units (SI). References are traceable to National Measurement Institutes or laboratories accredited to ISO/IEC 17025 by a signatory to the ILAC MRA.

The calibration procedures followed are in accordance with the terms of the NATA accreditation of this laboratory.

NATA
WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Calibration.

Accreditation No. 12604

Authorised Signatory

28 · 04 · 25 ·
Date of Issue

Noise & Vibration Measurement Systems Pty Ltd
112 Cambridge Street, West Leederville, WA 6007, Australia
PO Box 514, Wembley, WA 6913

Phone: (08) 9380 6933
e-mail: sales@nvms.com.au

NVMS

Certificate of Calibration – Sound Level Meter

Report Reference:	SLM/25/06/011	**Date of calibration:**	12/06/2025

Client: Wood Australia Pty Ltd
Address: Level 1, 240 St Georges Terrace, Perth, WA, 6000

Sound Level Meter:	Brüel & Kjær 2270	**Microphone:**	Brüel & Kjær 4189
Meter Serial No:	3000267	**Microphone Serial No:**	2662918
Meter Class:	1	**Preamplifier:**	Brüel & Kjær ZC-0032
Hardware Version:	4.0	**Preamplifier Serial No:**	14746
Software Version:	4.7.5	**Filters:**	Integral Octave & 1/3 Octave Band
Channel/s tested:	N/A		

Procedures from AS/NZS IEC 61672.3:2019 were used to perform periodic tests.

Clause 10	Indication at the calibration check frequency	**Complied**
Clause 11	Self-generated noise	**Checked**
Clause 12	Acoustical tests of frequency weighting	**Complied**
Clause 13	Electrical tests of frequency weightings	**Complied**
Clause 14	Frequency and time weighting at 1kHz	**Complied**
Clause 15	Long-Term stability	**Complied**
Clause 16	Level linearity on the reference level range	**Complied**
Clause 17	Level linearity including level range control	**N/A**
Clause 18	Toneburst response	**Complied**
Clause 19	Peak C sound level	**Complied**
Clause 20	Overload indication	**Complied**
Clause 21	High-Level Stablilty	**Complied**

Where the instrument includes an Octave Band or 1/3 Octave Band Filter Set, performance characteristics were checked against the requirements of the following clauses of AS/NZS4476:1997:

Clause 4.4, 5.3	Relative Attenuation	**Complied**

Primary test equipment:
Bruel & Kjaer type 4226 multifunction calibrator S/N 2831080
Agilent Technologies HP33120A Waveform generator S/N US36006913

Environmental conditions – start of test: 21.9 deg C, 102.3 kPa, 49.2 %RH
Environmental conditions – end of test: 22.2 deg C, 102.4 kPa, 48.3 %RH

The sound level meter submitted for testing has successfully completed the Class 1 periodic tests of AS/NZS IEC 61672.3:2019, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with AS/NZS IEC 61672.2:2019, to demonstrate that the model of sound level meter fully conformed to the requirements in AS/NZS IEC 61672.1:2019, the sound level meter submitted for testing conforms to the Class 1 requirements of AS/NZS IEC 61672.1:2019.

The results of the tests, calibrations and/or measurements included in this document are traceable to the International System of Units (SI). References are traceable to National Measurement Institutes or laboratories accredited to ISO/IEC 17025 by a signatory to the ILAC MRA.

The calibration procedures followed are in accordance with the terms of the NATA accreditation of this laboratory.

NATA
WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Calibration.

Accreditation No. 12604

Authorised Signatory

12.06.25
Date of Issue

Noise & Vibration Measurement Systems Pty Ltd
112 Cambridge Street, West Leederville, WA 6007, Australia
PO Box 514, Wembley, WA 6913

Phone: (08) 9380 6933
e-mail: sales@nvms.com.au

NVMS

Certificate of Calibration

Certificate No:	CAL/24/11/013	**Calibration Date:**	25/11/2024
Client:	Wood Australia Pty Ltd		
Address:	Level 1, 240 St George's Terrace, Perth, WA, 6000		
Description:	Acoustic Calibrator	**Specified Sound**	
Manufacturer:	GRAS	**Pressure Levels:**	94, 114 dB
Model:	42AG		
Serial:	279379	**Specified Frequencies:**	1000 Hz
Adaptors:	½ inch		

Tests performed The sound pressure level(s), frequency(ies) and total distortion of the calibrator have been checked against the requirements of AS IEC 60942 - 2004 Annex B

Test Results

Parameter	Measured Value	Expanded Measurement Uncertainty †	
Sound Pressure Level 1	**94.07**	0.14 dB	**Complied Class 1**
Sound Pressure Level 2	**114.07**	0.14 dB	**Complied Class 1**
Frequency	**999.9**	0.015 Hz	**Complied Class 1**
THD + N @ SPL 1	**0.3**	0.07 %	**Complied Class 1**
THD + N @ SPL 2	**0.1**	0.07 %	**Complied Class 1**

(Sound Pressure Levels are referred to a pressure of 20 micro-pascals)

† Measurement uncertainties are stated at the 95% confidence level, and have been calculated in accordance with the principles in the ISO Guide to the Expression of Uncertainty in Measurement. A coverage factor of 2 applies.

The results of the tests, calibrations and/or measurements included in this document are traceable to the International System of Units (SI). References are traceable to National Measurement Institutes or laboratories accredited to ISO/IEC 17025 by a signatory to the ILAC MRA.

Ambient Conditions

Temperature:	24.7°C
Relative Humidity:	47%
Atmospheric Pressure:	1007 hPa

Authorised Signatory

Checked By

25/11/24
Date of issue

NATA
WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Calibration.

Accreditation No. 12604.

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1 of 2

ANNEXURE 5

Noise Impact Addendum

ADDENDUM TO NOISE IMPACT ASSESSMENT FOR NIGHTTIME OVERBURDEN HAULAGE OPERATIONS AT RED HILL QUARRY

Extension of Primary Crusher Operating Hours

HEIDELBERG MATERIALS

Add1-Rpt01-AU03332-RevA-2 Jun 2026

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A	2 Jun 2026	Issued for Review	J McLoughlin	A Stronach	J McLoughlin	

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1 INTRODUCTION

This report is an addendum to the noise impact assessment prepared for the proposed nighttime overburden haulage operations at Red Hill Quarry. It presents an assessment of the noise impacts associated with extending the hours of operation of the primary crusher at the quarry from 6pm, when daytime noise limits apply, to 8pm, when more stringent evening-time limits apply.

1.1 Context

Heidelberg is proposing night-time operations to haul overburden from the stripping area to the old Herne Hill quarry. To support these operations, the hours of operation of the tertiary crusher will be extended from 8pm to 10pm. These impacts have been assessed and described in the initial impact assessment[1]. However, this is not viable without also extending the operation of the primary crusher from 6pm to 8pm.

Heidelberg's operations at Red Hill Quarry are subject to development approval conditions issued by the Western Australian Planning Commission and the City of Swan. These conditions limit operating hours to between 6am and 8pm with operations between 6pm and 8pm restricted to tertiary crushing and screening only. (i.e. primary crushing is currently precluded beyond 6pm).

It is noted that while the approval conditions preclude evening time operation of the primary crusher, they allow all operations (including primary crushing) to commence at 6am. 6am falls within the time period defined in the Environmental Protection (Noise) Regulations 1997 which is commonly referred to as the nighttime period, during which the most stringent noise limits apply. Heidelberg has advised that it has not received any noise complaints during the 6am to 7am timeframe.

1.2 Primary Crusher Operations

The equipment associated with primary crushing operations includes the primary crusher, feeder and grizzly, which are contained within a building (see Figure 1-1), and conveyors transporting the crushed material to the secondary crusher house.

Mobile equipment associated with the primary crushing operations includes:

- 2 x Komatsu HD605 haul trucks;
- 1 x Caterpillar 775 haul truck;

[1] Rpt01-AU03332-Rev1 20 Apr 2026

- 1 x Komatsu PC800 excavator; and
- 1 x Caterpillar 990K wheeled loader.



Figure 1-1 : Primary Crushing Building

1.3 Nearest Noise Sensitive Receivers

The nearest noise sensitive receivers associated with the nighttime haulage operations (R1 – R9 as described in Rpt01-AU03332-Rev1 20 Apr 2026) are approximately 800 m to the west of the proposed tipping location, at the base of the Darling Scarp.

The primary crusher is located approximately 1.5 km to the east of the haulage tipping location and approximately 2.5 km from the receivers at the base of the scarp. There are also noise sensitive receivers at a similar distance to the south-east of the primary crusher and approximately 3 km to the north of the crusher. Therefore, this assessment includes two additional receivers (R10 and R11) to ensure that all potential impacts are considered.

Figure 1-2 shows the locations of the noise sensitive receivers.



Figure 1-2 : Noise Sensitive Receivers

1.4 Scope of Assessment

This assessment considers noise emissions from the primary crusher and associated equipment only.

2 NOISE CRITERIA

The legislation governing applicable noise limits is described in the noise impact assessment for nighttime overburden haulage operations[2].

Table 2-1 presents the applicable Assigned Levels for evening and nighttime hours at the nearest selected receivers.

Table 2-1 : Evening and Nighttime L_{A10} Assigned Levels at Selected Receivers

Receivers	Assigned Level (dBA)	
	Evening[3]	Night[4]
R1 – R6, R10 & R11	40	35
R7 - R9	41	36

[2] Rpt01-AU03332-Rev1 20 Apr 2026

[3] 1900 to 2200 hours

[4] 2200 to 0700 hours

3 ASSESSMENT METHODOLOGY

The assessment methodology includes the following:

- Re-analysis and review of the noise monitoring data presented in the impact assessment for night-time haulage operations to:
    - quantify the ambient noise environment during evening hours; and
    - assess whether the onset and conclusion of primary crushing operations can be detected in the monitoring data.
- Measurement of sound power levels of the primary crusher and associated processing equipment;
- Noise modelling of primary crushing operations, including associated mobile equipment, to predict the contributions to noise levels at the nearest noise sensitive receivers under worst-case weather conditions;
- Comparison of predicted levels with ambient levels;
- Comparison of predicted levels with noise criteria; and
- Assessment of the likelihood of primary crushing operations contributing to exceedances of the Assigned Levels during the evening (proposed) and night-time (existing) periods.

3.1 Measurement of Ambient Noise Levels

Ambient noise levels were measured at a location representative of the nearest noise sensitive premises to the west of the Red Hill quarry as described and reported in Rpt01-AU03332-Rev1 20 Apr 2026. The monitoring location is at a similar distance from the primary crushing operations as the additional receivers to the south-east and north included in this assessment. (R10 & R11 as described in section 1.3.)

This data has been further analysed to determine typical ambient noise levels during the evening hours (7pm – 10pm) when the quarry was operational and when it was closed during the Christmas period.

Data collected immediately before and after the commencement and cessation of primary crushing operations has also been reviewed to determine if any systematic change in noise levels associated with the crushing operations is detectable.

3.2 Determination of Equipment Sound Power Levels

A site visit was undertaken on 19 May 2026 to record noise levels at the primary crusher. The noise level data collected was used to estimate the sound power levels of the major noise

emitting apertures of the primary crusher building and associated conveyors. Initial sound power level estimates were then refined using the noise model to ensure closest agreement with between modelled and measured sound pressure levels at calibration locations approximately 25 m from the crusher building.

Sound power levels for mobile equipment were measured as part of the initial nighttime noise impact assessment as described in Rpt01-AU03332-Rev1 20 Apr 2026.

Appendix B provides the sound power levels for the noise sources included in the noise model.

3.3 Noise Modelling

The noise model developed for the initial nighttime noise impact assessment was used to predict noise levels associated with the primary crushing operations. Full details of the modelling methodology are provided in Rpt01-AU03332-Rev1 20 Apr 2026.

The model was used to determine the contribution of the primary crushing operations only to received noise levels.

3.3.1 Noise Modelling Scenario

In order determine noise impacts associated with primary crushing, the operational scenario described below (and depicted in Figure 3-1) has been developed:

- Primary crusher operating;
- 1 x excavator in the Red Hill Quarry;
- 3 x haul trucks operating:
    - one at low idle being filled by the excavator in the quarry;
    - one driving on the haul road between the quarry and the primary crusher;
    - one at high idle unloading at the primary crusher; and
- 1 x loader operating near to the primary crusher.



Figure 3-1 : Worst-case Noise Modelling Scenario

Symbol	Equipment
	Komatsu PC800 excavator
	Komatsu HD605 haul truck
	Caterpillar 775 haul truck
	Caterpillar 990K wheeled loader

3.3.2 Selection of Meteorological Conditions

SoundPLAN calculates predicted noise levels for defined meteorological conditions. In particular, the following variables are included in the prediction algorithms and will affect the predicted noise level: temperature; Pasquill stability (temperature inversion); relative humidity; wind speed; and wind direction.

The default meteorological conditions as suggested by the WA DWER Draft Guideline have been used to determine the worst-case overall predicted noise levels (see Table 3-1).

Table 3-1 : Noise Model Meteorological Inputs for Worst-Case Conditions

Period	Temperature	Pasquill Stability	Wind speed	Wind Direction	Relative Humidity
Evening	20°C	Pasquill Stability E	4 m/s	Worst-case (source to receiver)	50%

4 ANALAYSIS OF AMBIENT NOISE LEVELS

4.1 Ambient Noise Levels during Evening Hours

Charts presenting the ambient noise levels throughout monitoring period during the evening hours only are provided in Appendix A (Fig A-1 to Fig A-3) and demonstrate the following:

- The quietest ambient L_{A90} noise levels, recorded under low wind conditions, were typically between 25 dB(A) – 30 dB(A).
- Ambient levels during the quarry's Christmas shut down period (22 Dec 25 to 04 Jan 26) were not significantly different to ambient levels when the quarry was operating.

4.2 Noise Levels at Onset and Cessation of Primary Crushing Operations

Fig A-4 to Fig A-5 in Appendix A isolate the noise monitoring data 2 hours before and 1 hour after the nominal onset and cessation times for primary crushing operations. (The data also includes the shutdown period between 22 Dec 25 and 04 Jan 26.)

It is not possible to identify the onset or cessation of the primary crushing operations from the monitored data. I.e. there is no systematic increase in monitored levels corresponding to the onset of crushing operations and no systematic decrease in levels corresponding to the end of crushing operations. Nor is there any obvious change in the range of noise levels when the quarry was shutdown over the Christmas period.

The quietest ambient levels L_{A90} recorded under low wind conditions during periods when the primary crusher was operating were typically 25–30 dB(A) both in the morning and afternoon periods.

5 NOISE LEVEL PREDICTIONS

The noise levels predicted for the primary crushing operations under the worst-case scenario described in section 3.3.1 are presented in Table 5-1 which also includes the evening Assigned Levels for each receiver.

Table 5-1 : Predicted Noise Levels

Receiving Location	Evening L_{A10} Assigned Level dB(A)	Predicted Noise Level for Primary Crushing dB(A)
R1	40	12.6
R2	40	13.8
R3	40	12.1
R4	40	16.4
R5	40	13.6
R6	40	13.8
R7	41	13.3
R8	41	17.5
R9	41	21.6
R10	40	26.4
R11	40	29.4

6 NOISE IMPACT ASSESSMENT

6.1 Ambient Noise Levels

The onset and cessation of the primary crusher operations cannot be detected in the ambient noise monitoring data. The quietest ambient levels recorded at the start and end of primary crusher operations were typically between 25-30 dB(A) which is similar to ambient levels recorded during the evening period when the primary crusher was not operating. This suggests that current operations at the Red Hill Quarry, including primary crushing, do not impact the nearest noise sensitive receivers.

6.2 Predicted Noise Levels

The highest predicted noise levels occur at receivers R9 (East), R10 (South) and R11 (North), where the surrounding topography provides the least amount of shielding for noise from primary crushing operations. At these receptors, predicted noise levels are between 10 and 20 dB lower than the evening Assigned Levels under worst-case weather conditions.

At other receivers, predicted levels are more than 20 dB lower than the evening Assigned Levels.

6.3 Intrusive or Dominant Characteristics

Predicted noise levels suggest that noise from primary crushing operations is unlikely to protrude sufficiently above measured ambient noise levels to exhibit any intrusive or dominant characteristics.

6.4 Compliance Assessment

As demonstrated in Table 5-1, predicted noise levels for worst-case conditions are more than 10 dB below the evening Assigned Levels at all selected receivers, demonstrating that evening time operation of the primary crusher will be compliant with the Regulations.

The predicted levels are also more than 5 dB below the nighttime Assigned Levels which demonstrates that existing primary crushing operations, which commence during the nighttime period (starting at 6 am), are compliant with the Regulations.

6.5 Noise Management Recommendations

No specific noise control or noise management measures are required for the proposed extension of primary crushing operating hours to achieve compliance with Regulations.

7 CONCLUSION

It is concluded that the proposed extension of primary crushing hours from 6pm to 8pm can comply with Environmental Protection (Noise) Regulations without noise control or noise management measures.

Appendix A Ambient Noise Level Charts

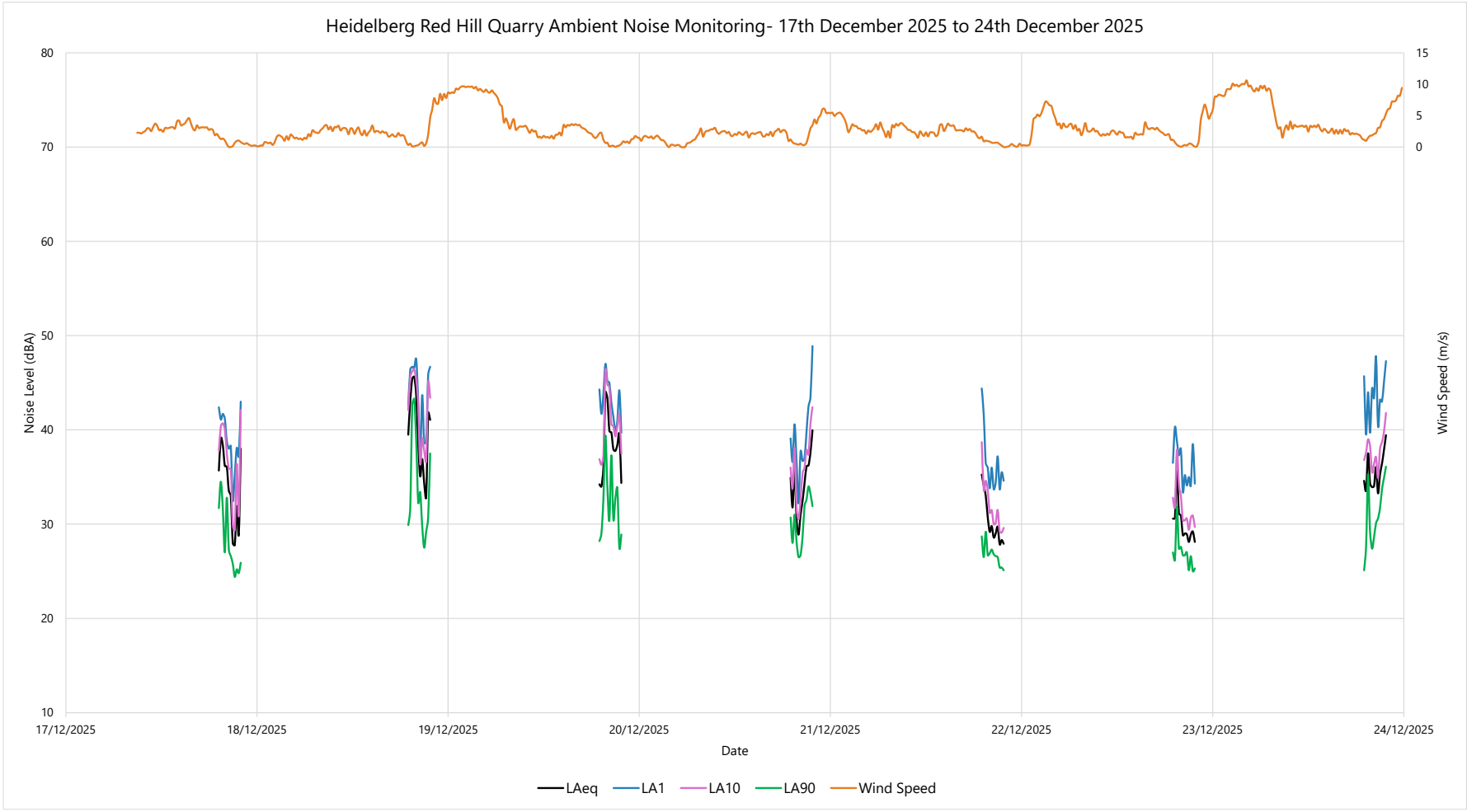


Figure A-1 Ambient Noise Monitoring – Evenings Only – Week 1

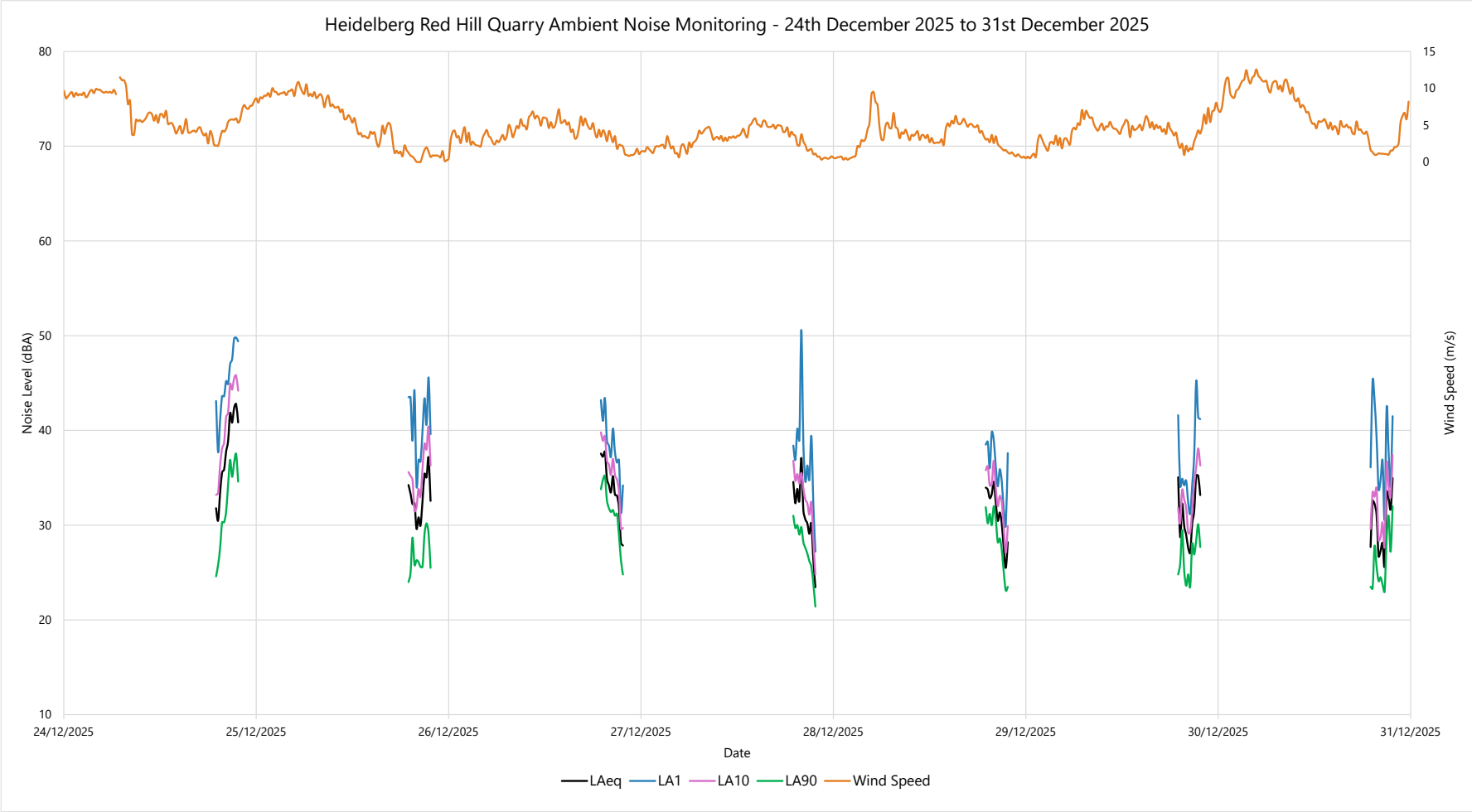


Figure A-2 Ambient Noise Monitoring – Evenings Only – Week 2

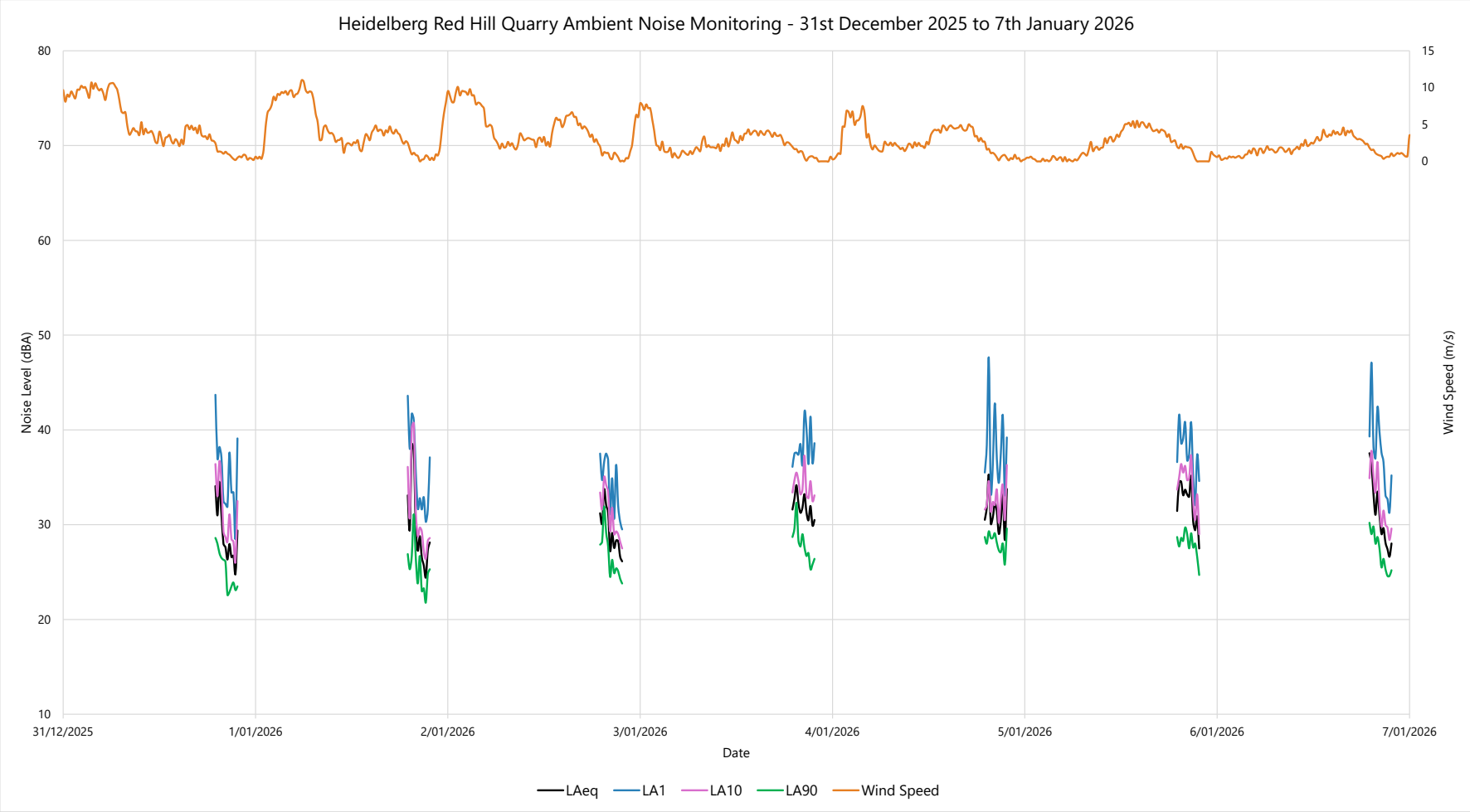


Figure A-3 Ambient Noise Monitoring – Evenings Only – Week 3

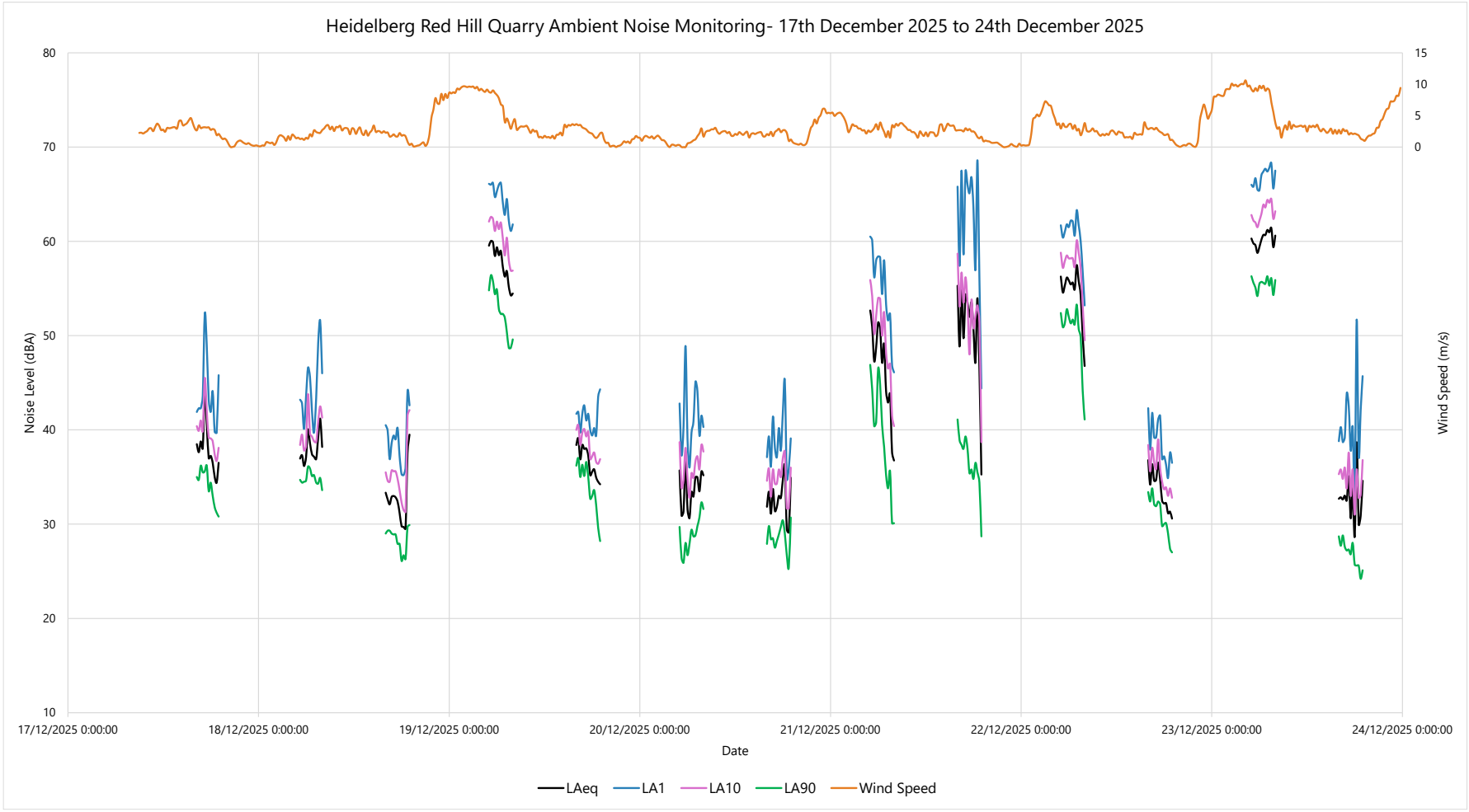


Figure A-4 Ambient Noise Monitoring – Primary Crushing Morning and Afternoon Start and End Times – Week 1

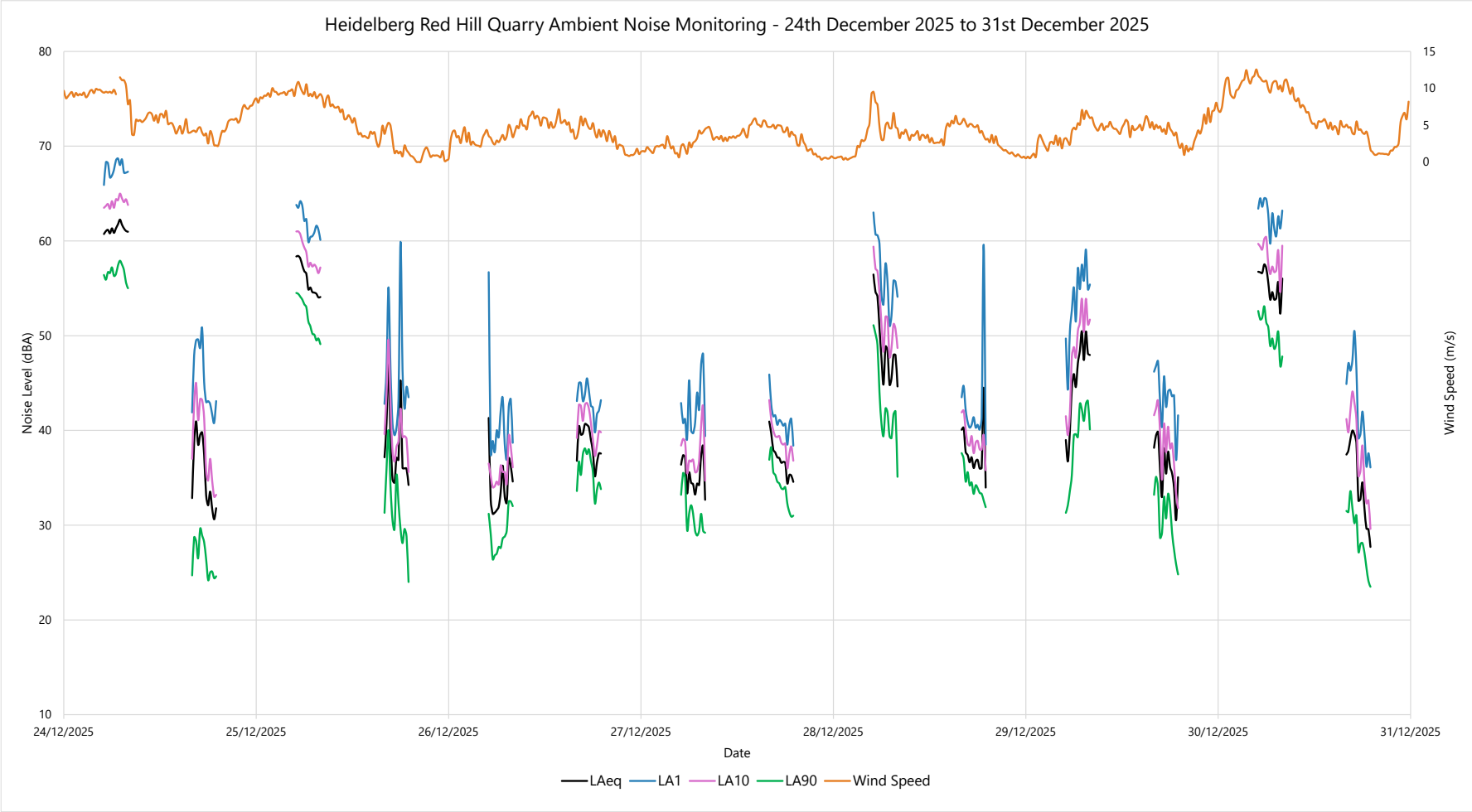


Figure A-5 Ambient Noise Monitoring – Primary Crushing Morning and Afternoon Start and End Times – Week 2

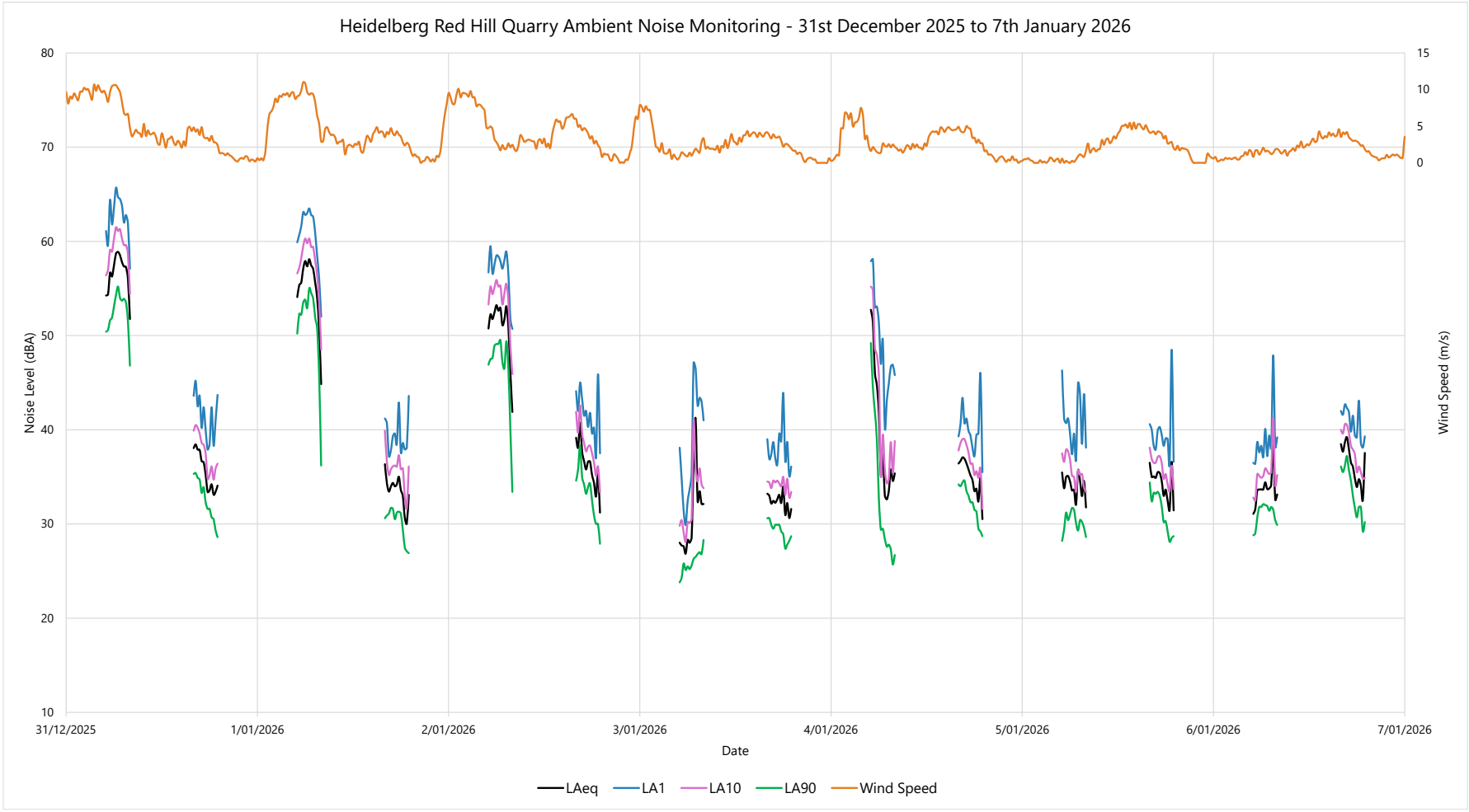


Figure A-6 Ambient Noise Monitoring – Primary Crushing Morning and Afternoon Start and End Times – Week 3

Appendix B Noise Source Details

Noise Source	Location	Coordinates		Height (m)	Sound Power Level (dB) at 1/1-Octave Band Centre Frequency (Hz)									Overall dB(A)
		Easting	Northing		31.5	63	125	250	500	1k	2k	4k	8k	
Primary crushing plant		413222.02	6478251.39	Varies[5]	116	117	115	111	109	105	101	96	88	110.7
Haul truck driving	Haul Road	412936.20	6477933.48	2	105	115	127	114	111	109	109	103	94	116.3
Haul truck at low idle	Pit	412567.22	6478278.90	2	102	99	98	92	94	94	93	86	77	98.6
Haul truck at high idle	Crusher access	413202.00	6478236.11	2	102	102	105	102	102	101	100	95	87	106.1
Excavator at high idle	Pit	412555.02	6478302.07	2	100	110	111	108	103	99	96	91	84	105.7
Loader at high idle	Crusher access	412567.22	6478278.90	2	98	112	114	101	104	106	101	91	83	108.6

[5] The data presented here represents the total sound power level of all sources / building apertures at the primary crusher. The heights of individual sources in the model (e.g. openings in the crusher building) correspond to the actual height of each individual source.