DIGBY WELLS
ENVIRONMENTAL

Environmental Regulatory Processes relating to the Thubilisha, Trichardtsfontein and Vaalkop Mining Right Areas

Noise Impact Assessment Report

Project Number:

SAS3869

Prepared for:

Sasol Mining (Pty) Ltd

August 2017

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Project Name:	**Environmental Regulatory Processes relating to the Thubilisha, Trichardtsfontein and Vaalkop Mining Right Areas**
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DECLARATION OF INDEPENDENCE

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I, Lukas Sadler as duly authorised representative of Digby Wells and Associates (South Africa) (Pty) Ltd., hereby confirm my independence (as well as that of Digby Wells and Associates (South Africa) (Pty) Ltd.) and declare that neither I nor Digby Wells and Associates (South Africa) (Pty) Ltd. have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of Sasol (Pty) Ltd, other than fair remuneration for work performed.

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EXECUTIVE SUMMARY

Sasol Mining (Pty) Ltd (Sasol) holds mining rights for the Twistdraai Colliery: Thubelisha Shaft (TCTS) and the Vaalkop mining area (Ref: MP30/5/1/2/2/138MR). Further to this, the mining right for the Trichardtsfontein Mine (Ref: MP30/5/1/2/2/10056MR) was ceded from Glencore Operations South Africa (Pty) Ltd in accordance with Section 11 of the Mineral and Petroleum Resources Development Act, 2002 (No. 28 of 2002) (MPRDA) to Sasol.

It is therefore required from Sasol that the Environmental Management Programme Reports (EMPRs) for the above mentioned mines be consolidated and updated to reflect changes in the mining plans and methodologies and consider additional infrastructure requirements.

This report relates specifically to the environmental noise impacts of the two new ventilation shafts as part of the additional surface infrastructure. The immediate area surrounding the project is classed as mainly rural because of the predominant surrounding farmsteads. The approach used in investigating the noise impacts is based on the National Noise Control Regulations, R.154 of 10 January 1992 (the Noise Regulations) in terms of Section 25 of the Environmental Conservation Act, 1989 (Act No. 73 of 1989).

The following additional legislation and standards were also considered during the assessment:

- The National Environmental Management Act, 1998 (Act No. 107 of 1998), NEMA;
- The National Environmental Management Air Quality Act, 2004 (Act No. 39 of 2004), NEMAQA; and
- The South African National Standards SANS 10103:2008 “The measurement and rating of environmental noise with respect to annoyance and to speech communication” (SANS 10103:2008).

The Environmental Noise Impact Assessment Report includes a baseline assessment and predicted noise impacts on the identified noise sensitive receptors by use of noise dispersion modelling as well as recommendations and mitigation measures for potential impacts.

Based on the daytime results from the noise measurements it is noted that the L_{Aeql} levels measured above the SANS guideline for the maximum allowable outdoor daytime rating level for ambient noise in rural districts (45dBA). The noise levels ranged from 50dBA to 57dBA. The night time results also measured above the SANS guideline for the maximum allowable outdoor night time rating level for ambient noise in rural districts (35dBA). The noise levels ranged from 42dBA to 53dBA.

As per the results of the noise dispersion models, it is concluded that the noise from the proposed ventilation fans will have a negligible impact on the surrounding rural receptors. The negligible impact is an acceptable negative impact for which mitigation is desirable. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. This is due to the proposed ventilation fans quantified noise level not significantly increasing the current ambient soundscape.

Additionally, due to the expected negligible impact, it is not recommended that a noise monitoring programme be implemented.

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Abbreviation	Description
L_{eq}	It is the Sound Pressure Level in dB, equivalent to the total Sound Energy over a given period of time.
A-weighting	the A-weighting filter covers the full audio range - 20 Hz to 20 kHz and the shape is similar to the response of the human ear at the lower levels
L_{AeqI}	A-frequency weighted, equivalent sound level value for a specific period measured using Impulse – time weighting.
Ambient Noise	Is the noise from all sources combined − mining noise, traffic noise, birdsong, running water, etc.
Residual Noise	It is ambient noise without specific noise. The residual noise is the noise remaining at a point under certain conditions when the noise from the specific source is suppressed.
Intermittent Noise	When machinery operates in cycles, or when single vehicles or aeroplanes pass by, the noise level increases and decreases rapidly. A single passing vehicle or aircraft is called an event.
Impulsive Noise	The noise from impacts or explosions, e.g., from blasting, is called impulsive noise. It is brief and abrupt, and its startling effect causes greater annoyance than would be expected from a simple measurement of sound pressure level.
Specific Noise	It is the noise from the source under investigation. The specific noise is a component of the ambient noise and can be identified and associated with the specific source.
Noise Level	Means the reading on an integrating impulse sound level meter taken at a measuring point in the presence of any alleged disturbing noise at the end of a total period of at least 10 minutes, after such meter had been put into operation, and, if the alleged disturbing noise has a discernible pitch, to which 5 dab has been added.
Disturbing Noise	Means 'n noise level which exceeds the zone sound level or, if no zone sound level has been designated, a noise level which exceeds the ambient sound level at the same measuring point by 7dBA or more.

1 Introduction

Sasol Mining (Pty) Ltd (Sasol) holds mining rights for the Twistdraai Colliery: Thubelisha Shaft (TCTS) and the Vaalkop mining area (Ref: MP30/5/1/2/2/138MR). Further to this, the mining right for the Trichardtsfontein Mine (Ref: MP30/5/1/2/2/10056MR) was ceded from Glencore Operations South Africa (Pty) Ltd in accordance with Section 11 of the Mineral and Petroleum Resources Development Act, 2002 (No. 28 of 2002) (MPRDA) to Sasol.

It is therefore required from Sasol that the Environmental Management Programme Reports (EMPRs) for the above mentioned mines be consolidated and updated to reflect changes in the mining plans and methodologies and consider additional infrastructure requirements.

It is proposed that Sasol will construct two ventilation shafts on TCTS and two ventilation shafts on Trichardtsfontein.

1.1 Project Overview

The consolidation project area owned by Sasol Mining Twistdraai Thubelisha Colliery comprises three mining right areas namely TCTS, Trichardtsfontein and Vaalkop. Twistdraai Thubelisha Colliery is currently mining TCTS and proposes to start mining Trichardtsfontein within the next few months. Vaalkop mining area although a priority to Twistdraai Thubelisha Colliery will only start mining in 2029. To ensure the mines operate in a more efficient and effective manner Twistdraai Thubelisha Colliery intends to compile (Vaalkop) and consolidate all amended EMPrs into one merged EMPr.

The Trichardtsfontein project area is 3 170 ha in size, but only an area of approximately 1 382 ha will be undermined. The coal seam depth at Trichardtsfontein is estimated to be at an approximate depth of 140 – 160 m below surface. The infrastructure (including access shafts) will be on the adjacent mining property of Sasol Mining at the TCTS. However, two ventilation shafts (up and downcast) have been proposed to be construction on TCTS and two ventilation shafts (up and downcast) have been proposed to be construction on Trichardtsfontein which will assist in providing sufficient ventilation to the underground mining area.

The Vaalkop project area is approximately 8 600 ha in extent. The initial mining activities in this area will be conducted as green field operations as no existing infrastructure for coal mining exists in the area. It is foreseen that the Thubelisha conveyor could possibly be utilised. All mining activities will be conducted by means of underground mining operations, such as the bord-and-pillar and high extraction mining method. No infrastructure will be constructed on the Vaalkop project area as all required infrastructure will be located at the TCTS site. It is estimated that the coal seam depth at Vaalkop is approximately 80 - 120 m below surface.

The TCTS project area is 7 200 ha in size. The coal seam depth at TCTS is estimated to be at a depth of 140 - 170 m below the surface and the seam is approximately 2 – 5 m thick.

In all mining right areas will only mine the No 4 seam as it is the only seam of coal that is economically viable.

Due to the variation in depth of mining and coal seam an assumption has been made that mining will be undertaken between 30 m and 215 m. Therefore all impact assessments and specialist studies have assessed the impacts of mining utilising bord and pillar with high extraction at this depth.

1.2 Terms of Reference

This report relates specifically to the environmental noise impacts of the proposed additional two ventilation shafts on Trichardtsfontein. The immediate area surrounding the project is classed as mainly rural because of the predominant surrounding farmsteads. The approach used in investigating the noise impacts is based on the National Noise Control Regulations, R.154 of 10 January 1992 (the Noise Regulations) in terms of Section 25 of the Environmental Conservation Act, 1989 (Act No. 73 of 1989).

The following additional legislation and standards were also considered during the assessment:

- The National Environmental Management Act, 1998 (Act No. 107 of 1998), NEMA;
- The National Environmental Management Air Quality Act, 2004 (Act No. 39 of 2004), NEMAQA; and
- The South African National Standards SANS 10103:2008 “The measurement and rating of environmental noise with respect to annoyance and to speech communication” (SANS 10103:2008).

The Environmental Noise Impact Assessment Report includes a baseline assessment and predicted noise impacts on the identified noise sensitive receptors by use of noise dispersion modelling as well as recommendations and mitigation measures for potential impacts.

2 Details of the Specialist

Lukas Sadler is an Affiliate Member of the Institute of Acoustics and has a B.COM degree in Geography and Environmental Management, including short courses in Environmental Noise Assessments, Environmental Noise Control and Air Quality Management as well as local and international work experience in the environmental acoustic sciences field. This includes experience working with projects in accordance with the International Finance Corporation (IFC) and World Bank standards. Lukas has also gained experience working in Africa namely Mali, Senegal, Ghana, Sierra Leone, DRC, Liberia, Mozambique and Namibia. At Digby Wells, Lukas’ core focus is working on Environmental Noise impact assessments, which includes baseline noise monitoring surveys, noise dispersion modelling and noise management programmes as well as carrying out compliance monitoring programmes. A Curriculum Vitae (CV) and declaration of independence is attached in Appendix A.

3 Aims and Objectives

The objective of the study is to assess what the current ambient noise levels are in the area as well as what the significance of the noise impacts from the ventilation shafts will be on the nearest surrounding receptors. The study includes baseline noise measurements to establish the soundscape of the area surrounding the proposed project, as well as assess, via predictive noise dispersion modelling, the potential impact of the noise emissions from the proposed ventilation fans on the nearest surrounding receptors.

4 Methodology

4.1 Literature Review and Desktop Assessment

The approach used in investigating noise impacts is based on the Noise Control Regulations as well as guidelines provided by SANS 10103:2008 “The measurement and rating of environmental noise with respect to annoyance and to speech communication”. Based on the National Noise Control Regulations it is prohibited to make, produce or cause a disturbing noise, or allow it to be made, produced or caused by any person, machine, device or apparatus or any combination thereof. According to the National Noise Control Regulations "disturbing noise" means a noise level which exceeds the zone sound level or, if no zone sound level has been designated, a noise level which exceeds the ambient sound level at the same measuring point by 7dBA or more.

According to the SANS 10103:2008, the sound pressure level is used as the measurement unit for noise levels. The acceptable rating levels according to SANS 10103:2008 for ambient noise in different districts (residential and non-residential) are presented in Table 4-1.

Table 4-1: Typical Rating Levels for Noise in Districts (SANS 10103, 2008)

Type of District	Equivalent continuous rating level ($L_{Reg.T}$) for noise (dBA)					
	Outdoors			Indoors, with open windows		
	Day-night	Day-time	Night-time	Day-night	Day-time	Night-time
	$L_{R,dn}$[a]	$L_{Req,d}$[b]	$L_{Req,n}$[b]	$L_{R,dn}$[a]	$L_{Req,d}$[b]	$L_{Req,n}$[b]
Residential Districts						
a) Rural districts	45	45	35	35	35	25
b) Suburban districts with little road traffic	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
Non-Residential Districts						

Type of District	Equivalent continuous rating level ($L_{Reg.T}$) for noise (dBA)					
	Outdoors			Indoors, with open windows		
	Day-night	Day-time	Night-time	Day-night	Day-time	Night-time
	$L_{R,dn}$[a]	$L_{Req,d}$[b]	$L_{Req,n}$[b]	$L_{R,dn}$[a]	$L_{Req,d}$[b]	$L_{Req,n}$[b]
d) Urban districts with some workshops, with business premises, and with main roads	60	60	50	50	50	40
e) Central business districts	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50
NOTE 1 If the measurement or calculation time interval is considerably shorter than the reference time intervals, significant deviations from the values given in the table might result.						
NOTE 2 If the spectrum of the sound contains significant low frequency components, or when an unbalanced spectrum towards the low frequencies is suspected, special precautions should be taken and specialist advice should be obtained. In this case the indoor sound levels might significantly differ from the values given in columns 5 to 7						
NOTE 3 In districts where outdoor LR,dn exceeds 55dBA, residential buildings (e.g. dormitories, hotel accommodation and residences) should preferably be treated acoustically to obtain indoor LReq,T values in line with those given in table 1.						
NOTE 4 For industrial districts, the LR,dn concept does not necessarily hold. For industries legitimately operating in an industrial district during the entire 24 h day/night cycle, LReq,d = LReq,n =70dBA can be considered as typical and normal.						
NOTE 5 The values given in columns 2 and 5 in this table are equivalent continuous rating levels and include corrections for tonal character, impulsiveness of the noise and the time of day.						
NOTE 6 The noise from individual noise sources produced, or caused to be produced, by humans within natural quiet spaces such as national parks, wilderness areas and bird sanctuaries, should not exceed a maximum Weighted sound pressure level of 50dBA at a distance of 15 m from each individual source.						
a) The values given in columns 2 and 5 are equivalent continuous rating levels and include corrections for tonal character and impulsiveness of the noise and the time of day.						
b) The values given in columns 3, 4, 6 and 7 are equivalent continuous rating levels and include corrections for tonal character and impulsiveness.						

The probable community/group response to levels in excess of the acceptable rating levels are presented in Table 4-2, where LReq,T is the equivalent continuous A-weighted sound pressure level, in decibels (dBA), determined over a specific time period. 'A-weighted' is a standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.

Table 4-2: Categories of Community/Group Response (SANS 10103, 2008)

Excess ($\Delta L_{Req,T}$)[a]dBA	Estimated community/group response

	Category	Description
0 – 10	Little	Sporadic complaints
5 – 15	Medium	Widespread complaints
10 - 20	Strong	Threats of action
>15	Very strong	Vigorous action
NOTE Overlapping ranges for the excess values are given because a spread in the community reaction might be anticipated.		
a ΔLReq,T should be calculated from the appropriate of the following:		
1) ΔLReq,T = LReq,T of ambient noise under investigation MINUS LReq,T of the residual noise (determined in the absence of the specific noise under investigation);		
2) ΔLReq,T = LReq,T of ambient noise under investigation MINUS the maximum rating level for the ambient noise given in table 1;		
3) ΔLReq,T = LReq,T of ambient noise under investigation MINUS the typical rating level for the applicable district as determined from table 2; or		
4) ΔLReq,T = Expected increase in LReq,T of ambient noise in an area because of a proposed development under investigation.		

4.2 Fieldwork

A baseline assessment was undertaken to determine the current ambient noise level at the nearest noise sensitive receptor to the proposed ventilation shaft locations. The criteria that were used for the siting of the measurement locations were:

- The location of the nearest farmsteads most likely to be impacted by the sound of the proposed ventilation shafts; and
- The location that serves as a suitable reference point for the measurement of ambient sound levels surrounding the project. The noise measurement locations cover four locations surrounding the project area (N1 – N4).

A Cirrus, Optimus Green, precision integrating sound level meter was used for the measurements. The instrument was field calibrated with a Cirrus, sound level calibrator. The “ambient sound level” as defined by the National Noise Control regulations, means the reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes, after such meter had been put into operation. Whereas the "integrating impulse sound level meter" means a device which integrates a function of the root mean square value of sound pressure over a period of time while it is set on 'I'-time weighting and indicates the result in dBA.

The L_{Aeql} level represents the ‘average’ noise level for the measurement period including impulsive and intermittent noise sources such as traffic and animal noise. The baseline locations are presented in Table 4-3 as well as on Plan 1 (refer to Appendix B).

Table 4-3: Noise Measurement Locations

Site ID	Farm/location	Category of Receiver	GPS Coordinates
N1	Rooipoort 143 IS Ptn 3	Rural	26°29'18.74"S & 29°16'20.02"E
N2	Rooipoort 144 IS Ptn 8	Rural	26°28'53.60"S & 29°17'57.60"E
N3	Zeekoegat 145 IS Ptn 1	Rural	26°28'8.08"S & 29°19'37.23"E
N4	Palmietfontein 110 IS Ptn 18	Rural	26°27'53.83"S & 29°20'34.39"E

4.3 Noise Dispersion Modelling

Predictive modelling was performed for the proposed activities through the use of the modelling software SoundPlan. The software specialises in computer simulations of noise pollution dispersion. Estimates of the cumulative noise levels for the study were derived from the noise emissions from all the major noise-generating components and activities of the project.

Table 4-4 indicates the noise power levels used in the model simulations. The sound power levels were mainly derived from the SoundPlan database.

Table 4-4: Sound Power Levels from Main Noise Causing Sources (SoundPlan, 2017)

Noise source	Sound power levels dB						
Octave band frequencies, Hz	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**
Construction							
Haul Truck	108	118	115	114	110	106	102
Excavators	113	117	107	108	106	101	95
Drill	109	118	113	113	113	112	110
Dozer	110	122	113	114	110	108	104
Diesel Generator	105	120	116	108	107	108	108
Operational							
Vent shaft	113	113	118	116	112	109	101

The noise dispersion modelling software was used to assess whether the noise from the proposed ventilation shafts will impact on the relevant noise sensitive receivers, by comparing the predicted propagating noise levels with the current ambient baseline noise levels as well as against the typical rating levels for ambient noise in districts. The significance of the impact was then rated according to the Impact Assessment Criteria (refer to Section 8 of this report).

5 Assumptions and Limitations

The following assumptions and limitations are included as part of this assessment:

- The construction phase is assumed to be carried out during daytime hours (06:00-22:00), therefore only a daytime scenario was modelled for the construction phase and the subsequent impact of the construction phase refers only to the daytime;
- The resulting noise contours represent worst case L_{Aeq} at any receiver located 360 degrees in the horizontal plane around the noise sources. The noise modelling software is limited to calculating the predominant wind direction (or downwind conditions of propagation) per single receptor only. Calm wind conditions have therefore been included in the model due to the number of surrounding receptors. Thus, the noise dispersion plots do not represent a typical seasonal scenario in the predominant wind direction but rather a yearly average of the area's meteorological conditions in all directions; and
- The modelling follows a conservative worst case scenario approach assuming all activities for each phase are being carried out simultaneously;

6 Baseline Environment

The results from the noise meter recordings for all the monitored locations as well as the rating limits according to the SANS 10103:2008 guidelines are presented in Table 6-1, with the time history graphs presented in Figure 6-1 to Figure 6-4. Please note that Figure 6-1 does not contain a night time guideline indication line, which indicates the 35 dBA level, due to the y-axis starting at 40 dBA. The locations of the monitoring points can be viewed in Plan 1 (Appendix B).

Table 6-1: Results of Baseline Noise Measurements

Sample ID	SANS rating limit guidelines			Measurement details		
	Type of district	Period	Typical rating level dBA	L_{Aeql} dBA	Maximum/Minimum dBA	Date
N1	Rural	Daytime	45	56	74 / 48	29/06/2017
		Night time	35	53	64 / 47	29/06/2017
N2	Rural	Daytime	45	50	78 / 36	26/06/2017
		Night time	35	45	55 / 38	26/06/2017
N3	Rural	Daytime	45	57	84 / 32	28/06/2017
		Night time	35	42	63 / 31	28/06/2017
N4	Rural	Daytime	45	51	82 / 35	27/06/2017
		Night time	35	45	61 / 29	27/06/2017
	Indicates L_{Aeql} levels above either the daytime rating limit or the night time rating limit					

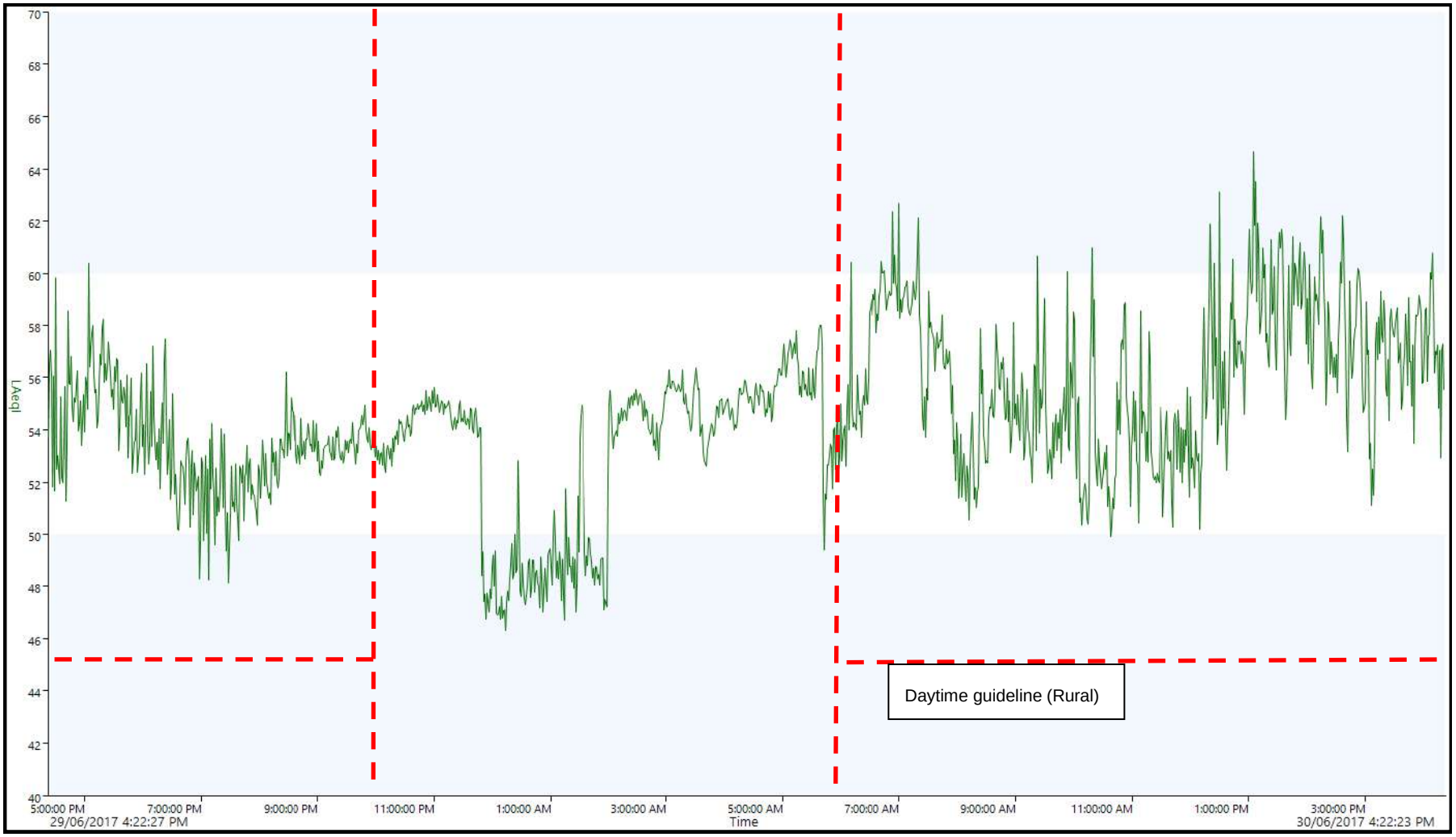

Figure 6-1: Noise time history for N1

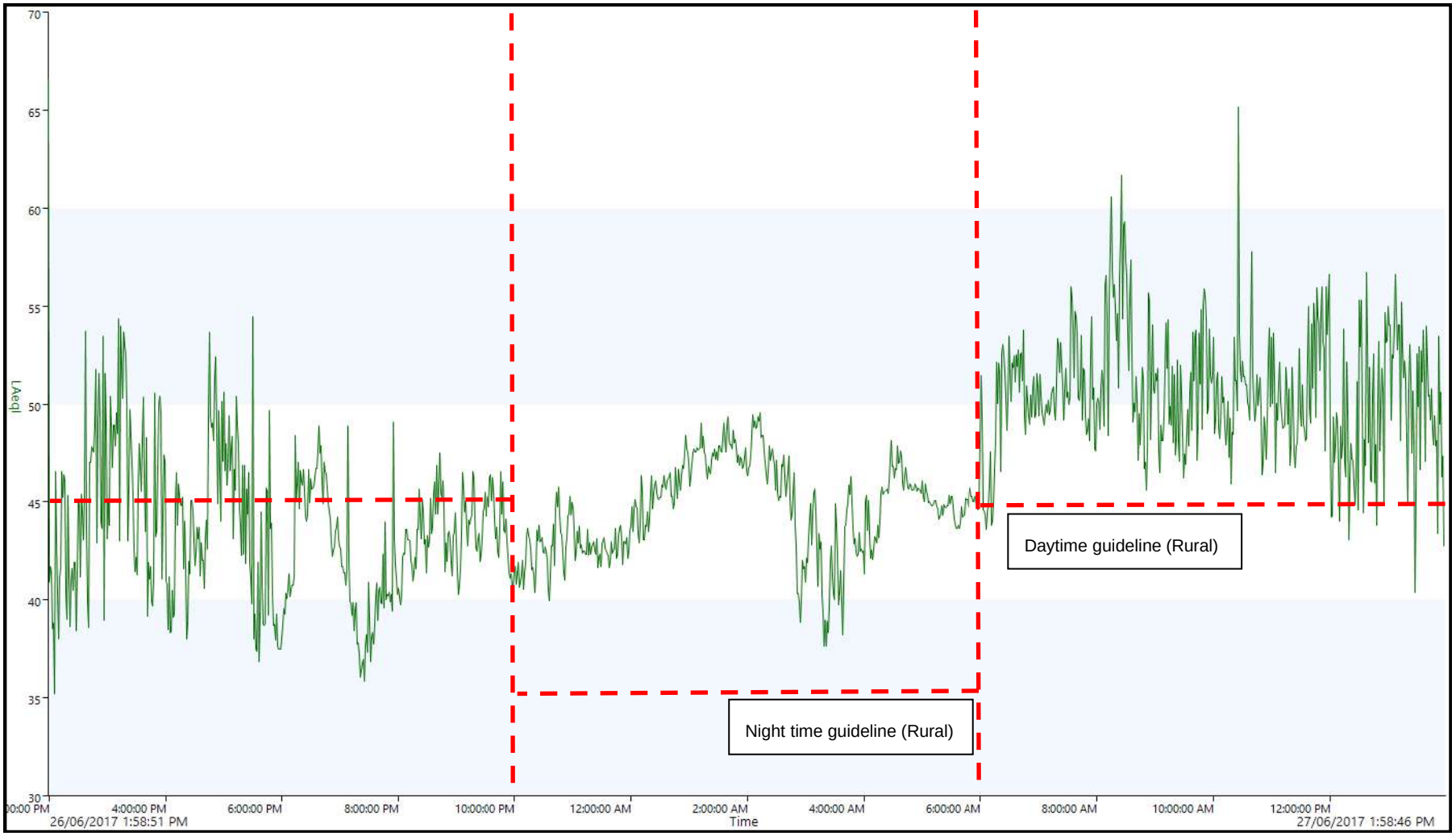

Figure 6-2: Noise time history for N2

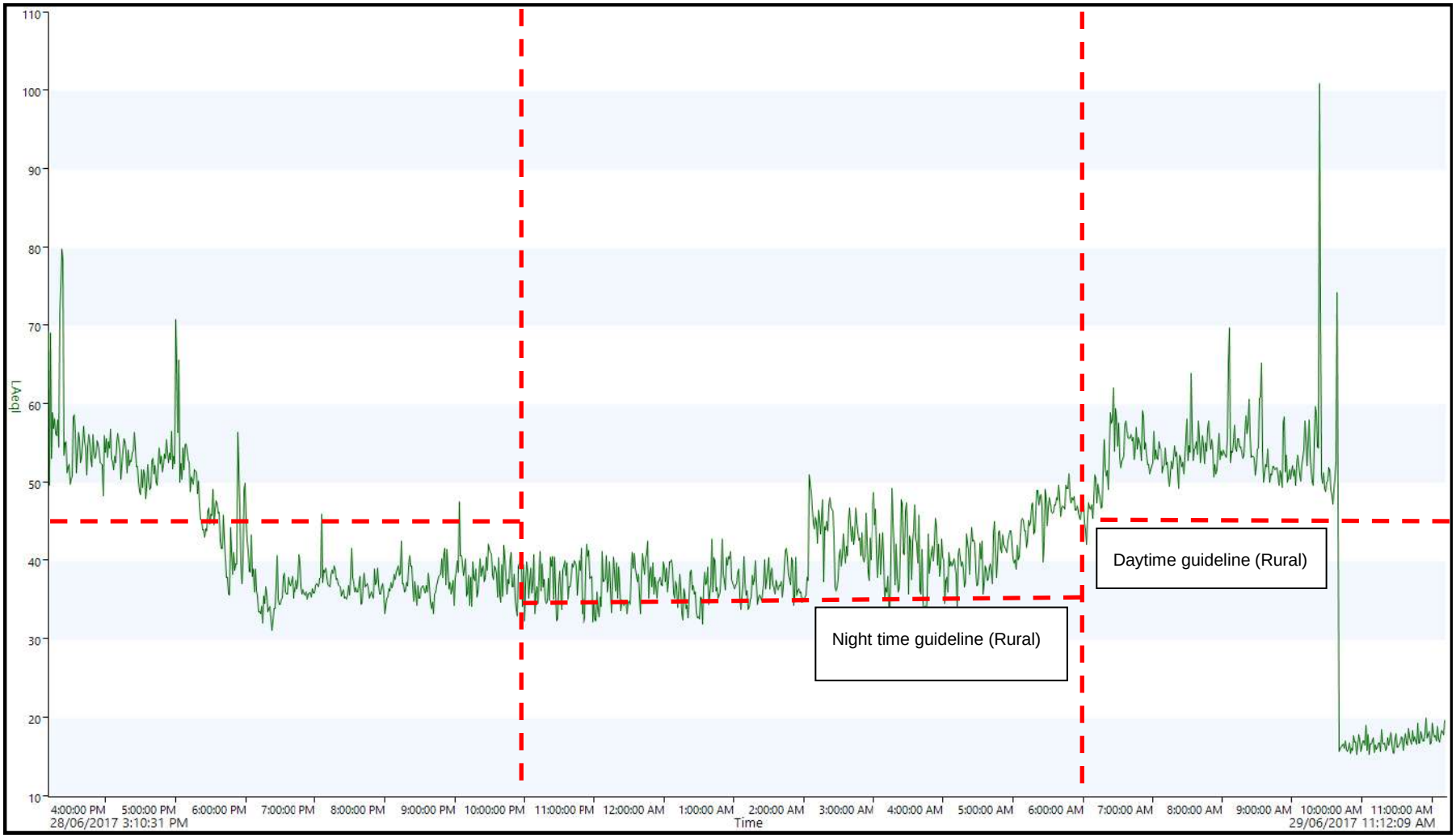

Figure 6-3: Noise time history for N3

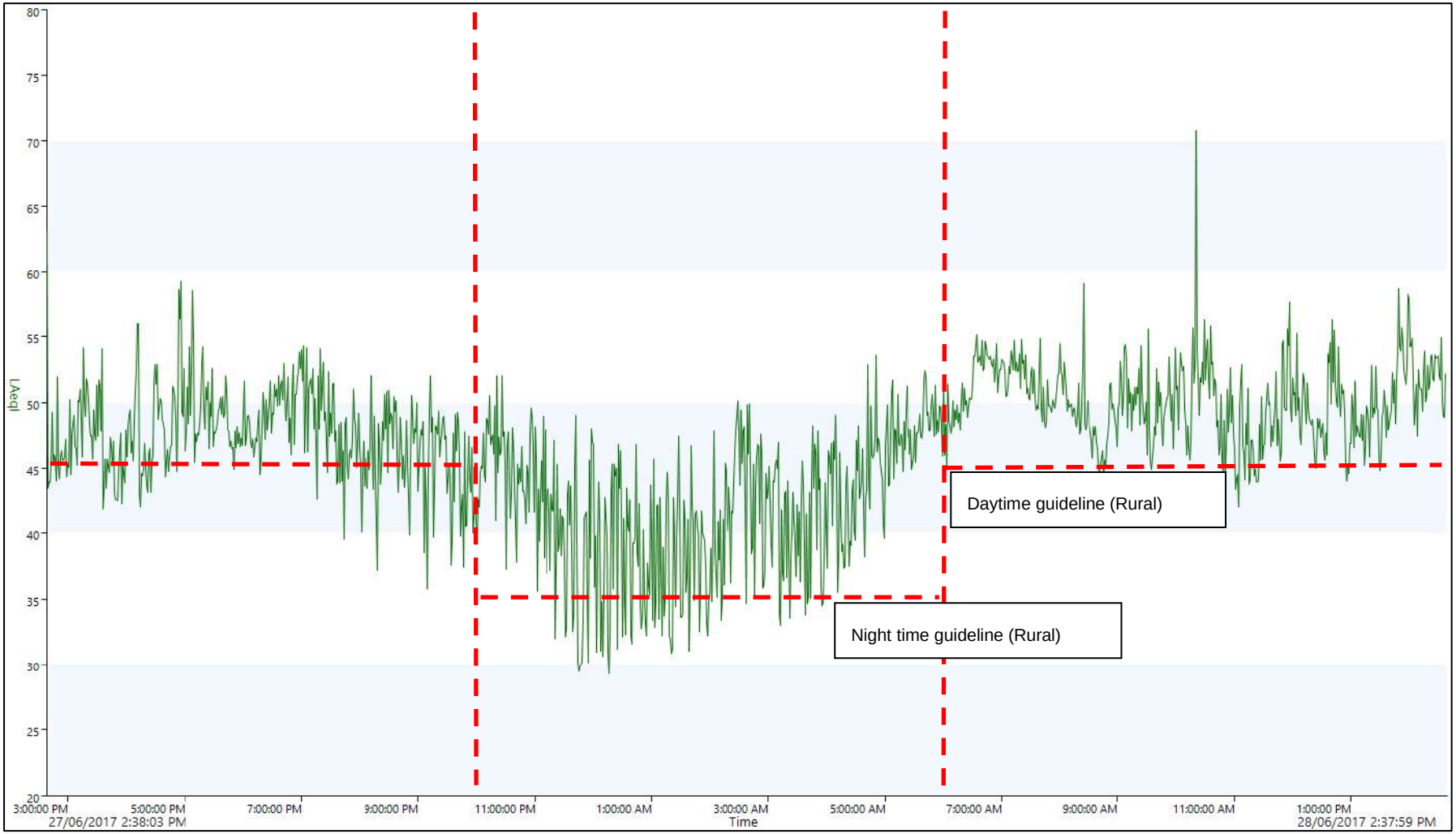

Figure 6-4: Noise time history for N4

6.1 Daytime Results

Based on the daytime results from the noise measurements it is noted that the L_{Aeql} levels measured above the SANS guideline for the maximum allowable outdoor daytime rating level for ambient noise in rural districts (45dBA). With the noise levels ranging from 50dBA to 57dBA.

Monitoring location N1 was taken on Portion 3 of the farm Rooipoort 143 IS, with the specific L_{Aeql} level measuring at 56dBA. The main cumulative noise sources at this location were:

- Engineering works on the premises;
- Nearby water pump continuously running; and
- Vehicle activity on the premises as well as on the national road (N17).

Monitoring location N2 was taken at the homestead on Portion 8 of the farm Rooipoort 144 IS, with the specific L_{Aeql} level measuring at 50dBA. The main cumulative noise sources at this location were:

- Dogs barking intermittently;
- Intermittent vehicle activity; and
- Sounds from the Thubelisha Shaft Complex was audible from this monitoring location, however was not significantly influencing the baseline noise level.

Monitoring location N3 was taken at the homestead on Portion 1 of the farm Zeekoegat 145 IS, with the specific L_{Aeql} level measuring at 57dBA. The main cumulative noise sources at this location were:

- Dog barking intermittently; and
- Intermittent vehicle activity on the premises.

Monitoring location N4 was taken at the homestead on Portion 18 of the farm Palmietfontein 110 IS, with the specific L_{Aeql} level measuring at 51dBA. The main cumulative noise sources at this location were:

- Sounds from farm animals such as sheep; and
- Birdsong from the bird species caged on the premises.

6.2 Night Time Results

Based on the night time results from the noise measurements it is noted that the L_{Aeql} levels predominantly measured above the SANS guideline for the maximum allowable outdoor night time rating level for ambient noise in rural districts (35dBA). With the noise levels ranging from 42dBA to 53dBA.

The specific L_{Aeql} level at Monitoring Location N1 measured at 53dBA. The main cumulative noise sources at this location were:

- Frequent vehicle traffic on the nearby national road (N17); and

- Nearby water pump continuously running.

The specific L_{Aeql} level at Monitoring Location N2 measured at 45dBA. The main cumulative noise sources at this location were:

- Insect sounds from the *Gryllidae* and *Cicada* as well as sounds from amphibians dominated throughout the night time period; and
- Sounds from the Thubelisha Shaft Complex was audible from this monitoring location, however was not significantly influencing the baseline noise level.

The specific L_{Aeql} level at Monitoring Location N3 measuring at 42dBA. The main cumulative noise sources at this location were the insect sounds from the *Gryllidae* and *Cicada* dominated throughout the night time period:

The specific L_{Aeql} level at Monitoring Location N4 measuring at 45dBA. The main cumulative noise sources at this location were:

- Insect sounds from the *Gryllidae* and *Cicada* as well as sounds from amphibians dominated throughout the night time period; and
- Birdsong from the bird species caged on the premises.

The noise sources that were influential during the baseline measurements at the time of the noise survey and that were responsible for the day/night time levels are summarised in

.

7 Sensitivity Analysis and No-Go Areas

In terms of the current proposed location of the ventilation shafts it is not expected that there are any ‘No-Go’ areas within the current proposed footprint. The reason for this is that based on the quantified noise levels, the noise from the project is unlikely to impact on the surrounding receptors.

8 Impact Assessment

8.1 Methodology used in Determining and Ranking the Nature, Significance, Consequence, Extent, Duration and Probability of Potential Environmental Noise Impacts and Risks

Details of the noise impact assessment methodology used to determine the significance of physical impacts are provided below.

The significance rating process follows the established impact/risk assessment formula:

Significance = Consequence x Probability x Nature

Where

Consequence = Intensity + Extent + Duration

And

Probability = Likelihood of an impact occurring

And

Nature = Positive (+1) or negative (-1) impact

Note: In the formula for calculating consequence, the type of impact is multiplied by +1 for positive impacts and -1 for negative impacts.

The matrix calculates the rating out of 147, whereby Intensity, Extent, Duration and Probability are each rated out of seven as indicated in Table 8-3. The weight assigned to the various parameters is then multiplied by +1 for positive and -1 for negative impacts.

Impacts are rated prior to mitigation and again after consideration of the mitigation measure proposed in this environmental noise impact assessment report. The significance of an impact is then determined and categorised into one of eight categories, as indicated in Table 8-2, which is extracted from Table 8-1. The description of the significance ratings is discussed in Table 8-3.

It is important to note that the pre-mitigation rating takes into consideration the activity as proposed, i.e. there may already be certain types of mitigation measures included in the design (for example due to legal requirements). If the potential impact is still considered too high, additional mitigation measures are proposed.

Table 8-1: Impact Assessment Parameter Ratings

Rating	Intensity/Replacability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
7	Irreplaceable loss or damage to biological or physical resources or highly sensitive environments. Irreplaceable damage to highly sensitive cultural/social resources.	Noticeable, on-going natural and / or social benefits which have improved the overall conditions of the baseline.	International The effect will occur across international borders.	Permanent: The impact is irreversible, even with management, and will remain after the life of the project.	Definite: There are sound scientific reasons to expect that the impact will definitely occur. >80% probability.
6	Irreplaceable loss or damage to biological or physical resources or moderate to highly sensitive environments. Irreplaceable damage to cultural/social resources of moderate to highly sensitivity.	Great improvement to the overall conditions of a large percentage of the baseline.	National Will affect the entire country.	Beyond project life: The impact will remain for some time after the life of the project and is potentially irreversible even with management.	Almost certain / Highly probable: It is most likely that the impact will occur. <80% probability.

Rating	Intensity/Replacability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
5	Serious loss and/or damage to physical or biological resources or highly sensitive environments, limiting ecosystem function. Very serious widespread social impacts. Irreparable damage to highly valued items.	On-going and widespread benefits to local communities and natural features of the landscape.	Province/ Region Will affect the entire province or region.	Project Life (>15 years): The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Likely: The impact may occur. <65% probability.
4	Serious loss and/or damage to physical or biological resources or moderately sensitive environments, limiting ecosystem function. On-going serious social issues. Significant damage to structures / items of cultural significance.	Average to intense natural and / or social benefits to some elements of the baseline.	Municipal Area Will affect the whole municipal area.	Long term: 6-15 years and impact can be reversed with management.	Probable: Has occurred here or elsewhere and could therefore occur. <50% probability.

Rating	Intensity/Replacability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
3	Moderate loss and/or damage to biological or physical resources of low to moderately sensitive environments and, limiting ecosystem function. On-going social issues. Damage to items of cultural significance.	Average, on-going positive benefits, not widespread but felt by some elements of the baseline.	Local Local extending only as far as the development site area.	Medium term: 1-5 years and impact can be reversed with minimal management.	Unlikely: Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur. <25% probability.
2	Minor loss and/or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	Low positive impacts experience by a small percentage of the baseline.	Limited Limited to the site and its immediate surroundings.	Short term: Less than 1 year and is reversible.	Rare / improbable: Conceivable, but only in extreme circumstances. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures. <10% probability.

Rating	Intensity/Replacability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
1	Minimal to no loss and/or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	Some low-level natural and / or social benefits felt by a very small percentage of the baseline.	Very limited/Isolated Limited to specific isolated parts of the site.	Immediate: Less than 1 month and is completely reversible without management.	Highly unlikely / None: Expected never to happen. <1% probability.

Table 8-2: Probability/Consequence Matrix

Probability	Significance																																					
7	-147	-140	-133	-126	-119	-112	-105	-98	-91	-84	-77	-70	-63	-56	-49	-42	-35	-28	-21	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147
6	-126	-120	-114	-108	-102	-96	-90	-84	-78	-72	-66	-60	-54	-48	-42	-36	-30	-24	-18	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
5	-105	-100	-95	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
4	-84	-80	-76	-72	-68	-64	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84
3	-63	-60	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
2	-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
1	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

Consequence

Table 8-3: Significance Rating Description

Score	Description	Rating
109 to 147	A very beneficial impact that may be sufficient by itself to justify implementation of the project. The impact may result in permanent positive change	Major (positive) (+)
73 to 108	A beneficial impact which may help to justify the implementation of the project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the (natural and / or social) environment	Moderate (positive) (+)
36 to 72	A positive impact. These impacts will usually result in positive medium to long-term effect on the natural and / or social environment	Minor (positive) (+)
3 to 35	A small positive impact. The impact will result in medium to short term effects on the natural and / or social environment	Negligible (positive) (+)
-3 to -35	An acceptable negative impact for which mitigation is desirable. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the natural and / or social environment	Negligible (negative) (-)
-36 to -72	A minor negative impact requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the natural and / or social environment	Minor (negative) (-)
-73 to -108	A moderate negative impact may prevent the implementation of the project. These impacts would be considered as constituting a major and usually a long-term change to the (natural and / or social) environment and result in severe changes.	Moderate (negative) (-)
-109 to -147	A major negative impact may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects. The impacts are likely to be irreversible and/or irreplaceable.	Major (negative) (-)

8.2 Project Activities

The project activities that have been assessed in terms of the noise impact are divided into the three project phases, namely, the Construction Phase, the Operational Phase and the Decommissioning Phase and are described in Table 8-4.

Table 8-4: Description of Activities to be Assessed

Project Phase	Project Activity
Construction Phase	Site clearing, including the removal of topsoil and vegetation; Development of shafts, including drilling; and Construction of ventilation shafts
Operational Phase	Operation of ventilation shafts
Decommissioning Phase	Rehabilitation, and demolition of ventilation shafts.

8.3 Impact Assessment

8.3.1 Construction Phase

8.3.1.1 Project Activities Assessed

The construction phase activities as listed in Table 8-4 may cause a noise disturbance at the surrounding rural receptors.

8.3.1.2 Impact Description

The construction noise dispersion model is indicated on Plan 2 (refer to Appendix B). The results indicate that the expected noise during the construction activities will unlikely cause a noise disturbance in terms of the National Noise Control Regulations at the nearest receptors. The reason for this is that the construction noise is unlikely to increase the ambient noise levels by more than 6dBA as seen in Table 8-5.

Table 8-5: Ambient Noise Level Increase During Construction Phase

Receptors	Daytime baseline dBA	Expected noise from construction activities dBA	Cumulative level dBA	Increase in ambient noise level dBA
N1	56	35	56	0
N2	50	27	50	0
N3	57	36	57	0
N4	51	34	51	0

8.3.1.3 Management Objectives

To minimise/prevent the noise impact from causing a noise disturbance at the surrounding receptors as a result of the construction activities and subsequently comply with the National Noise Control Regulations.

8.3.1.4 Management Actions and Targets

The following noise management measures are recommendation as good practice guidelines.

- Construction activities should be restricted to daylight hours (this will keep the night time noise levels to a minimum).
- Construction machinery and vehicles should be switched off when not in use.

Detailed noise control measures is not recommended at this stage due to the low impact expected from the ventilation shaft construction.

8.3.1.5 Impact Ratings

The rating table below summarises and calculates the impact significance of the construction phase in terms of the duration,extent, intensity and probability (refer to Table 8-6).

Table 8-6: Potential Impacts of the Construction Phase Activities

Dimension	Rating	Motivation	Significance
Activity and Interaction (construction phase activities as per Table 8-4)			
Impact Description: Noise will emanate from the machinery and vehicles operating during the construction activities			
Prior to Mitigation/Management			
Duration	Short term (2)	Noise will be produced for the duration of the construction phase	Negligible (negative) – 15
Extent	Limited (2)	It is expected that during construction noise will be limited to site and its immediate surroundings	
Intensity x type of impact	Minimal - negative (-1)	It is expected that during construction noise will have a minimal impact	
Probability	Unlikely (3)	There are sound scientific reasons to expect that that noise will unlikely impact on the surrounding receptors	
Nature	Negative		
Mitigation/Management Actions			
▪ Restricting construction activities to daylight hours (06:00 – 18:00); and ▪ Switching off equipment when not in use.			

Dimension	Rating	Motivation	Significance
Post-Mitigation			
Duration	Short term (2)	Noise will be produced for the duration of the construction phase	Negligible (negative) – 12
Extent	Isolated (1)	It is expected that if recommended management measures are implemented, noise will be limited to certain parts of the site.	
Intensity x type of impact	Minimal - negative (-1)	It is expected that during construction noise will have a minimal impact	
Probability	Unlikely (3)	There are sound scientific reasons to expect that the noise will unlikely impact on the surrounding receptors.	

8.3.2 Operational Phase

8.3.2.1 Project Activities Assessed

The operational phase activities as listed in Table 8-4, may cause a noise disturbance at the surrounding rural receptors.

8.3.2.2 Impact Description

The operational noise dispersion models for the day and night time scenarios are indicated on Plan 3 and Plan 4 (refer to Appendix B). The daytime results indicate that the expected noise during the operation of the ventilation shafts will unlikely cause a noise disturbance in terms of the National Noise Control Regulations at any receptor surrounding the proposed ventilation shaft locations. The reason is that the likely noise from the daytime operations will not increase the ambient noise level at 7dBA or more above the current ambient sound levels as seen in the Table 8-7.

Table 8-7: Ambient Noise Level Increase during Daytime Operations

Receptors	Daytime baseline dBA	Expected noise from daytime operations dBA	Cumulative level dBA	Increase in ambient noise level dBA
N1	56	43	56	0
N2	50	35	54	0
N3	57	44	57	0
N4	51	43	52	1

The night time results indicate that the expected noise during the operational activities is also not likely to cause a noise disturbance in terms of the National Noise Control Regulations at any receptor surrounding the proposed project. The reason is that the expected noise from the night time operations will not increase the ambient noise level by 7dBA or more above the current ambient sound levels as seen in the Table 8-8.

Table 8-8: Ambient Noise Level Increase during Night Time Operations

Receptors	Night time baseline dBA	Expected noise from night time operations dBA	Cumulative level dBA	Increase in ambient noise level dBA
N1	53	44	54	1
N2	45	37	46	1
N3	42	44	46	4
N4	45	43	47	2

8.3.2.3 Management Objectives

To minimise/prevent the noise impact from causing a noise disturbance at the surrounding receptors as a result of the operation of the ventilation shafts and subsequently comply with the National Noise Control Regulations.

8.3.2.4 Management Actions and Targets

The ventilation fan diffuser outlets should be installed horizontally so that it is directed away from the nearest receptors, who are situated to the south. In this case both ventilation fans need to be directed north. The noise control measures are recommended to specifically limit the night time noise, because the night time results indicate a slight increase in ambient noise levels at the selected receptors.

8.3.2.5 Impact Ratings

The rating table below summarises and calculates the impact significance of the operational phase in terms of the duration, extent, intensity and probability (refer to Table 8-9).

Table 8-9: Potential Impacts of the Operational Phase Activities

Dimension	Rating	Motivation	Significance
Activity and Interaction (operational activities as per Table 8-4)			
Impact Description: Noise will emanate from the operation of the ventilation shafts			
Prior to Mitigation/Management			
Duration	Project life (5)	Noise will be produced for the duration of the operational phase	Negligible (negative) – 16

Dimension	Rating	Motivation	Significance
Extent	Limited (2)	It is expected that during operation of the ventilation fans, noise will be limited to site and its immediate surroundings.	
Intensity x type of impact	Minimal - negative (-1)	It is expected that during operation of the ventilation fans, noise will have a minimal impact	
Probability	Rare (2)	There are sound scientific reasons to expect that that noise will unlikely impact on the surrounding receptors.	
Nature	Negative		
Mitigation/Management Actions			
▪ The ventilation fan diffuser outlets should be installed horizontally and directed north so that it is directed away from the receptors situated towards the south			
Post-Mitigation			
Duration	Project life (5)	Noise will be produced for the duration of the operational phase of 47 months	Negligible (negative) – 7
Extent	Isolated (1)	It is expected that if recommended management measures are implemented, noise will be limited to certain part of the site.	
Intensity x type of impact	Minimal - negative (-1)	It is expected that during operation of the ventilation fans, noise will have a minimal impact	
Probability	Highly Unlikely (1)	There are sound scientific reasons to expect that that noise will unlikely impact on the surrounding receptors.	

8.3.3 Decommissioning Phase

8.3.3.1 Project Activities Assessed

The decommissioning activities will mainly involve rehabilitation of the shaft by capping as well as demolition of surface infrastructure.

8.3.3.2 Impact Description

It is expected that the decommissioning activities will have negligible impact due to the limited and less machine intensive activities.

8.3.3.3 Management Objectives

To minimise/prevent the noise impact from causing a noise disturbance at the surrounding receptors and subsequently comply with the National Noise Control Regulations.

8.3.3.4 Management Actions and Targets

The following noise management measures are recommendation as good practice guidelines.

- Decommissioning activities should be restricted to daylight hours (this will keep the night time noise levels to a minimum).
- Decommissioning machinery and vehicles should be switched off when not in use.

Detailed noise control measures is not recommended at this stage due to the low impact expected from the Decommissioning Phase.

8.3.3.5 Impact Ratings

The rating table below summarises and calculates the impact significance of the decommissioning phase in terms of the duration, extent, intensity and probability (refer to Table 8-10).

Table 8-10: Potential Impacts of the Decommissioning Phase Activities

Dimension	Rating	Motivation	Significance
Activity and Interaction (the decommissioning phase requires removal of infrastructure and surface rehabilitation)			
Impact Description: Noise will emanate from the machinery and vehicles operating during the decommissioning activities			
Prior to Mitigation/Management			
Duration	Short term (2)	Noise will be produced for the duration of the decommissioning phase	Negligible (negative) – 10
Extent	Limited (2)	It is expected that during decommissioning noise will be limited to site and its immediate surroundings.	
Intensity x type of impact	Minimal - negative (-1)	It is expected that during decommissioning noise will have a minimal impact	
Probability	Improbable (2)	It is expected that that noise will improbably impact on the surrounding receptors.	
Nature	Negative		
Mitigation/Management Actions			

Dimension	Rating	Motivation	Significance
▪ Restricting decommissioning activities to daylight hours (06:00 – 18:00); ▪ Switching off equipment when not in use.			
Post-Mitigation			
Duration	Short term (2)	Noise will be produced for the duration of the decommissioning phase	Negligible (negative) – 8
Extent	Isolated (1)	It is expected that if recommended management measures are implemented, noise will be limited to certain part of the site.	
Intensity x type of impact	Minimal - negative (-1)	It is expected that during decommissioning noise will have a minimal impact	
Probability	Improbable (2)	It is expected that that noise will improbably impact on the surrounding receptors.	

9 Cumulative Noise Impacts

Cumulative impacts should be considered for the overall improvement of ambient noise levels. The proposed project is considered a causative source of noise pollution of a negligible significance.

With the quantified noise levels increasing the ambient noise by a maximum of 4dBA at receptor N4 during the night time, it is expected that the ventilation shafts will have an insignificant cumulative impact on the ambient soundscape.

10 Unplanned Events and Low Risks

Low risks can be monitored to gauge if the baseline changes and mitigation is required, but unplanned events may happen at any moment. However, taking into account the nature and location of the ventilation shafts, it is highly unlikely that any unplanned events may results in increased impact significance.

11 Environmental Management Plan

The objective of an EMP is to present mitigation to (a) manage undue or reasonably avoidable adverse impacts associated with the development of a project and (b) to enhance potential positives.

Mitigation measures will sometimes be built into the base of a project and should be considered as part of the “pre-mitigation” scenario; additional mitigation must be recommended if the impact assessment indicates it is necessary.

The key objectives of environmental and social management plans are to give S.M.A.R.T. mitigation measures to:

- Identify the actual environmental, socio-economic and public health impacts of the project and check if the observed impacts are within the levels predicted in the EIA;
- Determine that mitigation measures or other conditions attached to project approval (e.g. by legislation) are properly implemented and work effectively;
- Adapt the measures and conditions attached to project approval in the light of new information or take action to manage unanticipated impacts if necessary;
- Provide an auditable management plan that can follow the Deming Cycle;
- Gauge if predicted benefits of the project are being achieved and maximized; and
- Gain information for improving similar projects and EIA practice in the future.

The EMP must consider each activity and its potential (significant) impacts during the construction, operational and decommissioning phases. The EMP should be structured as described in Section 11.2.

11.1 Project Activities with Potentially Significant Impacts

The noise dispersion models were run as a conservative worst case scenario approach, as previously mentioned. The activities per phase were accounted for simultaneously and therefore cumulatively contribute to the significance of the noise impact. With the overall negligible calculated significance, no specific activity is expected to have a potential significant noise impact.

11.2 Summary of Mitigation and Management

Table 11-1 provides a description of the mitigation and management options for the environmental impacts anticipated during the construction, operational and closure and rehabilitations phases. Additionally it also provides a summary of the project activities, environmental aspects and impacts on the receiving environment as well as the frequency of mitigation.

Table 11-1: Mitigation and Management Plan

Activities	Potential Impact	Size and scale of disturbance	Aspects Affected	Phase	Mitigation Type/Measures	Compliance with standards/Standard to be achieved	Time period for Implementation
Site clearing, including the removal of topsoil and vegetation; and Construction of ventilation shafts	Noise Impact	The expected noise from the proposed project will be limited to site	Site only and immediate surrounding area	Construction phase	▪ Restricting construction activities to daylight hours (06:00 – 18:00); and ▪ Switching off equipment when not in use.	National Noise Control Regulations	Upon commencement of the construction phase
Operation of ventilation shafts	Noise Impact	The expected noise from the proposed project will be limited to site	Site only and immediate surrounding area	Operational phase	▪ The ventilation fan diffuser outlets should be installed horizontally and directed north.	National Noise Control Regulations	Upon commencement of the operational phase
Surface rehabilitation	Noise Impact	The expected noise from the proposed project will be limited to site	Site only and immediate surrounding area	Decommissioning phase	▪ Restricting construction activities to daylight hours (06:00 – 18:00); and ▪ Switching off equipment when not in use.	National Noise Control Regulations	Upon commencement of the closure phase

12 Consultation Undertaken

The relevant landowners and occupiers on whose property the noise measurements were taken were contacted by the noise specialist. This was to obtain the required permission to enter the property and explain the purpose of the study.

13 Conclusion and Recommendations

The aim of the environmental noise impact assessment is to ultimately assess whether the proposed ventilation shafts will impact on the surrounding noise sensitive receptors by causing disturbing noise as defined by the national noise control regulations. The objectives of the assessment are to firstly measure the current ambient sound levels and then compare it with the noise dispersion modelling results.

Based on the daytime results from the noise measurements it is noted that the L_{Aeql} levels measured above the SANS guideline for the maximum allowable outdoor daytime rating level for ambient noise in rural districts (45dBA). The noise levels ranged from 50dBA to 57dBA. The night time results also measured above the SANS guideline for the maximum allowable outdoor night time rating level for ambient noise in rural districts (35dBA). The noise levels ranged from 42dBA to 53dBA.

As per the results of the noise dispersion models, it is concluded that the noise from the proposed ventilation fans will have a negligible impact on the surrounding rural receptors. The negligible impact is an acceptable negative impact for which mitigation is desirable. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. This is due to the proposed ventilation fans quantified noise level not significantly increasing the current ambient soundscape.

Additionally, due to the expected negligible impact, it is not recommended that a noise monitoring programme be implemented.

14 References

National Conservation Act, Act 73 of 1989;

National Environmental Management Act, Act no 107 of 1998;

National Environmental Management Air Quality Act, Act no 39 of 2004;

National Noise Control Regulations;

South African National Standard - Code of practice, SANS 10103:2008, Edition Six, *The measurement and rating of environmental noise with respect to annoyance and to speech communication*. Available [online] http://www.sabs.co.za.

SoundPlan Essential, Version 4. (2017)

Appendix A: Curriculum Vitae

LUKAS SADLER

Mr. Lukas Sadler

Senior Environmental Noise Consultant

Atmospheric Sciences Department

Digby Wells Environmental (Pty) Ltd

1 EDUCATION

Institution	Dates	Degree(s) or Diploma(s) obtained:
Global Prospectus	2014	Noise and Vibration Fundamentals Assessment
Mackenzie Hoy Consulting Acoustic Engineers	2013	Environmental Noise Control
University of Johannesburg	2010	Air Quality Management
Open Access Industrial Training College (OAITC)	2009	Occupational and Environmental Noise
North West University	2002	B.Com Environmental Management
Randburg High School	2001	Matric

2 EMPLOYMENT

November 2007 - Present: Digby Wells Environmental

May 2006 – July 2007: West View Rail (Pty) Ltd (London)

3 EXPERIENCE

During my two year stay in London from September 2005 – September 2007, I worked for West View Rail (Pty) Ltd on the London Underground Railway doing reconstruction of the underground railway.

I am currently working at Digby Wells Environmental in the Environmental Noise Unit, where I am responsible for the Noise Impact Assessments relating to EIA/EMP's, as well as undertaking compliance monitoring. This includes experience working with projects in accordance with the International Finance Corporation (IFC) and World Bank standards, in countries such as Namibia, Mali, Senegal, Ghana, Mozambique Liberia, DRC, Sierra Leone, Cameroon, Botswana and Zambia.

My core focus is working on Environmental Noise Impact Assessments, which includes the assessment, remediation and management of impacts related to noise disturbance for the construction, mining and petrochemical industry.

4 PROJECT EXPERIENCE

DATE		DETAILS
FROM	TO	
2009	2009	**Project**: Knights and City Deep Tailings Reclamation Noise Assessment **Country**: South Africa **Client:** Crown Gold Recoveries **Nature of Work:** To conduct an environmental noise impact assessment of the proposed reclamation of Tailings Storage Facilities in and around Johannesburg. I was responsible for assessing the significance of the noise impact from the proposed reclamation activities on the surrounding urban and suburban sensitive receptors. The environmental noise impact assessment was undertaken in accordance with the Gauteng Noise Control Regulations. The Concawe noise quantification method was used to quantify the expected noise sources then compared to the noise control regulations to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2009	2009	**Project**: Environmental Noise Impact Assessment for Gold Mining activities in the Free State **Country**: South Africa **Client:** Pamodzi Gold **Nature of Work:** To conduct an environmental noise impact assessment of the proposed gold mining activities. I was responsible for assessing the significance of the noise impact from the proposed gold mining activities on the surrounding rural and suburban sensitive receptors. The environmental noise impact assessment was undertaken in accordance with the Free State Noise Control Regulations. The Concawe noise quantification method was used to quantify the expected noise sources then compared to the noise control regulations to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2009	2009	**Project**: Environmental Noise Impact Assessment for Boikarabelo Colliery, Waterberg **Country**: South Africa **Client:** Resource Generation **Nature of Work:** To conduct an environmental noise impact assessment of the proposed colliery. I was responsible for assessing the significance of the noise impact from the proposed colliery on the surrounding rural noise sensitive receptors. The environmental noise impact assessment was undertaken in accordance with the National Noise Control Regulations. The Concawe noise quantification method was used to quantify the expected noise sources then compared to the noise control regulations to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2010	2010	**Project**: Baseline Noise Survey for proposed Coal Mine in Mpumalanga Province

		Country: South Africa **Client:** BHP Billiton Energy South Africa **Nature of Work:** To conduct baseline noise measurements in order to assess the pre-mining soundscape as well as identify the current noise sources
2010	2010	**Project**: Environmental Noise Impact Assessment for the Lesedi Power Generation Project **Country**: South Africa **Client:** Xstrata Alloys **Nature of Work:** To conduct an environmental noise impact assessment of the proposed power generating activities. I was responsible for assessing the significance of the noise impact from the proposed coal fired power station on the surrounding rural and suburban sensitive receptors. The environmental noise impact assessment was undertaken in accordance with the National Noise Control Regulations. The Concawe noise quantification method was used to quantify the expected noise sources then compared to the noise control regulations to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2011	2011	**Project**: ESIA for Gold Mine in Armenia **Country**: Armenia **Client:** GeoPro Mining Limited **Nature of Work:** To conduct an environmental noise impact assessment in support of an ESIA for a gold mining project. I was responsible for assessing the significance of the noise impact from the proposed project on the surrounding noise sensitive receptors. The environmental noise impact assessment was undertaken in accordance with the International Finance Corporations' (IFC) Environmental Health and Safety's (EHS) Noise Management Guidelines. SoundPlan was used to quantify the expected noise sources then compared to the baseline noise measurements to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2011	2011	**Project**: Environmental Noise Impact Assessment for Extension of Koidu Diamond Mine **Country**: Sierra Leone **Client:** Koidu **Nature of Work:** To conduct an environmental noise impact assessment of the proposed extension of the diamond mine. I was responsible for assessing the significance of the noise impact from the extension of the kimberlite pipe on the surrounding villages. The environmental noise impact assessment was undertaken in accordance with the IFC EHS guidelines. The Concawe noise quantification method was used to quantify the expected noise sources then compared to background noise levels to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.

2011	2011	**Project**: Environmental Noise Impact Assessment for Roodekop Colliery **Country**: South Africa **Client:** Universal Coal **Nature of Work:** To conduct an environmental noise impact assessment of the proposed colliery. I was responsible for assessing the significance of the noise impact from the proposed colliery on the surrounding rural noise sensitive receptors. The environmental noise impact assessment was undertaken in accordance with the National Noise Control Regulations. The Concawe noise quantification method was used to quantify the expected noise sources then compared to the noise control regulations to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2012	2012	**Project**: Environmental Noise Impact Assessment for Kibali's Hydropower Plants **Country**: DRC **Client:** Randgold Resources **Nature of Work:** To conduct an environmental noise impact assessment of the proposed Hydropower Plants along the Kibali river. I was responsible for assessing the significance of the noise impact from the Hydropower Plnats on the surrounding villages. The environmental noise impact assessment was undertaken in accordance with the IFC EHS guidelines. The Concawe noise quantification method was used to quantify the expected noise sources then compared to the background noise levels to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2012	2012	**Project**: Environmental Noise Impact Assessment for Brakfontein Colliery **Country**: South Africa **Client:** Universal Coal **Nature of Work:** To conduct an environmental noise impact assessment of the proposed colliery. I was responsible for assessing the significance of the noise impact from the proposed colliery on the surrounding rural noise sensitive receptors. The environmental noise impact assessment was undertaken in accordance with the National Noise Control Regulations. SoundPlan was used to quantify the expected noise sources then compared to the noise control regulations to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2012	2016	**Project**: Environmental Noise Impact Assessment for Klipspruit South **Country**: South Africa **Client:** South 32 **Nature of Work:** To conduct an environmental noise impact assessment of the proposed colliery. I was responsible for assessing the significance of the noise impact from the proposed colliery on the surrounding rural and suburban noise sensitive receptors. The environmental noise impact assessment was undertaken in accordance with the National Noise Control Regulations. SoundPlan was used to quantify the expected noise sources then compared to the noise control

		regulations to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2012	2014	**Project**: Environmental Noise Impact Assessment for Platreef Platinum Mine **Country**: South Africa **Client:** Ivanplats **Nature of Work:** To conduct an environmental noise impact assessment of the proposed Platinum Mine. I was responsible for assessing the significance of the noise impact from the proposed colliery on the surrounding rural and suburban noise sensitive receptors. The environmental noise impact assessment was undertaken in accordance with the National Noise Control Regulations. SoundPlan was used to quantify the expected noise sources then compared to the noise control regulations to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2014	2016	**Project**: Compliance Monitoring for Platreef **Country**: South Africa **Client:** Ivanplats **Nature of Work:** To conduct compliance monitoring at the operational Platreef Mine to assess compliance with the relevant regulations as well as recommend noise control measures in the event of non-compliance.
2013	2013	**Project**: Environmental Noise Impact Assessment for Balama Graphite Mine **Country**: Mozambique **Client:** Syrah Resources **Nature of Work:** To conduct an environmental noise impact assessment of the proposed Graphite Mine. I was responsible for assessing the significance of the noise impact from the proposed mine on the surrounding villages. The environmental noise impact assessment was undertaken in accordance with the EHS IFS guidelines. SoundPlan was used to quantify the expected noise sources then compared to the background noise levels to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2013	2013	**Project**: Environmental Noise Impact Assessment for Ash Backfilling at Sasolburg **Country**: South Africa **Client:** Sasol **Nature of Work:** To conduct an environmental noise impact assessment of the proposed ash backfilling activities. I was responsible for assessing the significance of the noise impact from the proposed ash backfilling activities on the surrounding rural and suburban noise sensitive receptors. The environmental noise impact assessment was undertaken in accordance with the Free State Noise Control Regulations. SoundPlan was used to quantify the expected noise

		sources then compared to the noise control regulations to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2014	2014	**Project**: Environmental Noise Impact Assessment for Weltevreden Colliery, Belfast **Country**: South Africa **Client:** Northern Coal **Nature of Work:** To conduct an environmental noise impact assessment of the proposed colliery. I was responsible for assessing the significance of the noise impact from the proposed colliery on the surrounding rural noise sensitive receptors. The environmental noise impact assessment was undertaken in accordance with the National Noise Control Regulations. SoundPlan was used to quantify the expected noise sources then compared to the noise control regulations to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2014	2014	**Project**: Environmental Noise Impact Assessment for Water Treatment Facility **Country**: South Africa **Client:** TCTA **Nature of Work:** To conduct an environmental noise impact assessment of the proposed water treatment and sludge disposal for the short term intervention for acid mine drainage treatment. I was responsible for assessing the significance of the noise impact from the proposed water treatment and sludge disposal on the surrounding urban noise sensitive receptors on the east rand of Johannesburg. The environmental noise impact assessment was undertaken in accordance with the Gauteng Noise Control Regulations. SoundPlan was used to quantify the expected noise sources then compared to the noise control regulations to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2013	2016	**Project**: Compliance Monitoring for Kalgold **Country**: South Africa **Client:** Harmony Gold **Nature of Work:** To conduct compliance monitoring at the operational Kalgold Mine to assess compliance with the relevant regulations as well as recommend noise control measures in the event of non-compliance.
2015	2015	**Project**: Environmental Noise Impact Assessment for Thabametsi Colliery **Country**: South Africa **Client:** EXXARO **Nature of Work:** To conduct an environmental noise impact assessment of the proposed Thabametsi Colliery. I was responsible for assessing the significance of the noise impact from the proposed coal mining activities on the surrounding rural noise sensitive receptors. The

		environmental noise impact assessment was undertaken in accordance with the National Noise Control Regulations. SoundPlan was used to quantify the expected noise sources then compared to the noise control regulations to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2015	2015	**Project**: Environmental Noise Impact Assessment for a Vanadium Mine **Country**: South Africa **Client:** VMIC **Nature of Work:** To conduct an environmental noise impact assessment of the proposed Vanadium Mine. I was responsible for assessing the significance of the noise impact from the proposed mine on the surrounding communities. The environmental noise impact assessment was undertaken in accordance with the National Noise Control Regulations. SoundPlan was used to quantify the expected noise sources then compared to the background noise levels to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2015	2016	**Project**: Compliance Noise Monitoring for the Kazungula Bridge Construction Project **Country**: Botswana/Zambia **Client:** Daewoo Construction **Nature of Work:** To conduct compliance monitoring at surrounding noise sensitive receptors to the bridge construction site to assess compliance with the relevant regulations as well as recommend noise control measures in the event of non-compliance.

5 PROFESSIONAL AFFILIATIONS

Affiliate Member of the Institute of Acoustics

Appendix B: Plans

Plan 1: Noise Monitoring Locations

Plan 2: Construction Noise Dispersion

Plan 3: Operational Daytime Noise Dispersion

Plan 4: Operational Night Time Noise Dispersion

Plan 1

Thubelisha Consolidated EMPR
Noise Measurement Locations

29°15'0"E 29°20'0"E 29°25'0"E

26°20'0"S 26°25'0"S 26°30'0"S

R580 R547 R545 N17 R38

DWARS-IN-DIE-WEGSPRUIT

RIETFONTEIN DAM

TRICHARDTSFONTEIN DAM

TRICHARDSPRUIT

KLIPSPRUIT

BLESBOKSPRUIT

N1 N2 N3 N4

Trichardt Secunda Bethal

Legend

- Project Area
- Noise Measurement Location
- Major Town
- Secondary Town
- Other Town
- Power Line
- National / Arterial Route
- Main Road
- Minor Route
- Railway Line
- Non-Perennial Stream
- Perennial Stream
- Dam Wall
- Dam / Lake
- Non-Perennial Pan
- Perennial Pan

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Projection: Transverse Mercator	Ref #: kwt.SAS3869.201708.036
Datum: WGS 1984	Revision Number: 1
Central Meridian: 29°E	Date: 08/08/2017

N

0 1 2 4

Kilometres

1:110 000

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Plan 2

Thubelisha Consolidated EMPR
Construction Phase Noise Dispersion

29°15'0"E 29°18'0"E 29°21'0"E

26°26'15"S

26°28'30"S

26°30'45"S

East Vent

South Shaft

N17

TRICHARDSPRUIT

TRICHARDTSFONTEIN DAM

TRICHARDSFONTEIN

KLIPSPRUIT

Legend

- Project Area
- Shaft Location
- Power Line
- National / Arterial Route
- Main Road
- Minor Route
- Railway Line
- Non-Perennial Stream
- Perennial Stream
- Dam Wall
- Dam / Lake
- Non-Perennial Pan
- Perennial Pan

Construction Phase Noise Dispersion dBA

- 95
- 90
- 85
- 80
- 75
- 70
- 65
- 60
- 55
- 50
- 45 (Daytime Limit)
- 40
- 35
- 30
- 25

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Revision Number: 2
Date: 08/08/2017

N

0 0.5 1 2

Kilometres

1:60 000

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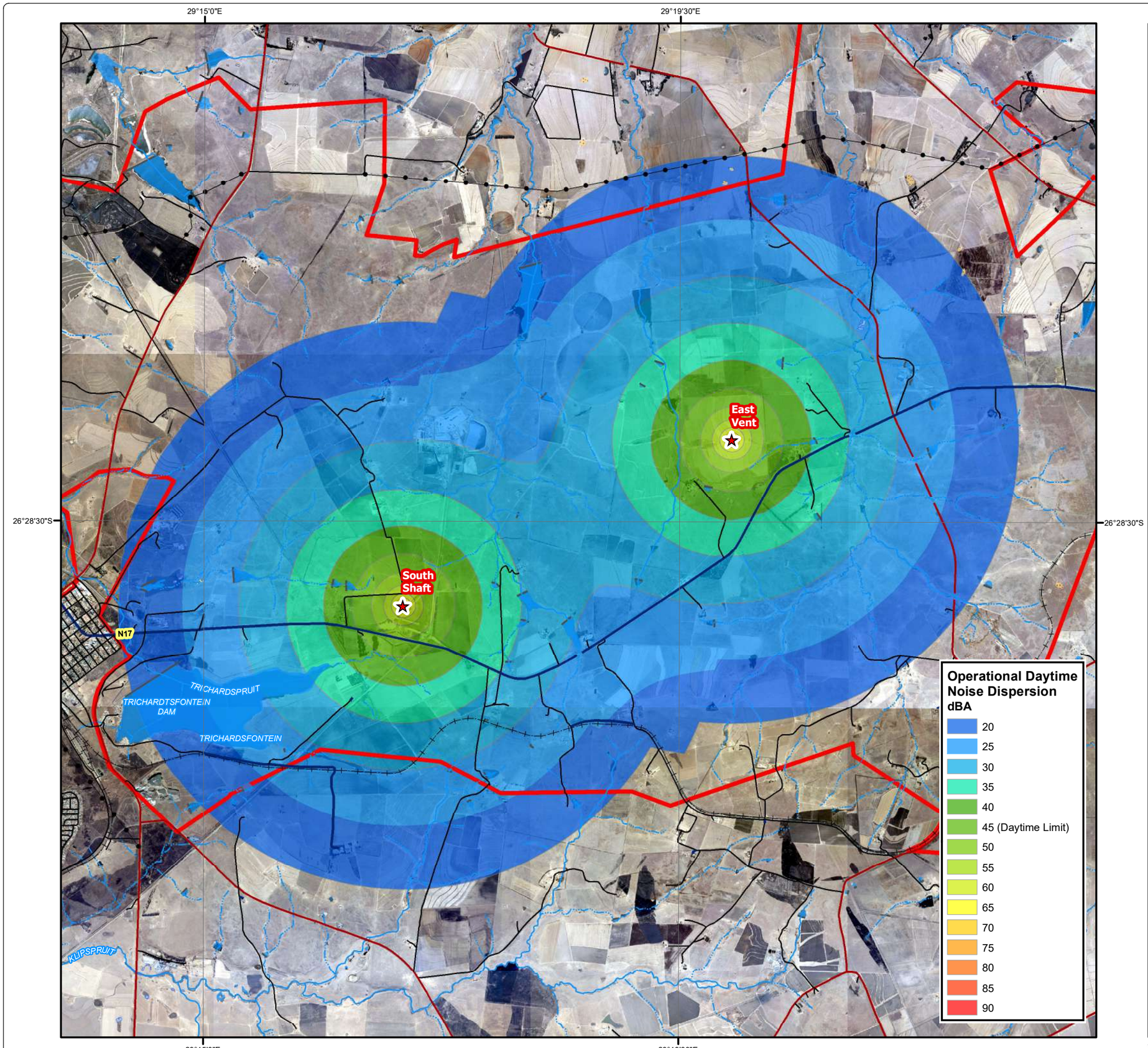
Plan 3

Thubelisha Consolidated EMPR Operational Day Time Noise Dispersion



Legend

- Project Area
- Shaft Location
- Power Line
- National / Arterial Route
- Main Road
- Minor Route
- Railway Line
- Non-Perennial Stream
- Perennial Stream
- Dam Wall
- Dam / Lake
- Non-Perennial Pan
- Perennial Pan

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Datum: WGS 1984	Revision Number: 1
Central Meridian: 29°E	Date: 08/08/2017

N

0 0.5 1 2

Kilometres

1:60 000

Plan 4

Thubelisha Consolidated EMPR Operational Night Time Noise Dispersion

29°14'30"E
29°18'0"E
29°21'30"E
26°25'0"S
26°28'30"S
26°32'0"S

East Vent
South Shaft
N17
TRICHARDSPRUIT
TRICHARDTSFONTEIN DAM
TRICHARDSFONTEIN
KLIPSPRUIT

Legend

- Project Area
- Shaft Location
- Power Line
- National / Arterial Route
- Main Road
- Minor Route
- Railway Line
- Non-Perennial Stream
- Perennial Stream
- Dam Wall
- Dam / Lake
- Non-Perennial Pan
- Perennial Pan

Operational Night Time Noise Dispersion
dBA

- 95
- 90
- 85
- 80
- 75
- 70
- 65
- 60
- 55
- 50
- 45
- 40
- 35 (Night Time Limit
- 30
- 25

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Projection: Transverse Mercator
Datum: WGS 1984
Central Meridian: 29°E

Ref #: kwt.SAS3869.201708.033
Revision Number: 1
Date: 08/08/2017

N

0 0.5 1 2
Kilometres
1:60 000