Environmental Noise Impact Assessment for the Proposed Waste Rock Dumps at the Tharisa Mine

Project done for **SLR Consulting (South Africa) (Pty) Ltd**

Report compiled by:
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Revision Record

Version	Date	Comments
Rev 0	July 2022	For client review
Rev 0.1	July 2022	Refining of conclusion (Section 7)
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Rev 0.3	July 2022	Changes made to Section 4 due to changes to East OG WRD equipment movement, which altered findings in Section 5, Section 6 and Section 7
Rev 0.4	August 2022	Update of Section 5

Glossary and Abbreviations

ADT	Articulated dump truck
Airshed	Airshed Planning Professionals (Pty) Ltd
BSI	British Standard
CAT	Caterpillar
dB	Descriptor that is used to indicate 10 times a logarithmic ratio of quantities that have the same units, in this case sound pressure.
dBA	Descriptor that is used to indicate 10 times a logarithmic ratio of quantities that have the same units, in this case sound pressure that has been A-weighted to simulate human hearing.
DMRE	Department of Mineral Resource and Energy
EA	Environmental Assessment
EHS	Environmental, Health, and Safety (IFC)
EIA	Environmental Impact Assessment
EMPr	Environmental Management Program
GN	Government Notice
Ha	Hectare
Hz	Frequency in Hertz
IFC	International Finance Corporation
ISO	International Standards Organisation
kW	Power in kilowatt
L_P	Sound pressure level (in dB)
Ltd	Limited
L_W	Sound Power Level (in dB)
masl	Metres above sea level
m	Metres
m/s	Speed in metres per second
NSR	Noise sensitive receptor
NACA	National Association for Clean Air
NEMA	National Environmental Management Act
NEMAQA	National Environmental Management Air Quality Act
OG	Above Ground
p	Pressure in Pa
Pa	Pressure in Pascal
PGM	Platinum Group Metals
µPa	Pressure in Micro-Pascal
p_{ref}	Reference pressure, 20 µPa
SABS	South African Bureau of Standards
SACNASP	South African Council for Natural Scientific Professions
SANS	South African National Standards

SLM	Social and Labour Plan
SLR	SLR Consulting (Africa) (Pty) Ltd
SoW	Scope of Work
STRM	Shuttle Radar Topography Mission
TSF	Tailings Storage Facility
USGS	United States Geological Survey
WHO	World Health Organisation
WRD	Waste Rock Dump
WRF	The Weather Research and Forecasting (WRF) Model

Executive Summary

Airshed Planning Professionals (Pty) Ltd (Airshed) was commissioned by SLR Consulting (South Africa) (Pty) Ltd (SLR) to undertake a specialist environmental noise impact study for the two additional waste rock dumps (WRDs) at the Tharisa Mine (hereafter referred to as the project). The following activities are proposed:

- The expansion of the existing and approved Far West WRD 1 by a footprint of 109 ha. The expanded area will be referred to as the West Above Ground (OG) WRD. Portions of the West OG WRD will be located on backfilled areas of the West Pit; and
- The establishment of a waste rock dump (referred to as the East OG WRD) on backfilled portions of the East Pit. The proposed East OG WRD will cover an area of approximately 72 ha.

The main objective of the noise specialist study was to determine the potential impact on the acoustic environment and noise sensitive receptors (NSRs) as a result of the proposed operations and to recommend suitable management and mitigation measures.

To meet the above objective, the following tasks were included in the Scope of Work (SoW):

1. A review of available technical project information.
2. A review of the legal requirements and applicable environmental noise guidelines.
3. A study of the receiving (baseline) acoustic environment, including:
    a. The identification of NSRs from available maps and field observations;
    b. A study of environmental noise attenuation potential by referring to available weather records, land use and topography data sources; and
    c. Determining representative baseline noise levels through the analysis of sampled environmental noise levels obtained from surveys conducted for the site.
4. An impact assessment, including:
    a. The establishment of a source inventory for proposed activities.
    b. Noise propagation simulations to determine environmental noise levels as a result of the project.
    c. The screening of simulated noise levels against environmental noise criteria.
5. The identification and recommendation of suitable mitigation measures and monitoring requirements.
6. The preparation of a comprehensive specialist noise impact assessment report.

In the assessment of simulated noise levels, reference was made to the calculated background noise levels and the International Finance Corporation (IFC) noise level guidelines for residential, institutional and educational receptors (55 dBA during the day and 45 dBA during the night) which is also in line with the SANS 10103 rating for urban districts. To assess annoyance at nearby places of residence, the increase in noise levels above the baseline at NSRs were calculated and compared to guidelines published in the SANS 10103 and the 1992 Noise Control Regulations.

The baseline acoustic environment was described in terms of the location of NSRs, the ability of the environment to attenuate noise over long distances, as well as existing background and baseline noise levels. The following was found:

- The closest potential sensitive receptors to the proposed project consist of the Mmaditlhokwa Community, Lapologang Community, Piet Retief Primary School and farmers.
- The surveyed baseline noise levels (during 2021 and 2022) were between 53 and 60 dBA during the day and between 48 and 59 dBA during the night.
- The estimated background noise levels were between 50 and 60 dBA during the day and between 45 and 50 dBA during the night.

The source inventory, local meteorological conditions and information on local land use were used to populate the noise propagation model (CadnaA, ISO 9613). The propagation of noise was calculated over an area of 9.8 km east-west by 5.8 km north-south. The area was divided into a grid matrix with a 20-m resolution.

The main findings of the impact assessment were as follows:

- The environmental noise impact assessment considered the operations on the two proposed new WRDs.
- Noise levels due to project operations are predicted to exceed the day-time IFC noise guideline of 55 dBA for residential areas up to a distance of ~110 m from the proposed West OG WRD (encompassing potential sensitive receptors such as Mmaditlhokwa Community) and ~250 m from the East OG WRD. Noise levels due to project operations are predicted to exceed the night-time IFC noise guideline of 45 dBA for residential areas up to a distance of ~700 m from the proposed West OG WRD and ~1100 m from the East OG WRD.
- Attenuation measures as recommended in Section 6, may be implemented but will potentially not reduce noise levels sufficiently within calculated background levels and IFC guidelines. Further attenuation measures will need to be implemented including the following:
    - <u>West OG WRD</u>:
        - Restricting operations to day-time hours only and implementing a noise berm of at least 5m along the perimeter of the WRD; or,
        - Relocating the Mmaditlhokwa Community (directly east of West OG WRD), NSR1 (farmstead ~650m south of West OG WRD), NSR3 (Wolvaardt residence ~400 m south of West OG WRD) and NSR4 (van der Hoven residence ~470 m south of west OG WRD) (as night-time activities due to West OG WRD exceed IFC residential guidelines at these NSRs).
    - <u>East OG WRD</u>:
        - Restricting operations to day-time hours only; or,
        - Relocating the Mmaditlhokwa Community (as night-time activities due to West OG WRD exceed IFC residential guidelines at these NSRs).
- The impact significance related to the project in terms of noise is **high** for unmitigated operations and mitigated operations given the location of potential NSRs to the project. Given mitigation measures such the implementation of a 5m noise berm at West OG WRD, the significance can reduce to **medium**. Further attenuation measures such as operating the West OG WRD during day-time hours only with the implementation of a noise berm of at least 5 m along the perimeter of the WRD, or relocating the nearest NSRs (i.e., Mmaditlhokwa Community (directly east of West OG WRD), NSR1 (farmstead

~650m south of West OG WRD), NSR3 (Wolvaardt residence ~400 m south of West OG WRD) and NSR4 (van der Hoven residence ~470 m south of west OG WRD)), would reduce the significance to **low**.

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1 Introduction

Tharisa Minerals (Pty) Ltd (Tharisa) is an opencast mining operation that produces chrome and platinum group metal (PGMs) concentrates. The mine has been operational since 2008. The opencast mine is located on farms 342 JQ and Elandsdrift 467 JQ, south of the Marikana Town, in the North West Province.

Mining is undertaken in two mining sections, namely the East Mine and West Mine, using conventional open pit truck and shovel methods. The two mining sections are separated by the perennial Sterkstroom River and the D1325 (Marikana Road). Waste rock from the open pit areas is stockpiled on Waste Rock Dumps (WRDs) and some in-pit dumping of waste rock has taken place at the East Mine. Key existing mine infrastructure includes haul roads, run-of-mine stockpiles, a concentrator complex, various product stockpiles, topsoil stockpiles, WRDs, Tailings Storage Facilities (TSFs) and supporting infrastructure such as offices, workshops, change houses and access control facilities.

As part of its on-going mine planning, Tharisa has identified the need for additional waste rock storage on site (hereafter referred to as the project). In this regard, Tharisa is making an application to the Department of Mineral Resources and Energy (DMRE) for an integrated Environmental Assessment (EA) and update of the mine's current Environmental Management Program (EMPr). The following activities are proposed (Figure 1-1):

- The expansion of the existing and approved Far West WRD 1 by a footprint of 109 ha. The expanded area will be referred to as the West Above Ground (OG) WRD. Portions of the West OG WRD will be located on backfilled areas of the West Pit; and
- The establishment of a waste rock dump (referred to as the East OG WRD) on backfilled portions of the East Pit. The proposed East OG WRD will cover an area of approximately 72 ha.

As part of the process, specialist studies need to be undertaken. Airshed Planning Professionals (Pty) Ltd (Airshed) was commissioned by SLR Consulting (South Africa) (Pty) Ltd (SLR) to undertake a specialist environmental noise impact study for the proposed project.

1.1 Study Objective

The main objective of the noise specialist study was to determine the potential impact on the acoustic environment and noise sensitive receptors (NSRs) as a result of the operations at the project site and to recommend suitable management and mitigation measures.

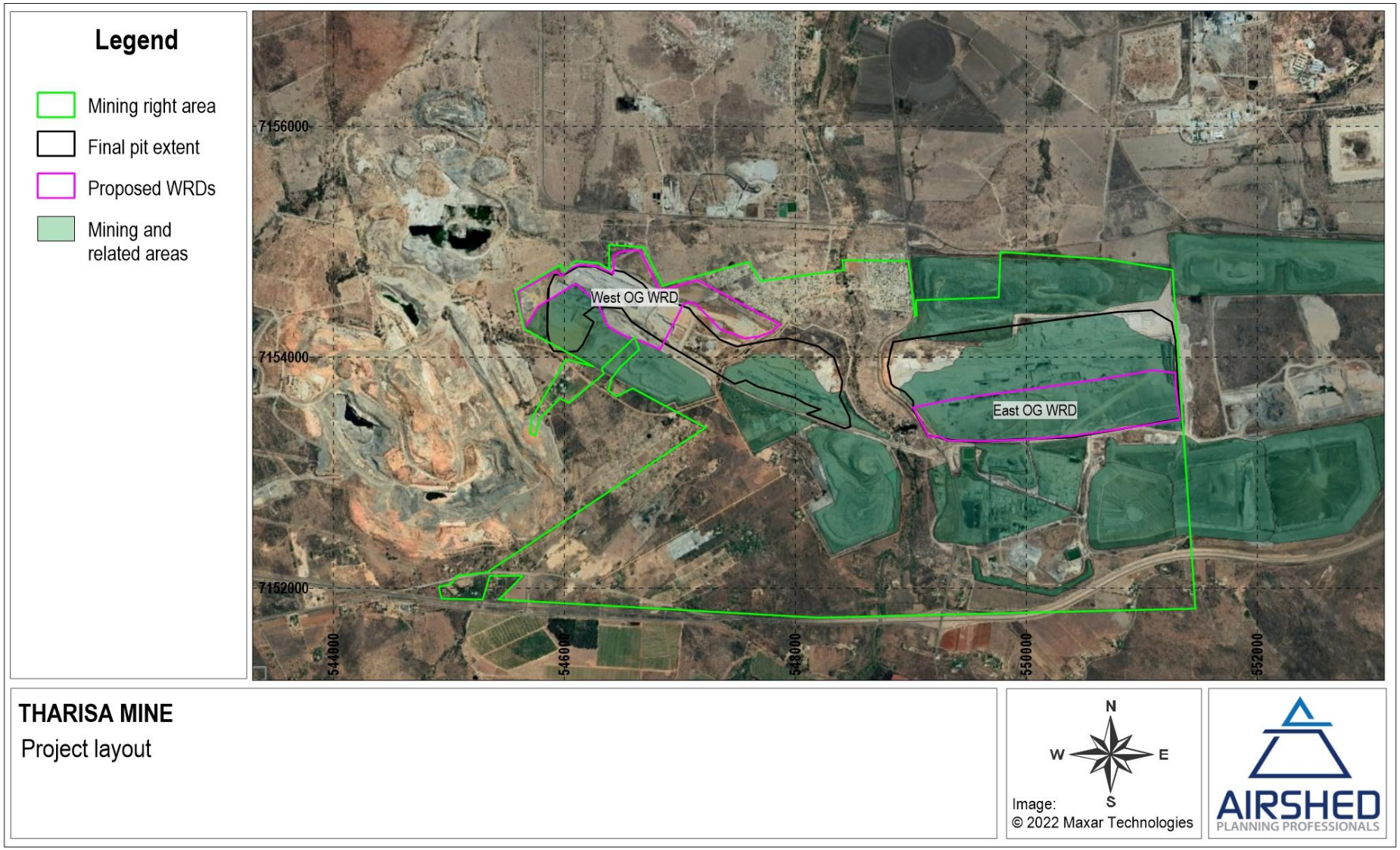

Figure 1-1: Proposed layout of the Tharisa Mine project

1.2 Scope of Work

To meet the above objective, the following tasks were included in the Scope of Work:

(a) A review of available technical project information.
(b) A review of the legal requirements and applicable environmental noise guidelines.
(c) A study of the receiving (baseline) acoustic environment, including:
    a. The identification of potential NSRs from available maps and field observations.
    b. A study of environmental noise attenuation potential by referring to available weather records, land use and topography data.
    c. Determining representative baseline noise levels through the analysis of sampled environmental noise levels obtained from surveys conducted for the site.
(d) An impact assessment, including:
    a. The establishment of a source inventory for proposed activities.
    b. Noise propagation simulations to determine environmental noise levels as a result of the project activities.
    c. The screening of simulated noise levels against environmental noise criteria.
(e) The identification and recommendation of suitable mitigation measures and monitoring requirements.
(f) The preparation of a comprehensive specialist noise impact assessment report.

1.3 Specialist Details

1.3.1 Specialist Details

Airshed is an independent consulting firm with no interest in the project other than to fulfil the contract between the client and the consultant for delivery of specialised services as stipulated in the terms of reference.

1.3.2 Competency Profile of Specialist

Reneé von Gruenewaldt is a Registered Professional Natural Scientist (Registration Number 400304/07) with the South African Council for Natural Scientific Professions (SACNASP) and a member of the National Association for Clean Air (NACA).

Following the completion of her bachelor's degree in atmospheric sciences in 2000 and honours degree (with distinction) with specialisation in Environmental Analysis and Management in 2001 at the University of Pretoria, her experience in air pollution started when she joined Environmental Management Services (now Airshed Planning Professionals) in 2002. Reneé von Gruenewaldt later completed her master's degree (with distinction) in Meteorology at the University of Pretoria in 2009.

Reneé von Gruenewaldt became a partner of Airshed Planning Professionals in September 2006. Airshed Planning Professionals is a technical and scientific consultancy providing scientific, engineering, strategic impact assessments, management services and policy support to assist clients in addressing a wide variety of air pollution and environmental noise related projects.

She has experience on the various components of environmental noise assessments from 2015 to present. Her project experience range over various countries in Africa, providing her with an inclusive knowledge base of international legislation and requirements pertaining to noise impacts.

A comprehensive curriculum vitae of Reneé von Gruenewaldt is provided in Appendix A.

1.4 Description of Activities from a Noise Perspective

As is typical of waste handling, sources of noise at the project site will include the following:

- Waste unloading on waste dumps;
- Waste dozing on waste dumps;
- Haul truck traffic on waste dumps; and,
- Diesel mobile equipment use (including reverse warnings).

The waste handling, transport activities and operating diesel mobile equipment generate noise that is intermittent and highly variable spatially.

1.5 Background to Environmental Noise and the Assessment Thereof

Before more details regarding the approach and methodology adopted in the assessment is given, the reader is provided with some background, definitions and conventions used in the measurement, calculation and assessment of environmental noise.

Noise is generally defined as unwanted sound transmitted through a compressible medium such as air. Sound in turn, is defined as any pressure variation that the ear can detect. Human response to noise is complex and highly variable as it is subjective rather than objective.

A direct application of linear scales (in pascal (Pa)) to the measurement and calculation of sound pressure leads to large and unwieldy numbers. As the ear responds logarithmically rather than linearly to stimuli, it is more practical to express acoustic parameters as a logarithmic ratio of the measured value to a reference value. This logarithmic ratio is called a decibel or dB. The advantage of using dB can be clearly seen in Figure 1-2. Here, the linear scale with its large numbers is converted into a manageable scale from 0 dB at the threshold of hearing (20 micro-pascals (µPa)) to 130 dB at the threshold of pain (~100 Pa) (Brüel & Kjær Sound & Vibration Measurement A/S, 2000).

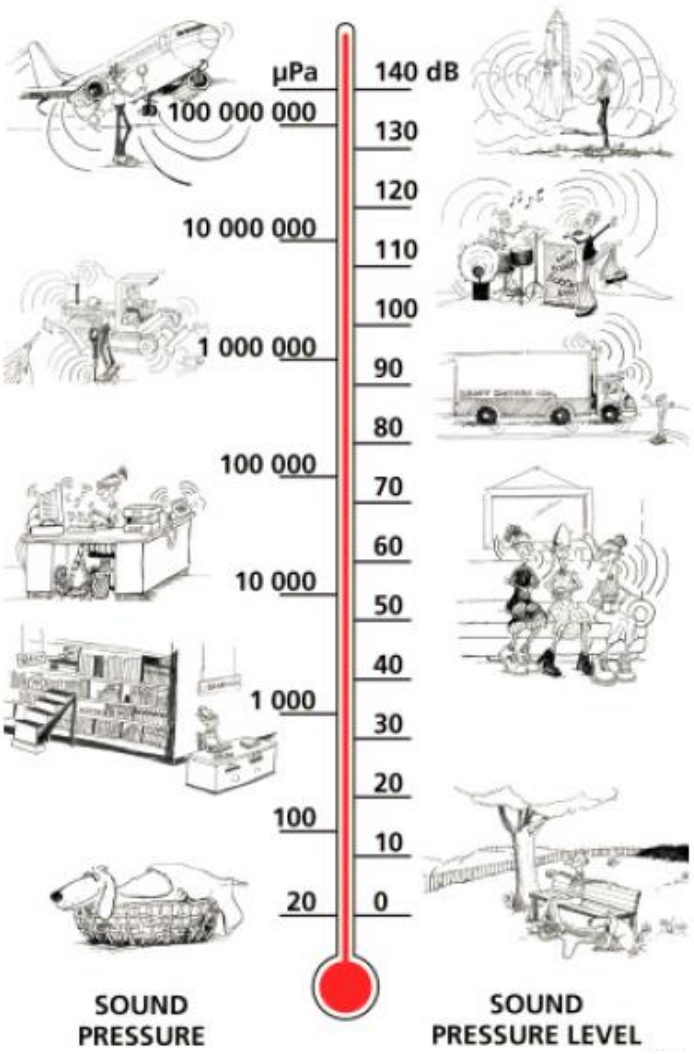

Figure 1-2: The decibel scale and typical noise levels (Brüel & Kjær Sound & Vibration Measurement A/S, 2000)

As explained, noise is reported in dB. "dB" is the descriptor that is used to indicate 10 times a logarithmic ratio of quantities that have the same units, in this case sound pressure. The relationship between sound pressure and sound pressure level is illustrated in this equation.

$$L_p = 20 \cdot \log_{10}\left(\frac{p}{p_{ref}}\right)$$

Where:

L_p *is the sound pressure level in dB;*

p *is the actual sound pressure in Pa; and*

p_{ref} *is the reference sound pressure (p_{ref} in air is 20 µPa).*

1.5.1 Perception of Sound

Sound has already been defined as any pressure variation that can be detected by the human ear. The number of pressure variations per second is referred to as the frequency of sound and is measured in hertz (Hz). The hearing frequency of a young, healthy person ranges between 20 Hz and 20 000 Hz.

Even though an increase in sound pressure level of 6 dB represents a doubling in sound pressure, an increase of 8 to 10 dB is required before the sound subjectively appears to be significantly louder. Similarly, the smallest perceptible change is about 1 dB (Brüel & Kjær Sound & Vibration Measurement A/S, 2000).

1.5.2 Frequency Weighting

Since human hearing is not equally sensitive to all frequencies, a 'filter' has been developed to simulate human hearing. The 'A-weighting' filter simulates the human hearing characteristic, which is less sensitive to sounds at low frequencies than at high frequencies (Figure 1-3). "dBA" is the descriptor that is used to indicate 10 times a logarithmic ratio of quantities that have the same units (in this case sound pressure) and have been A-weighted.

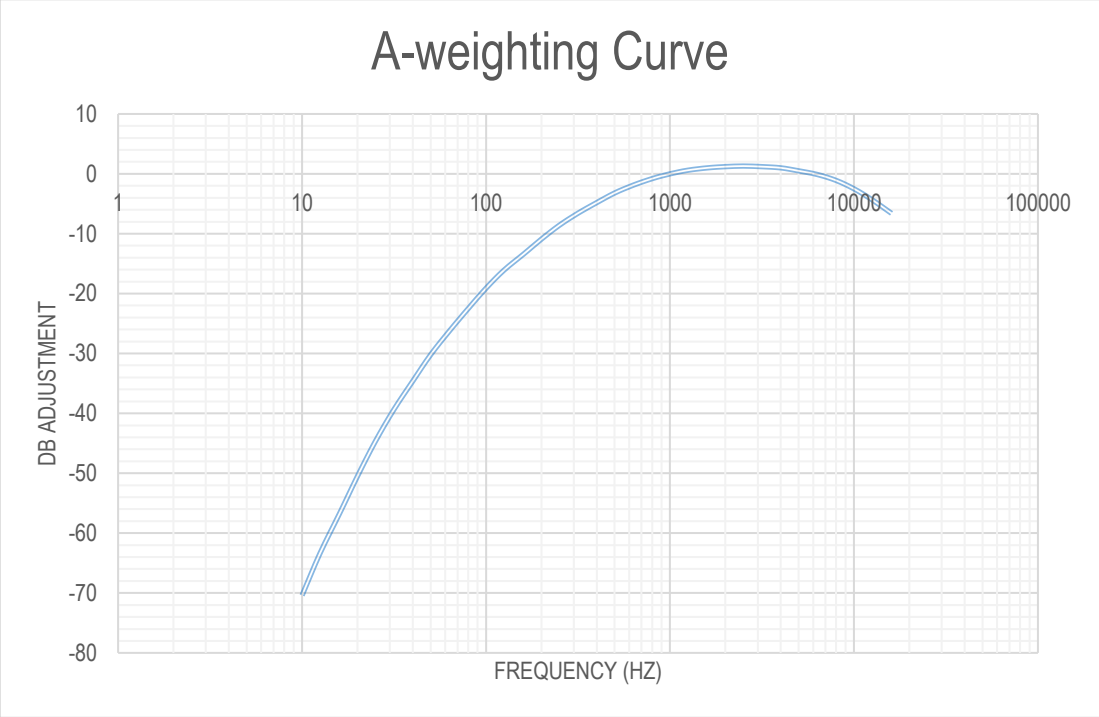

Figure 1-3: A-weighting curve

1.5.3 Adding Sound Pressure Levels

Since sound pressure levels are logarithmic values, the sound pressure levels as a result of two or more sources cannot simply be added together. To obtain the combined sound pressure level of a combination of sources such as those at a mine or industrial plant, individual sound pressure levels must be converted to their linear values and added using:

$$L_{p\_combined} = 10 \cdot \log\left(10^{\frac{L_{p1}}{10}} + 10^{\frac{L_{p2}}{10}} + 10^{\frac{L_{p3}}{10}} + \cdots 10^{\frac{L_{pi}}{10}}\right)$$

This implies that if the difference between the sound pressure levels of two sources is nil the combined sound pressure level is 3 dB more than the sound pressure level of one source alone. Similarly, if the difference between the sound pressure levels of two sources is more than 10 dB, the contribution of the quietest source can be disregarded (Brüel & Kjær Sound & Vibration Measurement A/S, 2000).

1.5.4 Environmental Noise Propagation

Many factors affect the propagation of noise from source to receiver. The most important of these are:

- The type of source and its sound power (L_W);
- The distance between the source and the receiver;
- Atmospheric conditions (wind speed and direction, temperature and temperature gradient, humidity etc.);
- Obstacles such as barriers or buildings between the source and receiver;
- Ground absorption; and
- Reflections.

To arrive at a representative result from either measurement or calculation, all these factors must be taken into account (Brüel & Kjær Sound & Vibration Measurement A/S, 2000).

1.6 Approach and Methodology

The assessment included a study of the legal requirements pertaining to environmental noise impacts, a study of the physical environment of the area surrounding the project and the analyses of existing noise levels in the area. The impact assessment focused on the estimation of sound power levels (L_W's) (noise 'emissions') and sound pressure levels (L_P's) (noise impacts) associated with the operational phase. The findings of the assessment components informed recommendations of management measures, including mitigation and monitoring. Individual aspects of the noise impact assessment methodology are discussed in more detail below.

1.6.1 Information Review

An information requirements list was sent to SLR at the onset of the project. In response to the request, the following information was supplied:

- Layout maps;
- Description of project activities; and
- List of mining equipment.

1.6.2 Review of Assessment Criteria

In South Africa, provision is made for the regulation of noise under the National Environmental Management Air Quality Act (NEMAQA) (Act. 39 of 2004) but environmental noise limits have yet to be set. It is believed that when published, national criteria will make extensive reference to SANS 10103 of 2008 '*The measurement and*

rating of environmental noise with respect to annoyance and to speech communication'. This standard has been widely applied in South Africa and is frequently used by local authorities when investigating noise complaints. These guidelines, which are in line with those published by the International Finance Corporation (IFC) in their *General EHS Guidelines* (IFC 2007) and World Health Organisation (WHO) *Guidelines for Community Noise* (WHO 1999), were considered in the assessment.

1.6.3 Study of the Receiving Environment

NSRs generally include private residences, community buildings such as schools, hospitals and any publicly accessible areas outside an industrial facility's property. Potential NSRs were identified from satellite imagery (Google Earth).

The ability of the environment to attenuate noise as it travels through the air was studied by considering local meteorology, land use and terrain. Atmospheric attenuation potential was described based on modelled WRF meteorological data. Data for the period 2019 to 2021 was considered. Land-use was determined from satellite imagery (Google Earth) and site observations. Readily available terrain data was obtained from the United States Geological Survey (USGS) web site (https://earthexplorer.usgs.gov/) in June 2022. A study was made of Shuttle Radar Topography Mission (STRM) 1 arc-sec data.

1.6.4 Baseline Environmental Noise Surveys

Numerous baseline noise surveys have been conducted for the area. The most recent surveys and have been included in the baseline noise discussions:

- Baseline noise survey conducted by Acusolv in 2021; and,
- Baseline noise survey conducted by Thlago Environmental Health and Safety Solutions in 2022.

1.6.5 Source Inventory

To determine the change in noise impacts associated with the project, a source inventory had to be developed. A detailed list of equipment was provided and used to compile the source inventory. L_W's for these were calculated using predictive equations for industrial machinery as per the Handbook of Acoustics, Chapter 69, by Bruce and Moritz (1998).

1.6.6 Noise Propagation Simulations

The propagation of noise from proposed activities was simulated with the DataKustic CadnaA software. Use was made of the International Organisation for Standardization's (ISO) 9613 module for outdoor noise propagation from industrial noise sources.

1.6.6.1 ISO 9613

ISO 9613 specifies an engineering method for calculating the attenuation of sound during propagation to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level under meteorological conditions favourable to propagation from sources of known sound emission. These conditions are for downwind propagation or, equivalently, propagation under a well-developed moderate ground-based temperature inversion, such as commonly occurs at night.

The method also predicts an average A-weighted sound pressure level. The average A-weighted sound pressure level encompasses levels for a wide variety of meteorological conditions. The method specified in ISO 9613 consists specifically of octave-band algorithms (with nominal mid-band frequencies from 63 Hz to 8 kHz) for calculating the attenuation of sound which originates from a point sound source, or an assembly of point sources. The source (or sources) may be moving or stationary. Specific terms are provided in the algorithms for the following physical effects: geometrical divergence, atmospheric absorption, ground surface effects, reflection and obstacles. A basic representation of the model is given in the equation below:

$$L_P = L_W - \sum [K_1, K_2, K_3, K_4, K_5, K_6]$$

Where;

L_P *is the sound pressure level at the receiver;*
L_W *is the sound power level of the source;*
K_1 *is the correction for geometrical divergence;*
K_2 *is the correction for atmospheric absorption;*
K_3 *is the correction for the effect of ground surface;*
K_4 *is the correction for reflection from surfaces; and*
K_5 *is the correction for screening by obstacles.*

This method is applicable in practice to a great variety of noise sources and environments. It is applicable, directly or indirectly, to most situations concerning road or rail traffic, industrial noise sources, construction activities, and many other ground-based noise sources.

To apply the method of ISO 9613, several parameters need to be known with respect to the geometry of the source and of the environment, the ground surface characteristics, and the source strength in terms of octave-band sound power levels for directions relevant to the propagation.

1.6.6.2 Simulation Domain

If the dimensions of a noise source are small compared with the distance to the listener, it is called a point source. All sources were quantified as point sources or areas/lines represented by point sources. The sound energy from a point source spreads out spherically, so that the sound pressure level is the same for all points at the same distance from the source and decreases by 6 dB per doubling of distance. This holds true until ground and air attenuation noticeably affect the level. The impact of an intruding industrial noise on the environment will therefore rarely extend over more than 5 km from the source and is therefore always considered “local” in extent.

The propagation of noise was calculated over an area of 9.8 km east-west by 5.8 km north-south and encompasses the project area. The area was divided into a grid matrix with a 20 m resolution. The model was set to calculate L_P's at each grid intercept point at a height of 1.5 m above ground level.

1.6.7 Presentation of Results

Results are presented in tabular and isopleth form. An isopleth is a line on a map connecting points at which a given variable (in this case sound pressure, L_P) has a specified constant value. This is analogous to contour lines on a map showing terrain elevation. In the assessment of environmental noise, isopleths present lines of constant noise level as a function of distance.

Simulated noise levels were assessed according to guidelines published in SANS 10103 and by the IFC. To assess annoyance at nearby places of residence, the increase in noise levels above the baseline at NSRs were calculated and compared to guidelines published in the SANS 10103.

1.6.8 Recommendations of Management and Mitigation

The findings of the noise specialist study informed the recommendation of suitable noise management and mitigation measures.

1.6.9 Impact Significance Assessment

The significance of environmental noise impacts was assessed according to the methodology developed by SLR. Refer to Appendix C of this report for the methodology.

1.7 Management of Uncertainties

The following limitations and assumptions should be noted:

- The mitigating effect of pit walls, buildings, and infrastructure acting as acoustic barriers were not taken into account providing a conservative assessment of the noise impacts off-site.
- The quantification of sources of noise was limited to the operational phase of the project. Construction and closure phase activities are expected to be similar or less significant and its impacts only assessed qualitatively. Noise impacts will cease post-closure.
- All activities were assumed to be 24 hours per day, 7 days per week.
- Although other existing sources of noise within the area were identified, such sources were not quantified but were taken into account during the surveys undertaken.
- Blast vibration and noise did not form part of the scope of work of this assessment.
- The WRDs were modelled as single areas encompassing all quantified noise producing equipment.
- It was assumed, as a conservative approach, that all equipment on the WRDs would be operational simultaneously.

- Although the noise impact due to reverse signals is recognised, it is not considered as part of the environmental noise impact assessment as these signals are used for warning purposes which are excluded in impact assessments.
- The environmental noise assessment focussed on the evaluation of impacts for humans. It is important to note that the applicability of environmental noise assessments to wildlife is limited as it is not possible simply to infer the impacts of anthropogenic noise on wildlife from the human literature. This is because the hearing ranges and sensitivities of non-human animals can be very different from those of humans. Noise studies on humans understandably use methodologies that tailors the quantification of anthropogenic noise to our hearing capabilities: for example, the use of microphones limited to the human hearing range (20 Hz – 20 kHz) and the implementation of frequency filters effectively mimicking human auditory sensitivity (A-weighting). As such, noise measurements may only cover part of the relevant acoustic range for other species. Moreover, species differences in behaviour, physiology, and ecology, in addition to hearing capabilities and perception, mean that extrapolations from human studies can provide only a limited understanding of the potential impact of anthropogenic noise on wildlife.

2 Legal Requirements and Noise Level Guidelines

2.1 National Noise Control Regulations

The 1992 Noise Control Regulations (The Republic of South Africa, 1992) published in terms of Section 25 of the Environment Conservation Act (Act no. 73 of 1989) defines a "disturbing noise" as 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 7 dBA or more.

The Noise Control Regulations were revised under Government Notice Number R. 55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations.

In 1994, with the shift of regulatory power from governmental to provincial level, the authority to promulgate noise regulations was ceded to provinces. Each province could therefore decide whether to develop their own regulations, or to adopt and adapt existing regulations. To date, however, only three provinces (Gauteng, Free State and Western Cape) have promulgated such regulations. Elsewhere, including North West Province, no provincial noise regulations have been put in place.

Consequently, in noise studies undertaken in provinces lacking official noise regulations, specialists usually consider the old national noise regulations to apply by default.

2.2 South African National Standards

In South Africa, provision is made for the regulation of noise under the National Environmental Management Air Quality Act (NEMAQA) (Act. 39 of 2004) but legally enforceable environmental noise limits have yet to be set. It is believed that when published, national criteria will make extensive reference to the South African Bureau of Standards (SABS) standard SANS 10103 (2008) *'The measurement and rating of environmental noise with respect to annoyance and to speech communication'*. This standard has been widely applied in South Africa and is frequently used by local authorities when investigating noise complaints. The standard is also fully aligned with the WHO guidelines for Community Noise (WHO, 1999). It should be noted that the values given in Table 2-1 are typical rating levels for different districts specified.

SANS 10103 also provides a useful guideline for estimating community response to an increase in the general ambient noise level caused by intruding noise. If Δ is the increase in noise level, the following criteria are of relevance:

- "$\Delta \leq 0$ dB: There will be no community reaction;
- 0 dB < $\Delta \leq$ 10 dB: There will be 'little' reaction with 'sporadic complaints';
- 5 dB < $\Delta \leq$ 15 dB: There will be a 'medium' reaction with 'widespread complaints'. Δ = 10 dB is subjectively perceived as a doubling in the loudness of the noise;
- 10 dB < $\Delta \leq$ 20 dB: There will be a 'strong' reaction with 'threats of community action'; and
- 15 dB < Δ: There will be a 'very strong' reaction with 'vigorous community action'.

The categories of community response overlap because the response of a community does not occur as a stepwise function, but rather as a gradual change.

Table 2-1: Typical rating levels for outdoor noise

Type of district	Equivalent Continuous Rating Level ($L_{Req,T}$) for Outdoor Noise		
	Day/night $L_{R,dn}$[c] (dBA)	Day-time $L_{Req,d}$[a] (dBA)	Night-time $L_{Req,n}$[b] (dBA)
Rural districts	45	45	35
Suburban districts with little road traffic	50	50	40
Urban districts	55	55	45
Urban districts with one or more of the following: business premises; and main roads.	60	60	50
Central business districts	65	65	55
Industrial districts	70	70	60

Notes

(a) $L_{Req,d}$ =The L_{Aeq} rated for impulsive sound and tonality in accordance with SANS 10103 for the day-time period, i.e. from 06:00 to 22:00.

(b) $L_{Req,n}$ =The L_{Aeq} rated for impulsive sound and tonality in accordance with SANS 10103 for the night-time period, i.e. from 22:00 to 06:00.

(c) $L_{R,dn}$ =The L_{Aeq} rated for impulsive sound and tonality in accordance with SANS 10103 for the period of a day and night, i.e. 24 hours, and wherein the $L_{Req,n}$ has been weighted with 10dB in order to account for the additional disturbance caused by noise during the night.

2.3 International Finance Corporation Guidelines on Environmental Noise

The IFC General Environmental Health and Safety Guidelines on noise address impacts of noise beyond the property boundary of the facility under consideration and provides noise level guidelines.

The IFC states that noise impacts **should not exceed the levels presented in Table 2-2**, or result in a maximum **increase above background levels of 3 dBA** at the nearest receptor location off-site (IFC, 2007). For a person with average hearing acuity an increase of less than 3 dBA in the general ambient noise level is not detectable. Δ = 3 dBA is, therefore, a useful significance indicator for a noise impact.

It is further important to note that the IFC noise level guidelines for residential, institutional and educational receptors correspond with the SANS 10103 guidelines for urban districts.

Table 2-2: IFC noise level guidelines

Area	One Hour L_{Aeq} (dBA) 07:00 to 22:00	One Hour L_{Aeq} (dBA) 22:00 to 07:00
Industrial receptors	70	70
Residential, institutional and educational receptors	55	45

2.4 Summary of Assessment Criteria

Simulated noise levels were assessed according to guidelines published by the National Noise Control Regulations and the IFC. To assess annoyance at nearby places of residence, the increase in noise levels above the baseline and estimated background at NSRs were calculated and compared to guidelines published in SANS 10103.

2.5 Regulations Regarding Report Writing

This report complies with the requirements of the National Environmental Management Act, 1998 (NEMA, No. 107 of 1998) and the Environmental Impact Assessment (EIA) regulations (Government Notice [GN] R982 as amended by GN 326 of 7 April 2017; GN 706 of 13 July 2018 and GN 320 of 20 March 2020). The table below provides a summary of the requirements, with cross references to the report sections where these requirements have been addressed.

Table 2-3: Specialist report requirements in terms of Appendix 6 of the EIA Regulations (Government Notice [GN] R982 as amended by GN 326 of 7 April 2017; GN 706 of 13 July 2018 and GN 320 of 20 March 2020)

A specialist report prepared in terms of the Environmental Impact Regulations must contain:	Relevant section in report
Details of the specialist who prepared the report	Section 1.3
The expertise of that person to compile a specialist report including a curriculum vitae	Section 1.3.2 Appendix A
A declaration that the person is independent in a form as may be specified by the competent authority	Section 1.3.1 Appendix B
An indication of the scope of, and the purpose for which, the report was prepared	Section 1.2
An indication of the quality and age of base data used for the specialist report;	Section 3.2 Section 3.3
A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 4
The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 3.3 Section 4
A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 1.6
Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternative;	Section 3.1

A specialist report prepared in terms of the Environmental Impact Regulations must contain:	Relevant section in report
An identification of any areas to be avoided, including buffers	Section 3.1 Section 4
A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 4
A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.7
A description of the findings and potential implications of such findings on the impact of the proposed activity or activities	Section 4
Any mitigation measures for inclusion in the EMPr	Section 6
Any conditions for inclusion in the environmental authorisation	Section 6
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 6
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	Section 7
Regarding the acceptability of the proposed activity or activities; and	Section 4
If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 4 Section 6 Section 7
A description of any consultation process that was undertaken during the course of carrying out the study	Not applicable
A summary and copies if any comments that were received during any consultation process	Appendix D
Any other information requested by the competent authority.	Appendix D

2.6 Procedures for the Assessment

This report complies with protocols for the assessment and minimum report content in terms of sections 24(5)(a), (h) and 44 of the National Environmental Management Act, 1998 (NEMA, No. 107 of 1998) (Government Gazette No. 43110) published on 20 March 2020. The table below provides a summary of the requirements, with cross references to the report sections where these requirements have been addressed.

Table 2-4: Specialist assessment requirements in terms of Government Gazette No. 43110 (2020)

Assessment and Reporting on Noise Impacts	Section in Report
The assessment must be undertaken by a noise specialist	Section 1.3 and Appendix A
The assessment must be undertaken based on a site inspection as well as applying the noise standards and methodologies stipulated in SANS 10103:2008 and SANS 10328:2008 (or latest versions) for residential and non -residential areas as defined in these standards.	Section 2, Section 3.3 and Section 4
A baseline description must be provided of the potential receptors and existing ambient noise levels. The receptors could include places of residence or tranquillity that have amenity value associated with low noise levels. As a minimum, this description must include the following: • current ambient sound levels recorded at relevant locations (e.g. receptors and proposed new noise sources) over a minimum of two nights and that provide a representative measurement of the	Section 3.3

Assessment and Reporting on Noise Impacts	Section in Report
ambient noise climate, with each sample being a minimum of ten minutes and taken at two different times of the night (such as early evening and late at night) on each night, in order to record typical ambient sound levels at these different times of night;	
• records of the approximate wind speed at the time of the measurement;	Section 3.3
• mapped distance of the receiver from the proposed development that is the noise source; and	Section 3.1
• discussion on temporal aspects of baseline ambient conditions.	Section 3.3
Assessment of impacts done in accordance to SANS 10103:2008 and SANS 10328:2008 (or latest versions) must include the following aspects which must be considered as a minimum in the predicted impact of the proposed development:	
• characterisation and determination of noise emissions from the noise source, where characterization could include types of noise, frequency, content, vibration and temporal aspects;	Section 4
• projected total noise levels and changes in noise levels as a result of the construction, commissioning and operation of the proposed development for the nearest receptors using industry accepted models and forecasts; and,	Section 4
• desired noise levels for the area.	Section 2.2, Section 2.3, Section 4 and Section 5
The findings of the Noise Specialist Assessment must be written up in a Noise Specialist Report that must contain as a minimum the following information:	
• details and relevant qualifications and experience of the noise specialist preparing the assessment including a curriculum vitae;	Section 1.3 and Appendix A
• a signed statement of independence by the specialist;	Appendix B
• the duration and date of the site inspection and the relevance of the season and weather conditions to the outcome of the assessment;	Section 3.2 and Section 3.3
• a description of the methodology used to undertake the on-site assessment inclusive of the equipment and models used, as relevant, together with results of the noise assessment;	Section 1.6.4, Section 1.6.6 and Section 4
• a map showing the proposed development footprint (including supporting infrastructure) with a 50m buffered development envelope;	Figure 1-1
• confirmation from the specialist that all reasonable measures have been considered, or not, in the micro- siting of the proposed development to minimise disturbance of receptors;	Section 4 and Section 6
• a substantiated statement from the specialist on the acceptability, or not, of the proposed development and a recommendation on the approval, or not, of the proposed development;	Section 7
• any conditions to which this statement is subjected;	Section 6 and Section 7
• the assessment must identify alternative development footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification and which were not considered;	Section 4. No alternative development footprints were provided for the assessment.

Assessment and Reporting on Noise Impacts	Section in Report
• a motivation must be provided if there were development footprints identified as per paragraph 2.5.9. above that were identified as having a "low" noise sensitivity and that were not considered appropriate;	Not applicable
• where identified, proposed impact management outcomes, mitigation measures for noise emissions during the construction and commissioning phases that may be of relative short duration, or any monitoring requirements for inclusion in the Environmental Management Programme (EMPr); and,	Section 6
• a description of the assumptions made and any uncertainties or gaps in knowledge or data.	Section 1.7

3 Description of the Receiving Environment

This chapter provides details of the receiving acoustic environment which is described in terms of:

- Local NSRs;
- The local environmental noise propagation and attenuation potential; and
- Current noise levels and the existing acoustic climate.

3.1 Noise Sensitive Receptors

Noise sensitive receptors generally include places of residence and areas where members of the public may be affected by noise generated by mining, processing, and transport activities.

As mentioned in Section 1.5.4, the impact of an intruding industrial/mining noise on the environment rarely extends over more than 5 km from the source. The closest residential developments to the proposed project consist of the Mmaditlhokwa and Lapologang communities. Individual farmsteads also surround the project area (Figure 3-1 as identified from Google Earth). The location of selected sensitive receptors (individual homesteads) that have the potential to be impacted by the project have been provided in Table 3-1.

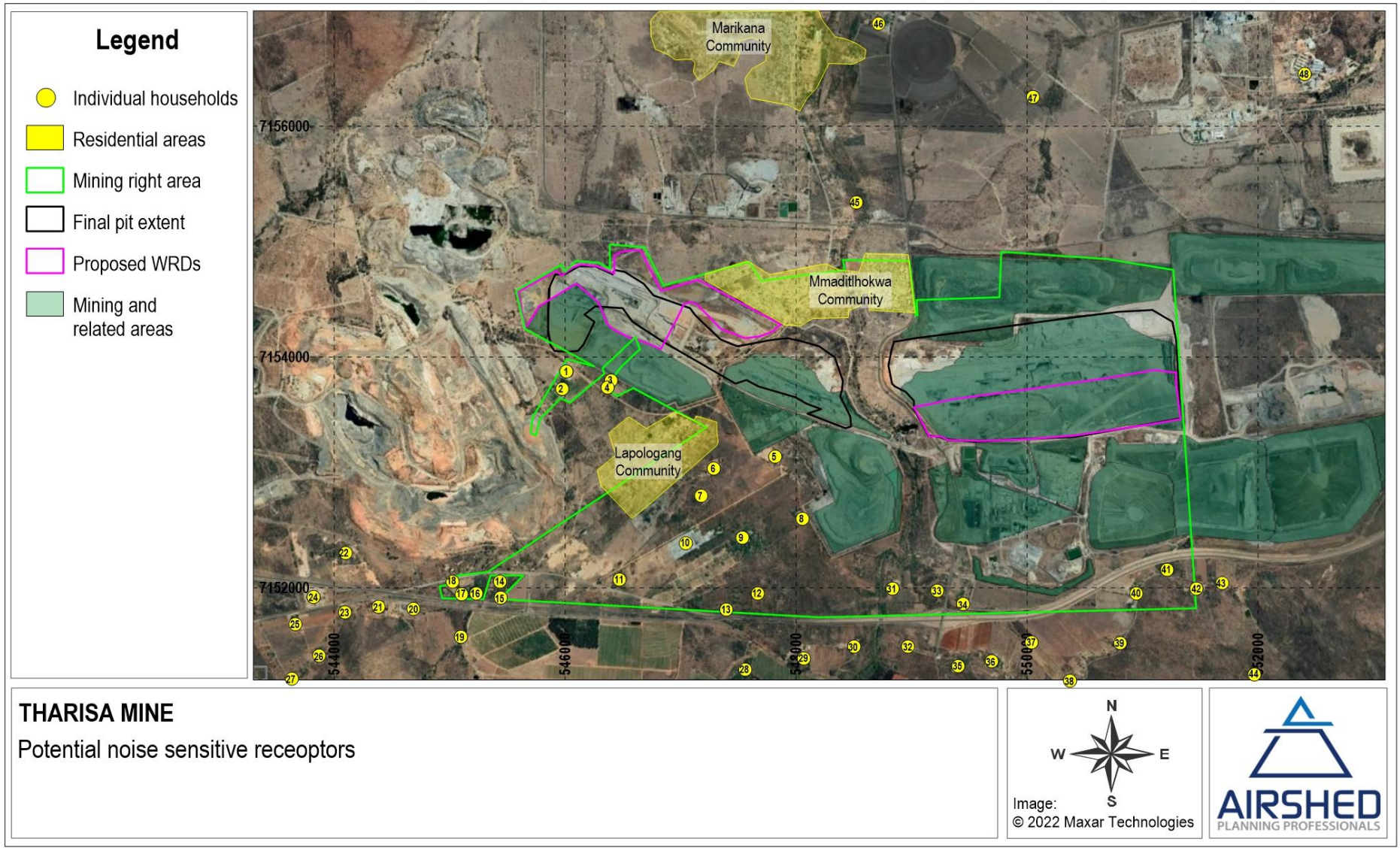

Figure 3-1: Potential noise sensitive receptors within the study area

Table 3-1: The location of individual sensitive receptors within the study area

Receptor	Easting	Northing
NSR1	25°43'56.58" S	27°27'31.47" E
NSR2	25°44'01.67" S	27°27'29.85" E
NSR3 (Wolvaardt Residence)	25°43'59.08" S	27°27'45.26" E
NSR4 (van der Hoven Residence)	25°44'01.20" S	27°27'44.10" E
NSR5 (Retief Primary School)	25°44'20.70" S	27°28'36.02" E
NSR6 (Pretorius Residence)	25°44'23.72" S	27°28'17.35" E
NSR7 (du Preez Residence)	25°44'31.14" S	27°28'13.41" E
NSR8	25°44'37.38" S	27°28'44.96" E
NSR9	25°44'43.15" S	27°28'26.07" E
NSR10 (industrial)	25°44'44.48" S	27°28'08.56" E
NSR11	25°44'55.12" S	27°27'48.04" E
NSR12	25°44'58.58" S	27°28'31.27" E
NSR13	25°45'03.48" S	27°28'21.24" E
NSR14	25°44'55.45" S	27°27'10.91" E
NSR15	25°45'00.53" S	27°27'11.63" E
NSR16	25°44'59.07" S	27°27'03.69" E
NSR17	25°44'59.51" S	27°26'58.78" E
NSR18	25°44'55.71" S	27°26'56.19" E
NSR19	25°45'11.56" S	27°26'58.59" E
NSR20	25°45'03.36" S	27°26'43.85" E
NSR21	25°45'02.97" S	27°26'33.10" E
NSR22	25°44'48.19" S	27°26'22.77" E
NSR23	25°45'04.49" S	27°26'22.60" E
NSR24	25°45'00.28" S	27°26'13.00" E
NSR25	25°45'07.92" S	27°26'07.43" E
NSR26	25°45'16.99" S	27°26'14.70" E
NSR27	25°45'23.14" S	27°26'06.55" E
NSR28	25°45'20.38" S	27°28'27.15" E
NSR29	25°45'17.14" S	27°28'45.59" E
NSR30	25°45'13.71" S	27°29'00.99" E
NSR31	25°44'57.59" S	27°29'13.07" E
NSR32	25°45'13.65" S	27°29'18.04" E
NSR33	25°44'57.76" S	27°29'26.85" E
NSR34 (Potgieter Residence)	25°45'01.54" S	27°29'35.04" E
NSR35	25°45'19.31" S	27°29'33.01" E
NSR36	25°45'17.58" S	27°29'43.51" E
NSR37	25°45'12.25" S	27°29'56.34" E
NSR38	25°45'23.00" S	27°30'08.07" E
NSR39	25°45'12.37" S	27°30'23.43" E
NSR40	25°44'58.18" S	27°30'28.74" E
NSR41	25°44'51.59" S	27°30'38.53" E
NSR42	25°44'57.06" S	27°30'47.42" E

Receptor	Easting	Northing
NSR43	25°44'55.34" S	27°30'55.36" E
NSR44	25°45'21.11" S	27°31'05.52" E
NSR45	25°43'08.70" S	27°29'01.42" E
NSR46	25°42'18.33" S	27°29'07.99" E
NSR47	25°42'38.48" S	27°29'56.16" E
NSR48 (Lonmin Training Centre)	25°42'31.63" S	27°31'20.42" E

3.2 Environmental Noise Propagation and Attenuation Potential

3.2.1 Atmospheric Absorption and Meteorology

Atmospheric absorption and meteorological conditions have already been mentioned with regards to their role in the propagation on noise from a source to receiver (Section 1.5.4). The main meteorological parameters affecting the propagation of noise include wind speed, wind direction and temperature. These, along with other parameters such as relative humidity, air pressure, solar radiation and cloud cover, affect the stability of the atmosphere and the ability of the atmosphere to absorb sound energy.

Wind speed increases with altitude. This results in the 'bending' of the path of sound to 'focus' it on the downwind side and creating a 'shadow' on the upwind side of the source. Depending on the wind speed, the downwind level may increase by a few dB but the upwind level can drop by more than 20 dB (Brüel & Kjær Sound & Vibration Measurement A/S, 2000). It should be noted that at wind speeds of more than 5 m/s, ambient noise levels are mostly dominated by wind generated noise.

Data from WRF data for the period 2019 to 2021 was used for the assessment (Figure 3-2). The modelled data set indicates wind flow primarily from the north for day-time. At night, wind shifted to be mostly from the south. On average, noise impacts are expected to be slightly more notable to the south during the day and to the north of the project activities during the night.

Temperature gradients in the atmosphere create effects that are uniform in all directions from a source. On a sunny day with no wind, temperature decreases with altitude and creates a 'shadowing' effect for sounds. On a clear night, temperatures may increase with altitude thereby 'focusing' sound on the ground surface. Noise impacts are therefore generally more notable during the night.

Temperature gradients in the atmosphere create effects that are uniform in all directions from a source. On a sunny day with no wind, temperature decreases with altitude and creates a 'shadowing' effect for sounds. On a clear night, temperatures may increase with altitude thereby 'focusing' sound on the ground surface. Noise impacts are therefore generally more notable during the night (Figure 3-3). CadnaA requires the definition of both temperature and humidity. An average temperature of 19°C and a humidity of 60% were applied in simulations.

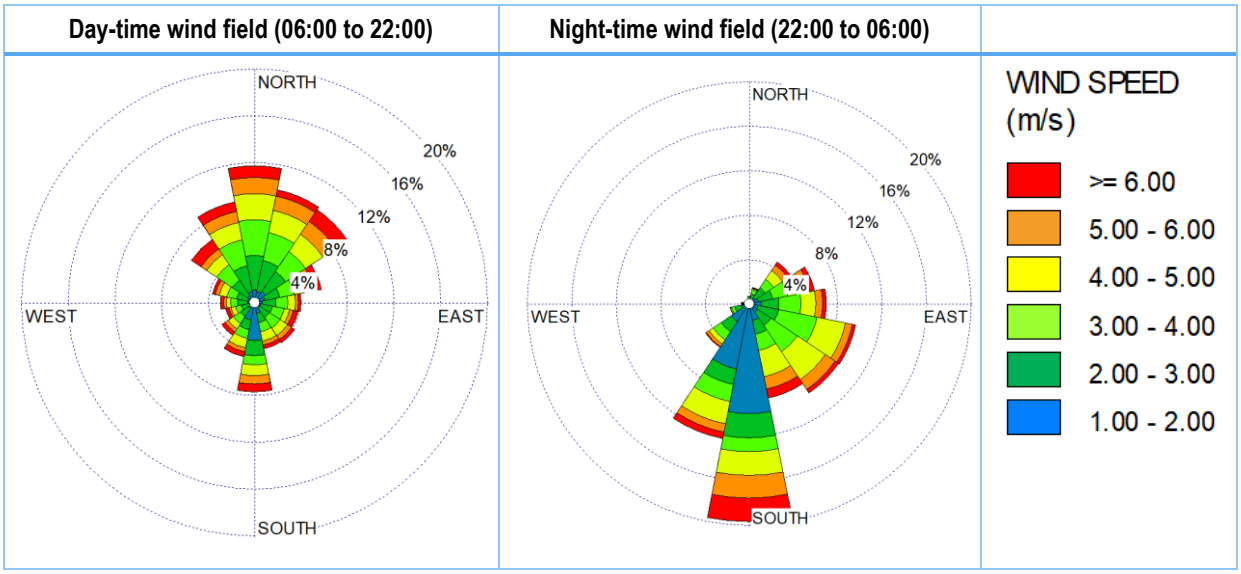

Figure 3-2: Wind rose for WRF data, 1 January 2019 to 31 December 2021

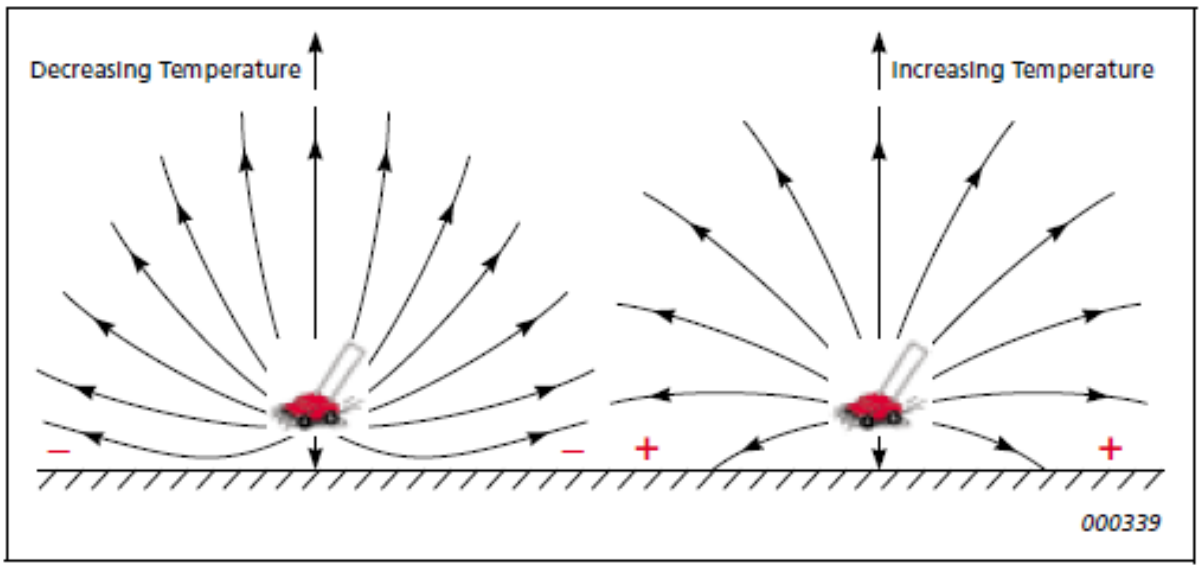

Figure 3-3: Bending the path of sound during typical day time conditions (image provided on the left) and night-time conditions (image provided on the right)

3.2.2 Terrain, Ground Absorption and Reflection

Noise reduction caused by a barrier (i.e., natural terrain, installed acoustic barrier, building) feature depends on two factors namely the path difference of a sound wave as it travels over the barrier compared with direct transmission to the receiver and the frequency content of the noise (Brüel & Kjær Sound & Vibration Measurement A/S, 2000). The topography[1] for the study area is provided in Figure 3-4.

Sound reflected by the ground interferes with the directly propagated sound. The effect of the ground is different for acoustically hard (e.g., concrete or water), soft (e.g., grass, trees or vegetation) and mixed surfaces. Ground

[1] SRTM1 from the United States Geological Survey at https://earthexplorer.usgs.gov

attenuation is often calculated in frequency bands to take into account the frequency content of the noise source and the type of ground between the source and the receiver (Brüel & Kjær Sound & Vibration Measurement A/S, 2000). Based on observations made during the visit to site, ground cover was found to be acoustically mixed.

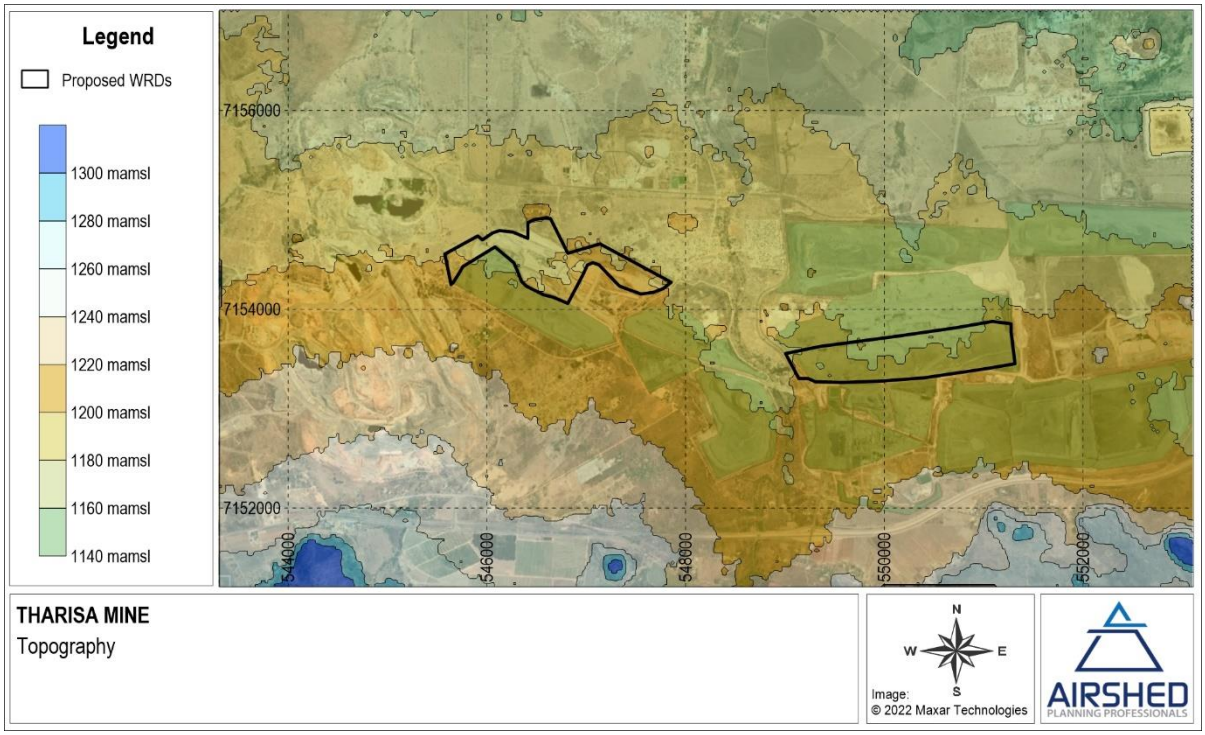

Figure 3-4: Topography for the study area

3.3 Baseline Noise Levels

3.3.1 Background Reference Conditions

Acusolv have been undertaking noise measurements for the Tharisa Mine since 2012. The general ambient noise profile of the area, as concluded by Acusolv (van Zyl, 2021), is summarised below.

Tharisa Mine is located in a district where the character of ambient noise is already affected by industrialisation and economic activity, which over time, has resulted in an increase in road traffic noise and noise generated by intensive mining activities. Road traffic noise emanates from the N4 and secondary roads, such as the D1325 between Buffelspoort and Marikana. The N4 has a wide noise footprint. It has a significant impact on people living within a zone of approximately 1.2 km either side of the road and is clearly audible in most of the study area. In addition, mining noise affects communities in the immediate surroundings of mines.

Against this background, the area surrounding Tharisa Mine in its current state cannot be considered a typical rural environment anymore. None of the district descriptions in SANS 10103 (**Error! Reference source not found.**) meaningfully applies to typical mining areas.

Moreover, background noise levels (i.e., excluding noise from Tharisa) in the assessment area are not homogeneous but vary over a considerable range. Depending on the locations and distances of houses or communities relative to the N4 and relative to other roads and other mines in the area, background noise levels measured in surveys conducted by Acusolv have been found to vary between broadly 50 to 60 dBA (daytime) and 40 to 55 dBA night-time, respectively.

Residences within a zone of 250 m from the N4, for example, are subject to night-time road traffic noise levels of between 45 and 55 dBA, depending on topography and distance from the N4. This has been confirmed by noise surveys conducted in earlier studies.

The location of the noise sampling sites is provided in Table 3-2 and Figure 3-5.

Table 3-2: Location of the noise sampling sites for surveys conducted by Acusolv for the annual Tharisa Mine noise surveys (van Zyl, 2021)

Sampling Location	Description	Latitude	Longitude
M1	Madithlokwa Village near church	25°43'39.6" S	27°29'18.6" E
M2	School	25°44'19.8" S	27°28'36.0" E
M3	Lapologang Village	25°44'14.1" S	27°28'14.4" E
M4	Bokamoso Village	25°43'27.0" S	27°32'01.9" E
M5	Residence Potgieter D	25°44'53.6" S	27°30'53.7" E
M6	Residence Potgieter H	25°45'00.7" S	27°29'35.2" E

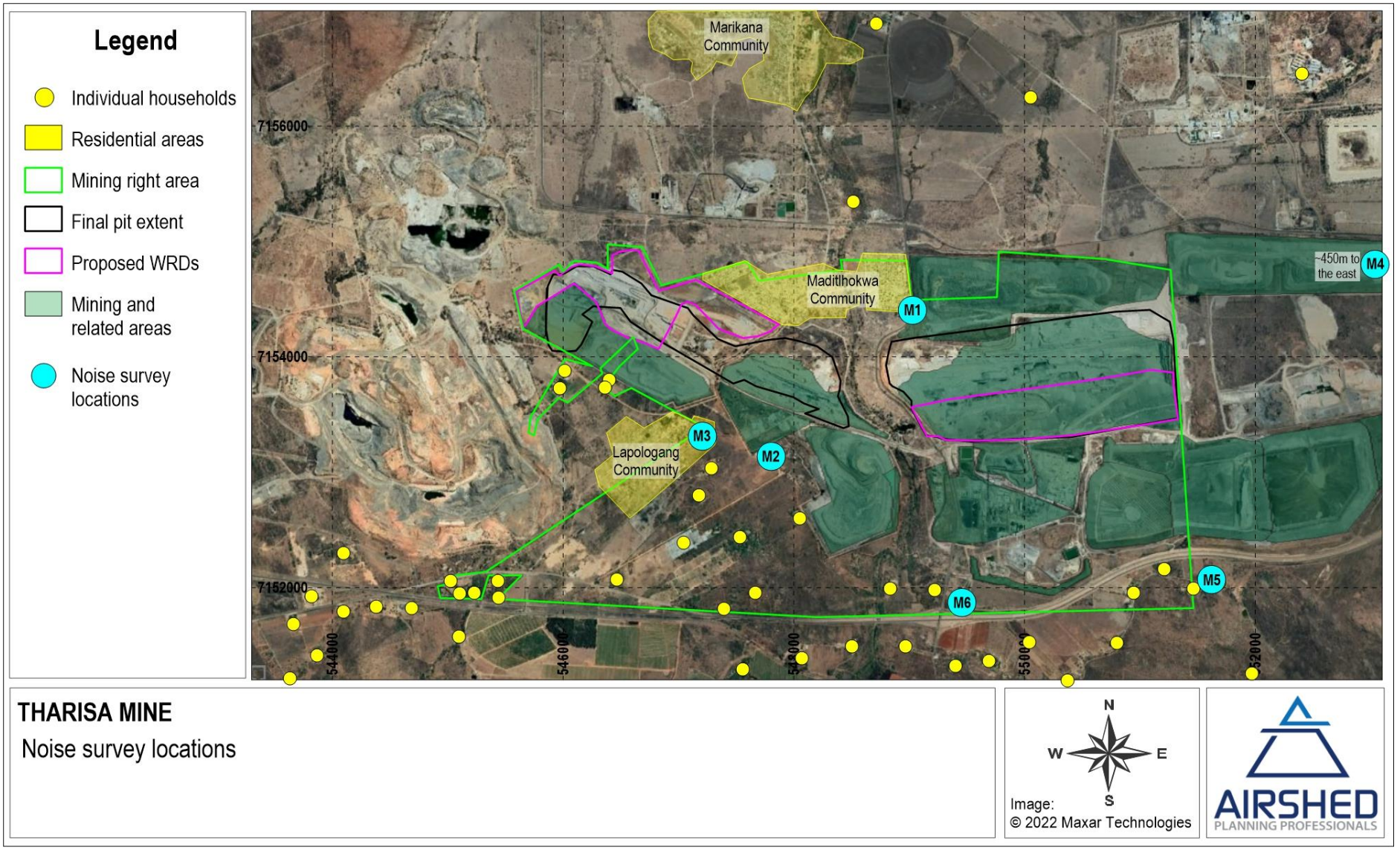

Figure 3-5: Location of the noise sampling sites for surveys conducted by Acusolv for the annual Tharisa Mine noise surveys (van Zyl, 2021)

Although no formal baseline surveys had been carried out prior to the initial start-up of Tharisa Mine, various efforts have been made in previous surveys conducted by Acusolv to acquire data representative of prevailing background conditions (in the absence of Tharisa Mine). These estimated nominal background daytime and night-time noise levels under normal conditions (outside lockdown restrictions), are summarised in Table 3-3 and Figure 3-6.

Table 3-3: Estimated background levels[2] in the areas surrounding Tharisa Mine (based on information obtained from the 2021 noise survey (van Zyl, 2021))

Sampling Location	Description	Main Sources of Background Noise	Background Noise Levels (dBA)	
			Day-Time	Night-Time
M1	Madithlokwa Village opposite East Pit mining operations	• D1325 Road Noise • Community activities • Distant mining activities in the area	60	50
M2	School and surroundings	• Community activities • Mining activities in the district	50	45
M3	Lapologang south of Tharisa Far West mining operations	• Community activities • Mining activities in the district	50	45
M4	Bokamoso Village in the vacinity of the dump operations north-east of Tharisa East Mine	• Road traffic noise from tarred public road • Community activities	55	45
M5	Residence Potgieter D south of the N4 opposite Tharisa TSF	• N4 highway traffic • Distant mining activities in the district	60	50
M6	Residence Potgieter H between Tharisa Mine and the N4	• N4 highway traffic • Distant mining activities in the district	60	50

[2] Daytime and night-time background noise ratings in the absence of Tharisa noise. Derived from measurements and observations made in previous surveys. Rounded to the nearest 5 dB interval as per SANS 10103 practice.

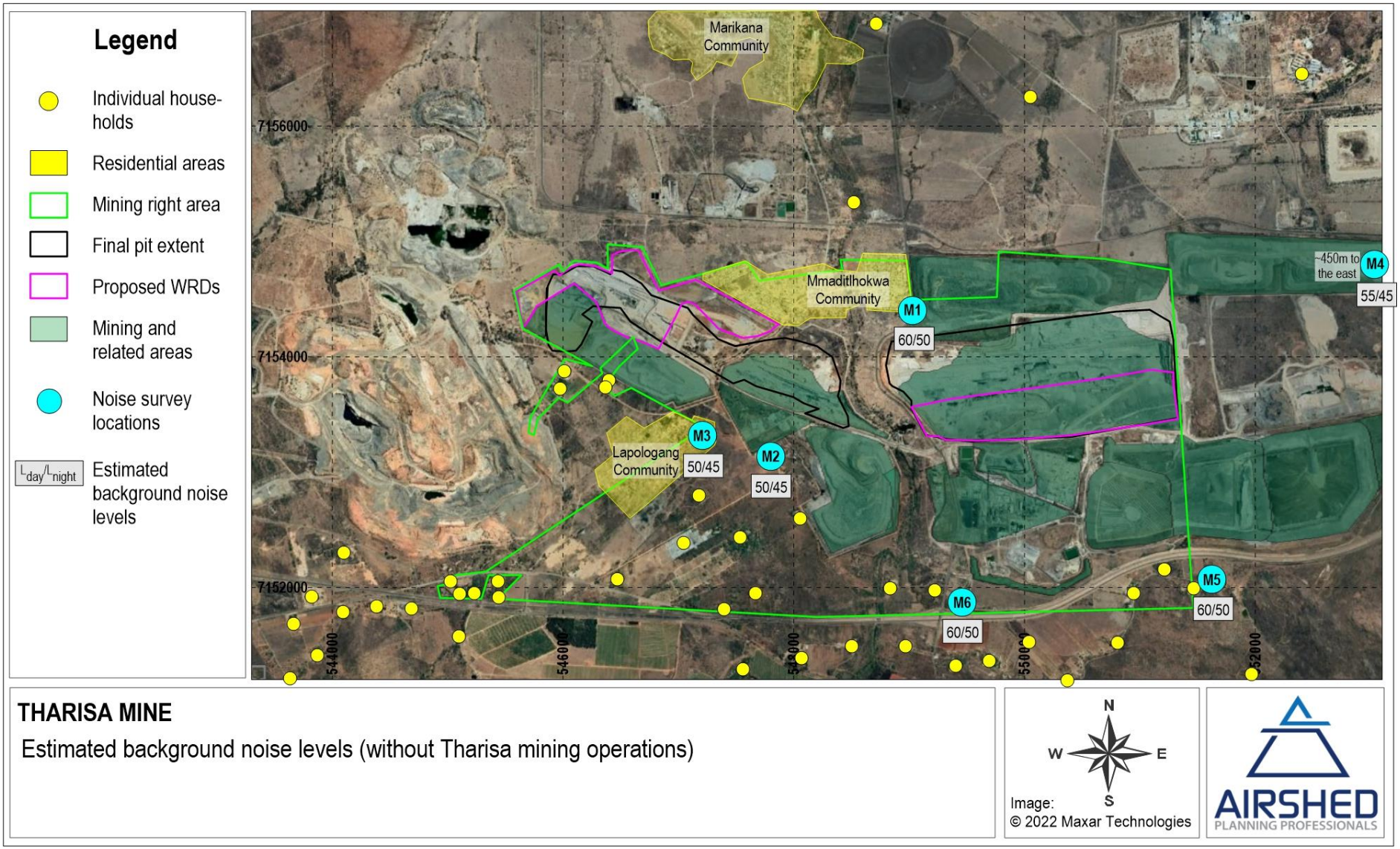

Figure 3-6: Estimated background levels in the areas surrounding Tharisa Mine (based on information obtained from the 2021 noise survey (van Zyl, 2021))

3.3.2 Measured Noise Levels for the 2021 Survey

Acusolv undertook a noise survey for the Tharisa Mine in 2021 (van Zyl, 2021). A summary of the measured baseline noise levels for this period is provided in Table 3-4 and Figure 3-7.

Table 3-4: Measured baseline noise levels for 2021 in the areas surrounding Tharisa Mine (based on information obtained from the 2021 noise survey (van Zyl, 2021))

Sampling Location	Description	Measured noise levels obtained from the 2021 annual survey (dBA)	
		Day-Time	Night-Time
M1	Madithlokwa Village opposite East Pit mining operations	60	56
M2	School and surroundings	56	50
M3	Lapologang south of Tharisa Far West mining operations	58	50
M4	Bokamoso Village in the vicinity of the dump operations north-east of Tharisa East Mine	53	52
M5	Residence Potgieter D south of the N4 opposite Tharisa TSF	54	48
M6	Residence Potgieter H between Tharisa Mine and the N4	57	59

Considering the estimated background noise levels as provided in Section 3.3.1, the noise levels measured at M3 (day-time), M4 (night-time) and M6 (night-time) are equivalent or exceed the 1992 Noise Control Regulations (The Republic of South Africa, 1992) “disturbing noise” definition (greater than 7dBA from ambient sound levels). Complaints are thus to be expected from close sensitive receptors to the Tharisa mining area as observed in Appendix D.

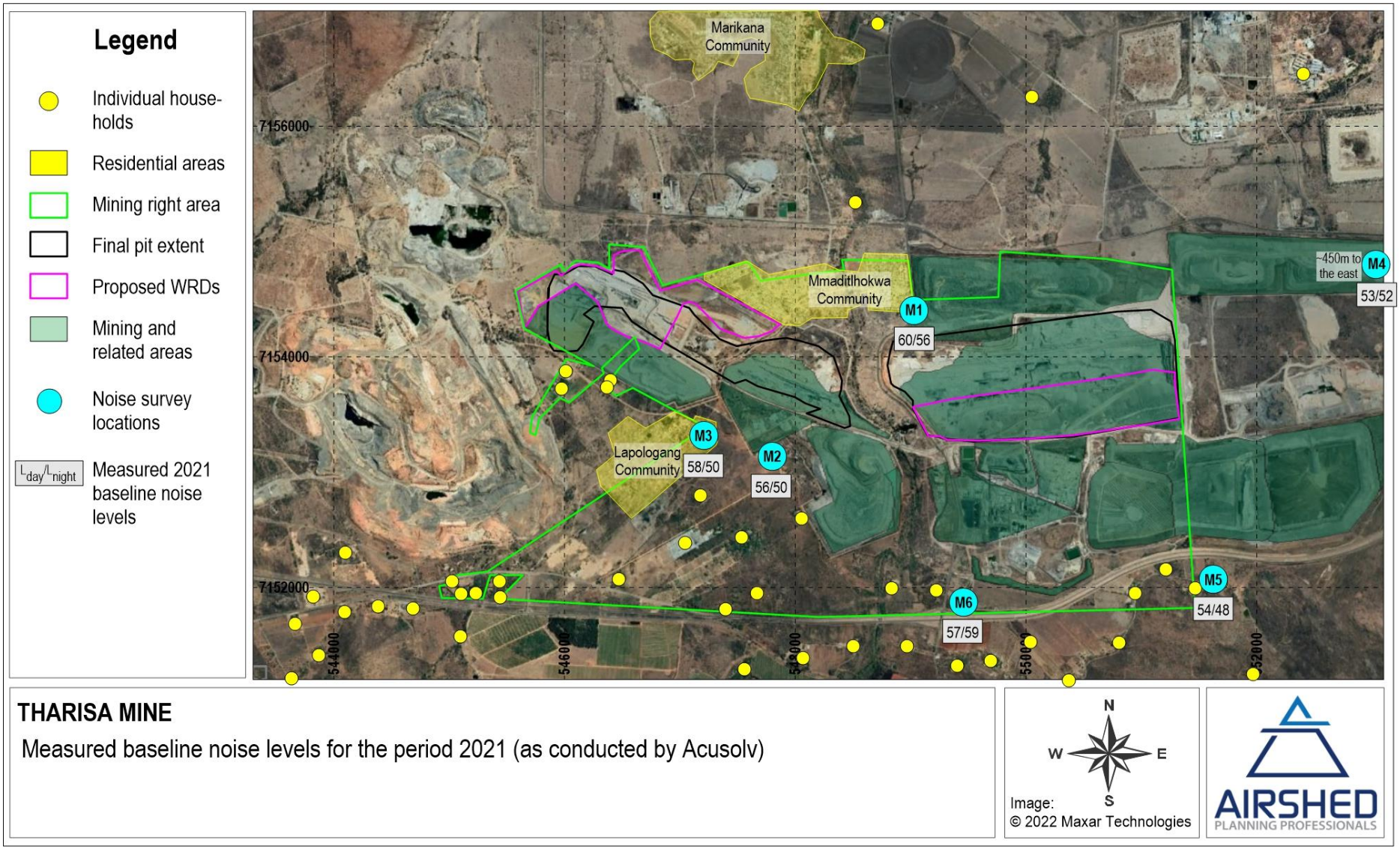

Figure 3-7: Measured baseline noise levels for 2021 in the areas surrounding Tharisa Mine (based on information obtained from the 2021 noise survey (van Zyl, 2021))

3.3.3 Measured Noise Levels for the 2022 Survey

Noise measurements were undertaken by Thlago Environmental Health and Safety Solutions (Thlago) on 24 and 25 May 2022 (Thlago Environmental Health and Safety Solutions, 2022) at five selected sampling locations (summarised in Table 3-5). A summary of the measured baseline noise levels for this period is provided in Table 3-6 and Figure 3-8.

Table 3-5: Location of the sampling sites for the noise survey conducted by Thlago for the Tharisa Mine in May 2022 (Thlago Environmental Health and Safety Solutions, 2022)

Sampling Location	Description	Latitude	Longitude
R1	Potgieter residence	25°45'00.39" S	27°29'35.89" E
R2	Pretorius residence	25°44'22.75" S	27°28'19.34" E
R3	van der Hoven residence	25°43'59.78" S	27°27'47.31" E
R4	Kgoitsi house (residence)	25°43'42.76" S	27°28'44.67" E
R5	Church	25°43'40.31" S	27°29'16.41" E

Table 3-6: Measured baseline noise levels for 2022 in the areas surrounding Tharisa Mine (based on information obtained from the 2022 noise survey (Thlago Environmental Health and Safety Solutions, 2022))

Sampling Location	Description	Measured noise levels obtained from the 2022 survey (dBA)	
		Day-Time	Night-Time
R1	Potgieter residence	58.9	55.3
R2	Pretorius residence	59.7	54.7
R3	van der Hoven residence	60.0	55.7
R4	Kgoitsi house (residence)	58.3	55.6
R5	Church	58.1	56.5

Considering the estimated background noise levels as provided in Section 3.3.1, the noise levels measured at R2 (day-time), R3 (day-time) and R5 (night-time) are equivalent or exceed the 1992 Noise Control Regulations (The Republic of South Africa, 1992) “disturbing noise” definition (greater than 7dBA from ambient sound levels). Noise complaints received from sensitive receptors in the area is provided in Appendix D.

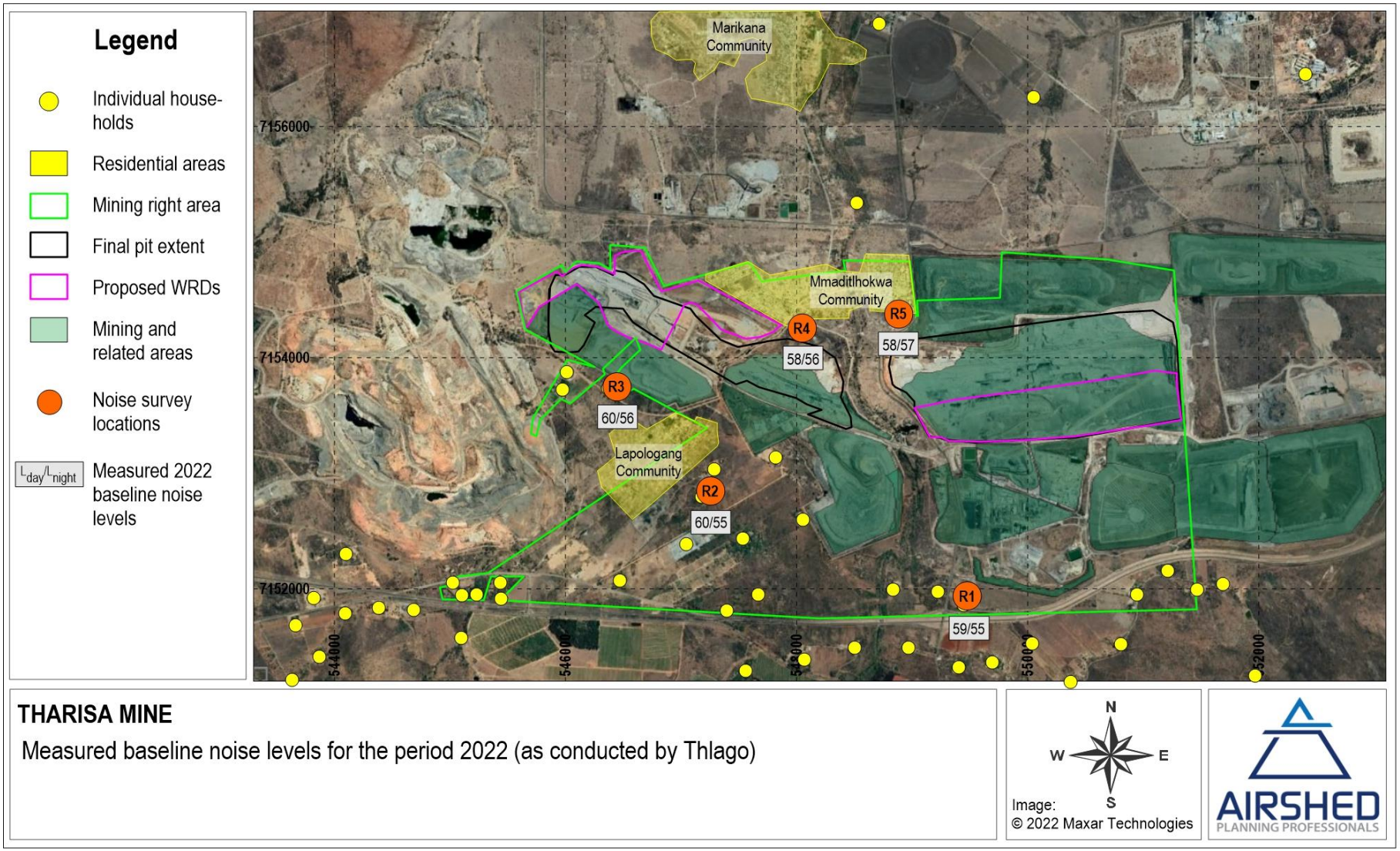

Figure 3-8: Measured baseline noise levels for 2022 in the areas surrounding Tharisa Mine (based on information obtained from the 2022 noise survey (Thlago Environmental Health and Safety Solutions, 2022))

4 Impact Assessment

The noise source inventory, noise propagation modelling and results are discussed in Section 4.1 and Section 4.2 respectively.

4.1 Noise Sources and Sound Power Levels

The complete source inventory for the project is included in Table 4-1. Octave band frequency spectra L_W's are included in Table 4-2.

The reader is reminded of the non-linearity in the addition of L_W's. If the difference between the sound power levels of two sources is nil the combined sound power level is 3 dB more than the sound pressure level of one source alone. Similarly, if the difference between the sound power levels of two sources is more than 10 dB, the contribution of the quietest source can be disregarded (Brüel & Kjær Sound & Vibration Measurement A/S, 2000). Therefore, although some sources of noise could not be quantified (e.g., light vehicle movements, etc.), the incremental contributions of such sources are expected to be minimal given that the majority of sources are considered in the source inventory.

Table 4-1: Proposed truck activity for the project areas

Area	Equipment	# Trucks at dump at any time
West OG WRD	Dozer (CAT D10T)	1
	ADT (Volvo A40E/F)	2
	ADT (CAT 745C)	6
East OG WRD	Dozer (CAT D10T)	1
	ADT (CAT 785C/D)	3
	ADT (CAT 789C/D)	2

Table 4-2: Octave band frequency spectra L_W's

Equipment	Type	L_W octave band frequency spectra (dB)								L_W (dB)	L_{WA} (dBA)	Source
		63	125	250	500	1000	2000	4000	8000			
Dozer (CAT D10T)	L_W	114.5	119.5	122.5	117.5	115.5	112.5	106.5	100.5	126.1	120.8	L_W Predictions (Bruce & Moritz, 1998)
ADT (Volvo A40E)	L_W	113.4	118.4	121.4	116.4	114.4	111.4	105.4	99.4	125.1	119.7	L_W Predictions (Bruce & Moritz, 1998)
ADT (Volvo A40F)	L_W	113.5	118.5	121.5	116.5	114.5	111.5	105.5	99.5	125.1	119.8	L_W Predictions (Bruce & Moritz, 1998)
ADT (CAT 745C)	L_W	113.8	118.8	121.8	116.8	114.8	111.8	105.8	99.8	125.4	120.1	L_W Predictions (Bruce & Moritz, 1998)
ADT (CAT 785C)	L_W	118.3	123.3	126.3	121.3	119.3	116.3	110.3	104.3	130.0	124.6	L_W Predictions (Bruce & Moritz, 1998)
ADT (CAT 785D)	L_W	118.3	123.3	126.3	121.3	119.3	116.3	110.3	104.3	130.0	124.6	L_W Predictions (Bruce & Moritz, 1998)
ADT (CAT 789C)	L_W	119.5	124.5	127.5	122.5	120.5	117.5	111.5	105.5	131.1	125.8	L_W Predictions (Bruce & Moritz, 1998)
ADT (CAT 789D)	L_W	119.9	124.9	127.9	122.9	120.9	117.9	111.9	105.9	131.6	126.2	L_W Predictions (Bruce & Moritz, 1998)

4.2 Noise Propagation and Simulated Noise Levels

The propagation of noise generated during the operational phase was calculated with CadnaA in accordance with ISO 9613. Meteorological and site-specific acoustic parameters as discussed in Section 3.2 along with source data discussed in 4.1, were applied in the model.

Table 4-3 provides a summary of simulated noise levels for the project operations at closest potential NSRs within the study area. Simulated noise levels due to project operations are also presented in isopleth form (Figure 4-1 and Figure 4-2).

Noise levels due to project operations are predicted to exceed the day-time IFC noise guideline of 55 dBA for residential areas up to a distance of ~110 m from the proposed West OG WRD and ~250 m from the East OG WRD. Noise levels due to project operations are predicted to exceed the night-time IFC noise guideline of 45 dBA for residential areas up to a distance of ~700 m from the proposed West OG WRD and ~1100 m from the East OG WRD. The NSRs where IFC noise guidelines for residential areas is exceeded, due to project activities, is as follows:

- Mmaditlhokwa Community (day- and night-time);
- NSR1 (night-time);
- NSR3 (night-time);
- NSR4 (night-time).

For a person with average hearing acuity an increase of less than 3 dBA in the general ambient noise level is not detectable. According to SANS 10103 (2008); the predicted increase in noise levels from the current baseline due to proposed project operations is expected to result in the following community reaction:

- Maditlhokwa Community:
    - Night-time – 'little' reaction with sporadic complaints

Tharisa Mine, however, has received complaints regarding current mining activities. It is thus clear that current operations are causing a noise nuisance. Assessment has therefore also been undertaken assuming an estimated background level (in the absence of Tharisa mining activities). The predicted increase in noise levels from an estimated background due to project activities would result in the following community reaction and, given current complaints, may be more in line with community response to the project:

- Mmaditlhokwa Community:
    - Day-time – 'medium' reaction with widespread complaints
    - Night-time – 'strong' to 'very strong' reaction with threats of community action or vigorous community action

Considering the estimated background noise levels as provided in Section 3.3.1, the noise levels due to the project exceed the 1992 Noise Control Regulations (The Republic of South Africa, 1992) definition of "disturbing noise" (greater than 7dBA from ambient sound levels) at the following sensitive receptors:

- Mmaditlhokwa Community (during day- and night-time conditions).

Table 4-3: Summary of simulated noise levels (provided as dBA) for proposed project operations at potential NSRs within the study area

Noise Sensitive Receptor	Project operations [a]		Background [b]		Increase Above Background [d]		Baseline [c]		Increase Above Baseline [d]	
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
Mmaditlhokwa Community	**59.7**	**60.0**	50	45	10.1	15.1	58	56	3.9	5.5
Lapologang Community	45.8	43.1	50	45	1.4	2.2	58	50	0.3	0.8
Marikana Community	35.1	36.5	55	45	0.0	0.6	54	48	0.1	0.3
NSR1	47.4	**46.1**	50	45	1.9	3.6	58	50	0.4	1.5
NSR2	46.3	44.8	50	45	1.5	2.9	58	50	0.3	1.1
NSR3 (Wolvaardt Residence)	49.2	**47.4**	50	45	2.6	4.4	58	50	0.5	1.9
NSR4 (van der Hoven Residence)	48.3	**46.5**	50	45	2.2	3.8	58	50	0.4	1.6
NSR5 (Piet Retief Primary School)	42.9	41.4	50	45	0.8	1.6	56	50	0.2	0.6
NSR6 (Pretorius Residence)	42.8	40.6	50	45	0.8	1.3	58	50	0.1	0.5
NSR7 (du Preez Residence)	40.0	37.5	50	45	0.4	0.7	60	55	0.0	0.1
NSR8	40.6	39.9	50	45	0.5	1.2	56	50	0.1	0.4
NSR9	37.6	36.6	50	45	0.2	0.6	60	55	0.0	0.1
NSR10 (industrial)	32.5	30.1	70	70	0.0	0.0	60	55	0.0	0.0
NSR11	0.0	0.0	60	50	0.0	0.0	57	55	0.0	0.0
NSR12	0.0	0.0	60	50	0.0	0.0	57	55	0.0	0.0
NSR13	0.0	0.0	60	50	0.0	0.0	57	55	0.0	0.0
NSR14	0.0	0.0	60	50	0.0	0.0	57	55	0.0	0.0
NSR15	0.0	0.0	60	50	0.0	0.0	57	55	0.0	0.0
NSR16	0.0	0.0	60	50	0.0	0.0	57	55	0.0	0.0
NSR17	0.0	0.0	60	50	0.0	0.0	57	55	0.0	0.0
NSR18	0.0	0.0	60	50	0.0	0.0	57	55	0.0	0.0
NSR19	0.0	0.0	60	50	0.0	0.0	54	48	0.0	0.0
NSR20	0.0	0.0	60	50	0.0	0.0	57	55	0.0	0.0
NSR21	0.0	0.0	60	50	0.0	0.0	57	55	0.0	0.0
NSR22	0.0	0.0	55	45	0.0	0.0	57	55	0.0	0.0
NSR23	0.0	0.0	60	50	0.0	0.0	57	55	0.0	0.0
NSR24	0.0	0.0	60	50	0.0	0.0	57	55	0.0	0.0
NSR25	0.0	0.0	60	50	0.0	0.0	57	55	0.0	0.0
NSR26	0.0	0.0	55	45	0.0	0.0	54	48	0.0	0.0
NSR27	0.0	0.0	55	45	0.0	0.0	54	48	0.0	0.0
NSR28	0.0	0.0	55	45	0.0	0.0	54	48	0.0	0.0
NSR29	0.0	0.0	55	45	0.0	0.0	54	48	0.0	0.0
NSR30	35.8	34.1	60	50	0.0	0.1	57	55	0.0	0.0
NSR31	39.6	38.0	60	50	0.0	0.3	54	48	0.2	0.4

Noise Sensitive Receptor	Project operations [a]		Background [b]		Increase Above Background [d]		Baseline [c]		Increase Above Baseline [d]	
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
NSR32	37.6	35.6	60	50	0.0	0.2	57	55	0.0	0.0
NSR33	41.3	39.4	60	50	0.1	0.4	57	55	0.1	0.1
NSR34 (Potgieter Residence)	41.2	39.0	60	50	0.1	0.3	57	55	0.1	0.1
NSR35	34.2	32.0	55	45	0.0	0.2	54	48	0.0	0.1
NSR36	37.5	35.3	60	50	0.0	0.1	54	48	0.1	0.2
NSR37	38.9	36.4	60	50	0.0	0.2	57	55	0.1	0.1
NSR38	0.0	0.0	55	45	0.0	0.0	54	48	0.0	0.0
NSR39	36.6	34.0	55	45	0.1	0.3	54	48	0.1	0.2
NSR40	43.2	40.8	60	50	0.1	0.5	57	55	0.2	0.2
NSR41	44.0	41.6	60	50	0.1	0.6	57	55	0.2	0.2
NSR42	39.8	37.4	60	50	0.0	0.2	54	48	0.2	0.4
NSR43	41.3	39.0	60	50	0.1	0.3	54	48	0.2	0.5
NSR44	0.0	0.0	60	50	0.0	0.0	54	48	0.0	0.0
NSR45	37.9	38.6	55	45	0.1	0.9	54	48	0.1	0.5
NSR46	0.0	0.0	55	45	0.0	0.0	54	48	0.0	0.0
NSR47	0.0	0.0	55	45	0.0	0.0	54	48	0.0	0.0
NSR48 (Lonmin Training Centre)	0.0	0.0	55	45	0.0	0.0	54	48	0.0	0.0

Notes:

(a) Exceedance of day- and night-time IFC guideline for residential areas is provided in bold

(b) Daytime and night-time background noise ratings in the absence of Tharisa Mine noise only. Derived from measurements and observations made in previous surveys undertaken by Acusolv. Rounded to the nearest 5 dB interval as per SANS 10103 practice.

(c) Baseline measurements based on closest sampling sites and reflective of current noise levels with existing Tharisa Mine activities.

(d) Likely community response in accordance with the SANS 10103:

< 3 dBA	*< 5 dBA*	*< 10 dBA*	*< 15 dBA*	*< 20 dBA*
Change imperceptible	*No reaction*	*'Little' reaction with sporadic complaints*	*'Medium' reaction with widespread complaints*	*'Strong' to 'very strong' reaction with threats of community action or vigorous community action.*

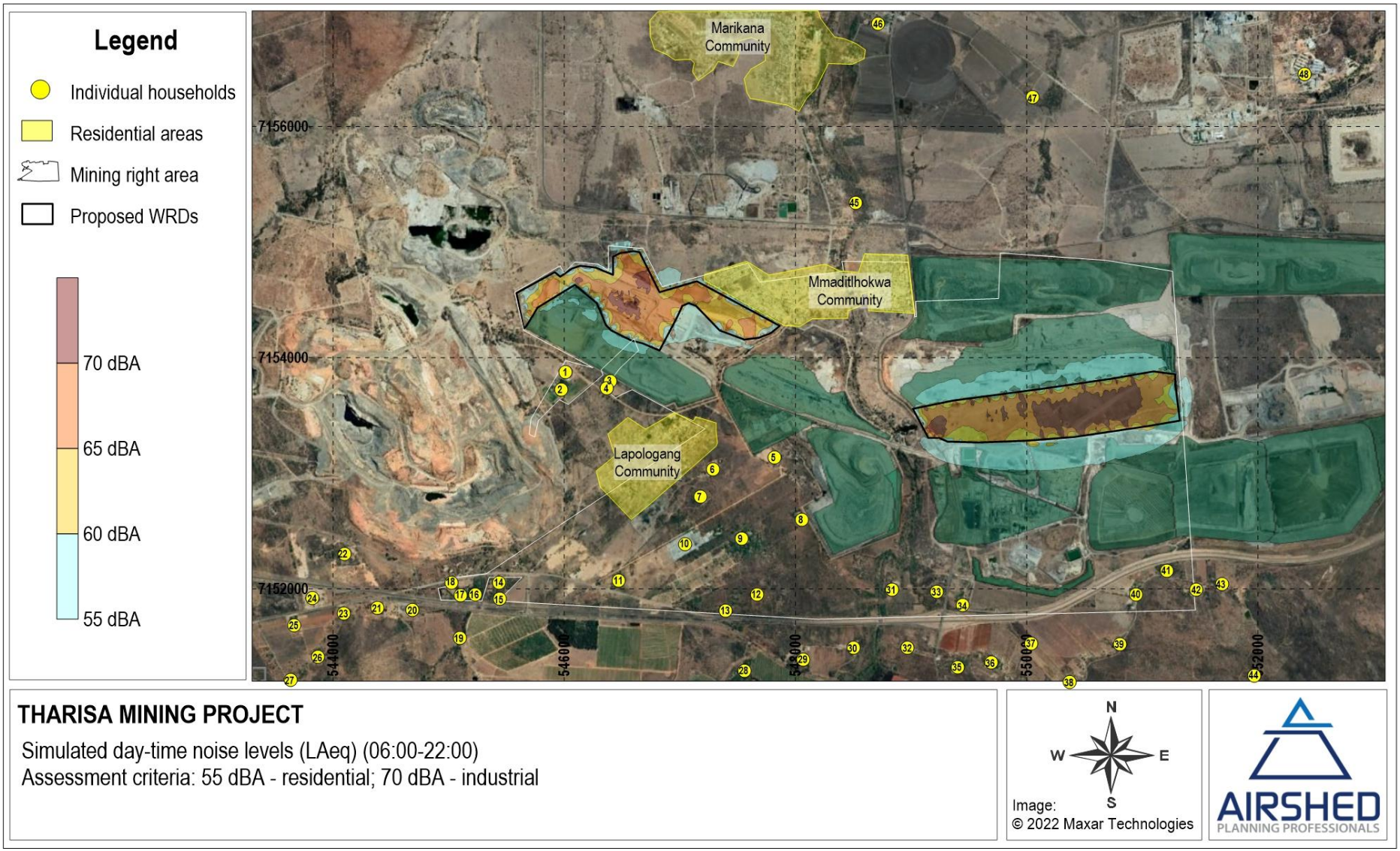

Figure 4-1: Simulated day-time noise levels due to proposed project operations

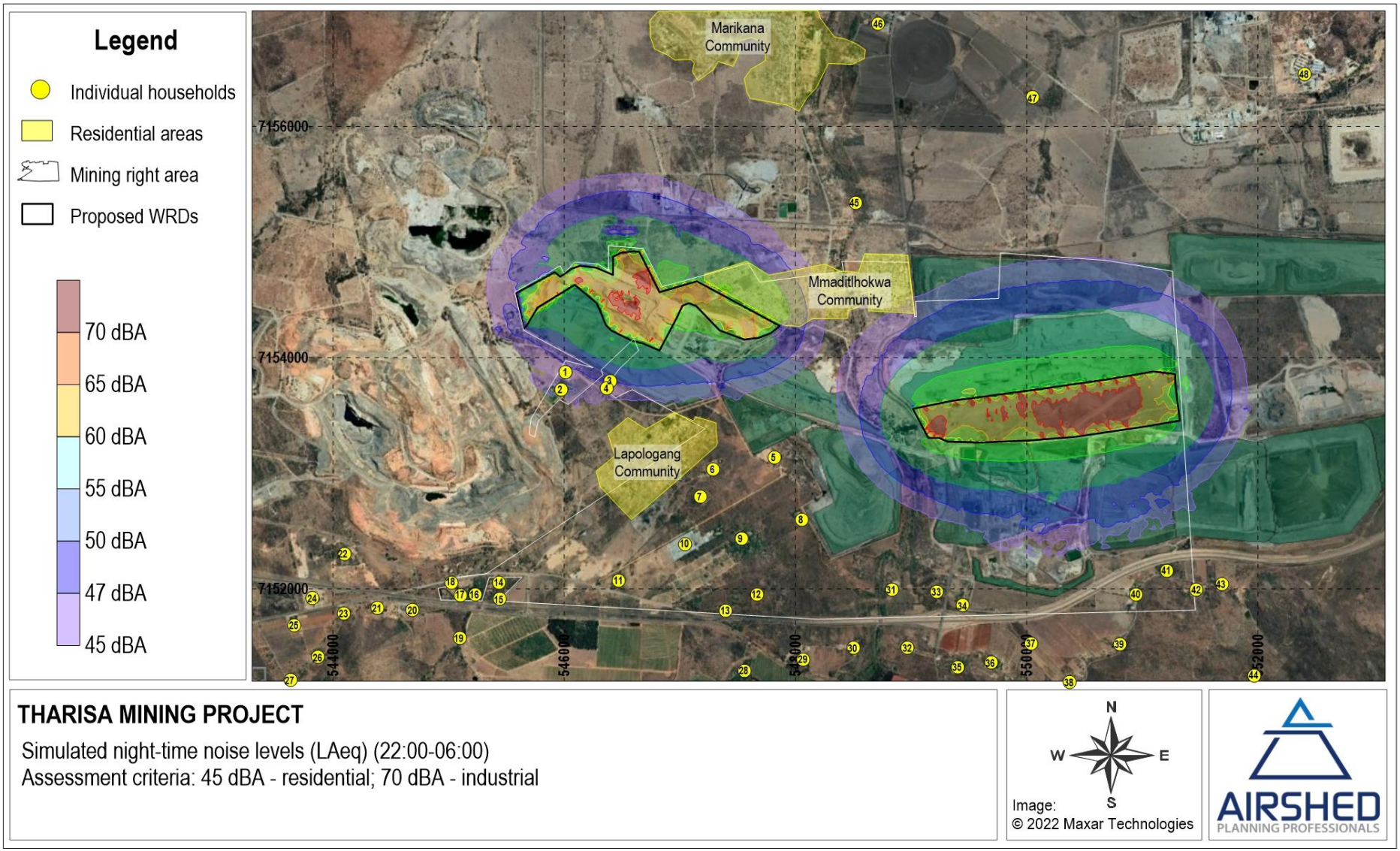

Figure 4-2: Simulated night-time noise levels due to proposed project operations

Given the potential elevated noise levels at close NSRs to the proposed project area, a mitigated scenario was modelled assuming a 5 m berm on the perimeter of the WRDs (Table 4-4, Figure 4-3 and Figure 4-4). The higher noise levels due to project operations decreased close to site with the IFC noise guideline for residential areas still predicted up to a distance of ~670 m for night-time (45 dBA) from the proposed West OG WRD and ~1100 m from the East OG WRD. The NSRs where IFC noise guidelines for residential areas is exceeded due to project activities is as follows:

- Mmaditlhokwa Community (night-time);
- NSR1 (night-time);
- NSR3 (night-time);
- NSR4 (night-time).

With the 5 m noise berm in place, the predicted increase in noise levels from the current baseline due to proposed project operations is not expected to result in a community reaction (Table 4-4).

The predicted increase in noise levels from an estimated background due to project activities, assuming a 5 m noise berm, would result in the following community:

- Mmaditlhokwa Community:
    - Night-time – 'little' reaction with sporadic complaints

Considering the estimated background noise levels as provided in Section 3.3.1, the noise levels due to the project with a 5 m berm on the perimeter of the proposed WRDs will not exceed the 1992 Noise Control Regulations (The Republic of South Africa, 1992) definition of "disturbing noise" (greater than 7dBA from ambient sound levels).

Table 4-4: Summary of simulated noise levels (provided as dBA) for proposed project operations (assuming 5 m noise berm on the perimeter of the proposed WRDs) at potential NSRs within the study area

Noise Sensitive Receptor	Project operations [a]		Background [b]		Increase Above Background [d]		Baseline [c]		Increase Above Baseline [d]	
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
Mmaditlhokwa Community	46.8	**48.4**	50	45	1.7	5.0	58	56	0.3	0.7
Lapologang Community	45.3	42.9	50	45	1.3	2.1	58	50	0.2	0.8
Marikana Community	34.9	36.4	55	45	0.0	0.6	54	48	0.1	0.3
NSR1	47.3	**45.9**	50	45	1.9	3.5	58	50	0.4	1.4
NSR2	45.2	43.7	50	45	1.2	2.4	58	50	0.2	0.9
NSR3 (Wolvaardt Residence)	48.7	**46.9**	50	45	2.4	4.1	58	50	0.5	1.7
NSR4 (van der Hoven Residence)	47.6	**45.8**	50	45	2.0	3.4	58	50	0.4	1.4
NSR5 (Piet Retief Primary School)	41.4	40.2	50	45	0.6	1.2	56	50	0.1	0.4
NSR6 (Pretorius Residence)	40.7	38.6	50	45	0.5	0.9	58	50	0.1	0.3
NSR7 (du Preez Residence)	37.7	35.2	50	45	0.2	0.4	60	55	0.0	0.0
NSR8	38.8	38.0	50	45	0.3	0.8	56	50	0.1	0.3
NSR9	36.1	35.1	50	45	0.2	0.4	60	55	0.0	0.0
NSR10 (industrial)	33.2	30.7	70	70	0.0	0.0	60	55	0.0	0.0
NSR11	0.0	0.0	60	50	0.0	0.0	57	55	0.0	0.0
NSR12	0.0	0.0	60	50	0.0	0.0	57	55	0.0	0.0
NSR13	0.0	0.0	60	50	0.0	0.0	57	55	0.0	0.0
NSR14	0.0	0.0	60	50	0.0	0.0	57	55	0.0	0.0
NSR15	0.0	0.0	60	50	0.0	0.0	57	55	0.0	0.0
NSR16	0.0	0.0	60	50	0.0	0.0	57	55	0.0	0.0
NSR17	0.0	0.0	60	50	0.0	0.0	57	55	0.0	0.0
NSR18	0.0	0.0	60	50	0.0	0.0	57	55	0.0	0.0
NSR19	0.0	0.0	60	50	0.0	0.0	54	48	0.0	0.0
NSR20	0.0	0.0	60	50	0.0	0.0	57	55	0.0	0.0
NSR21	0.0	0.0	60	50	0.0	0.0	57	55	0.0	0.0
NSR22	0.0	0.0	55	45	0.0	0.0	57	55	0.0	0.0
NSR23	0.0	0.0	60	50	0.0	0.0	57	55	0.0	0.0
NSR24	0.0	0.0	60	50	0.0	0.0	57	55	0.0	0.0
NSR25	0.0	0.0	60	50	0.0	0.0	57	55	0.0	0.0
NSR26	0.0	0.0	55	45	0.0	0.0	54	48	0.0	0.0
NSR27	0.0	0.0	55	45	0.0	0.0	54	48	0.0	0.0
NSR28	0.0	0.0	55	45	0.0	0.0	54	48	0.0	0.0
NSR29	0.0	0.0	55	45	0.0	0.0	54	48	0.0	0.0

Noise Sensitive Receptor	Project operations [a]		Background [b]		Increase Above Background [d]		Baseline [c]		Increase Above Baseline [d]	
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
NSR30	34.4	32.8	60	50	0.0	0.1	57	55	0.0	0.0
NSR31	39.5	37.9	60	50	0.0	0.3	54	48	0.2	0.4
NSR32	35.8	33.8	60	50	0.0	0.1	57	55	0.0	0.0
NSR33	40.6	38.7	60	50	0.0	0.3	57	55	0.1	0.1
NSR34 (Potgieter Residence)	40.2	38.1	60	50	0.0	0.3	57	55	0.1	0.1
NSR35	33.3	31.1	55	45	0.0	0.2	54	48	0.0	0.1
NSR36	35.5	33.3	60	50	0.0	0.1	54	48	0.1	0.1
NSR37	38.5	36.1	60	50	0.0	0.2	57	55	0.1	0.1
NSR38	0.0	0.0	55	45	0.0	0.0	54	48	0.0	0.0
NSR39	36.5	34	55	45	0.1	0.3	54	48	0.1	0.2
NSR40	41	38.5	60	50	0.1	0.3	57	55	0.1	0.1
NSR41	41.7	39.3	60	50	0.1	0.4	57	55	0.1	0.1
NSR42	39.6	37.2	60	50	0.0	0.2	54	48	0.2	0.3
NSR43	39.2	36.9	60	50	0.0	0.2	54	48	0.1	0.3
NSR44	0.0	0.0	60	50	0.0	0.0	54	48	0.0	0.0
NSR45	37.7	38.5	55	45	0.1	0.9	54	48	0.1	0.5
NSR46	0.0	0.0	55	45	0.0	0.0	54	48	0.0	0.0
NSR47	0.0	0.0	55	45	0.0	0.0	54	48	0.0	0.0
NSR48 (Lonmin Training Centre)	0.0	0.0	55	45	0.0	0.0	54	48	0.0	0.0

Notes:

(a) Exceedance of day- and night-time IFC guideline for residential areas is provided in bold

(b) Daytime and night-time background noise ratings in the absence of Tharisa Mine noise only. Derived from measurements and observations made in previous surveys undertaken by Acusolv. Rounded to the nearest 5 dB interval as per SANS 10103 practice.

(c) Baseline measurements based on closest sampling sites and reflective of current noise levels with existing Tharisa Mine activities.

(d) Likely community response in accordance with the SANS 10103:

< 3 dBA	*< 5 dBA*	*< 10 dBA*	*< 15 dBA*	*< 20 dBA*
Change imperceptible	*No reaction*	*'Little' reaction with sporadic complaints*	*'Medium' reaction with widespread complaints*	*'Strong' to 'very strong' reaction with threats of community action or vigorous community action.*

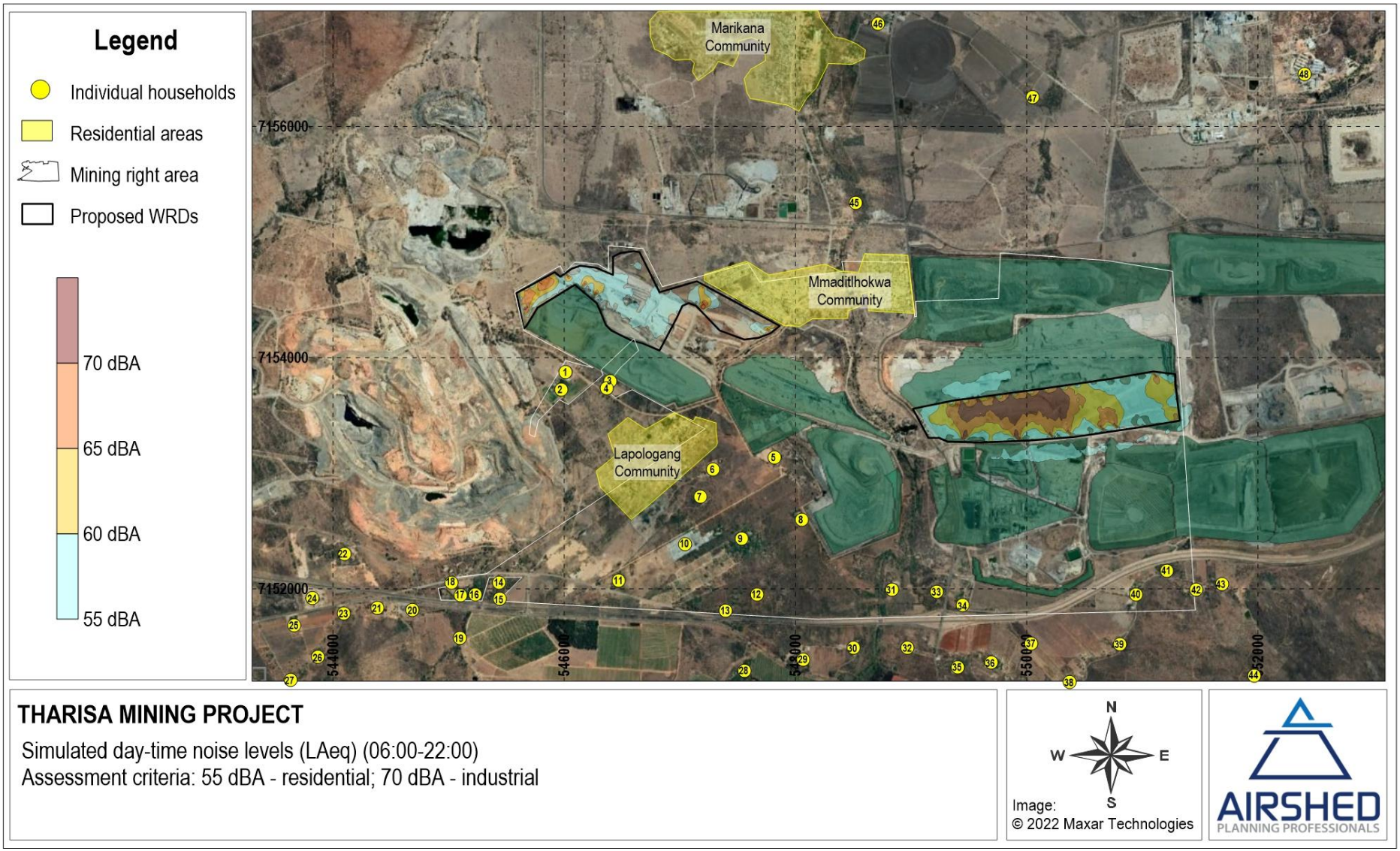

Figure 4-3: Simulated day-time noise levels due to proposed project operations (assuming 5 m noise berm on the perimeter of the proposed WRDs)

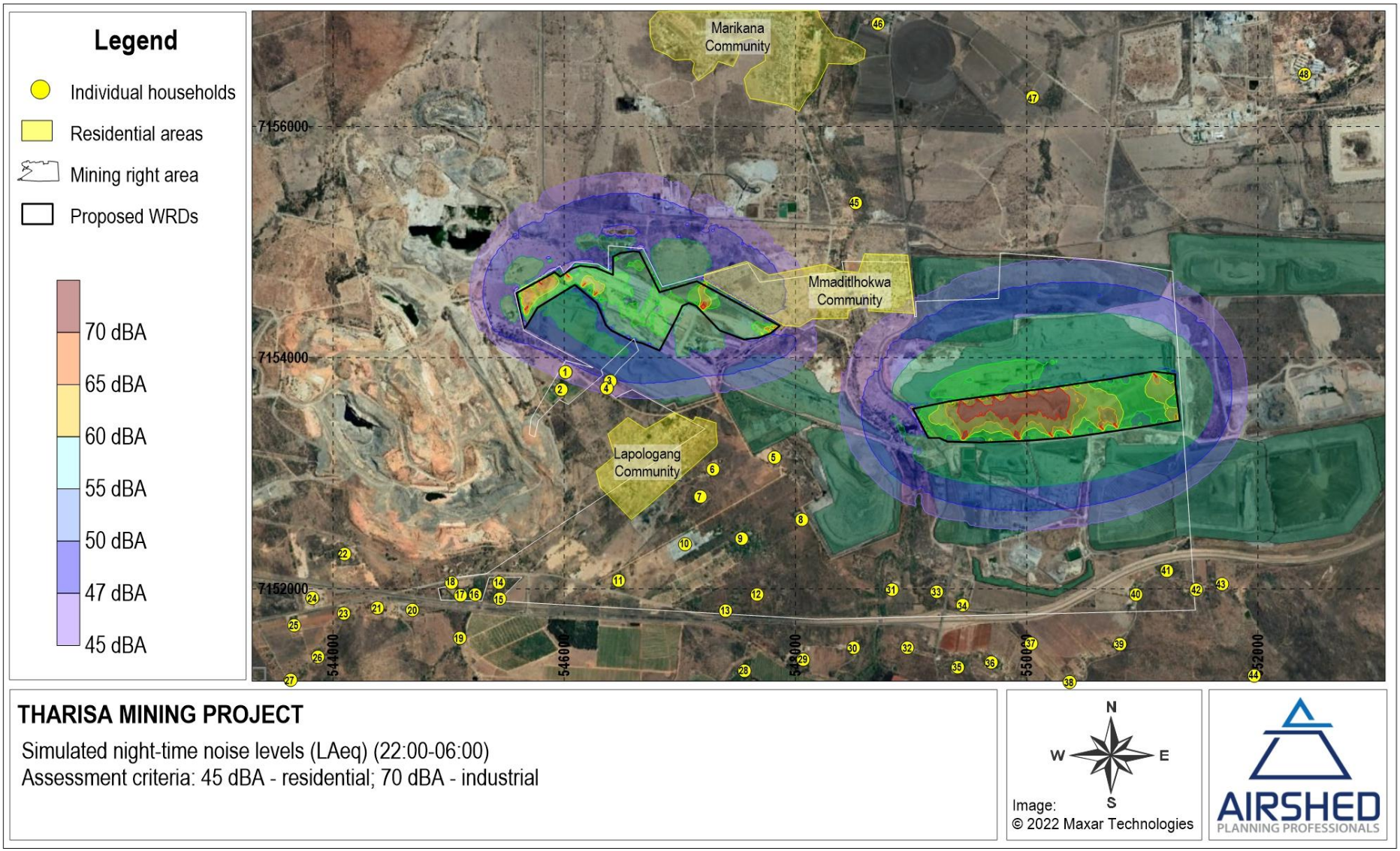

Figure 4-4: Simulated night-time noise levels due to proposed project operations (assuming 5 m noise berm on the perimeter of the proposed WRDs)

5 Impact Significance Rating

The significance of environmental noise impacts was assessed according to the methodology provided by SLR (Appendix C).

5.1 Construction

The significance of construction phase noise impacts on nearby NSRs is considered medium (without mitigation) (Table 5-1). Due to the close proximity to the NSRs (assuming no NSRs are relocated), it is unlikely the significance will reduce unless the Mmaditlhokwa and Lapologang communities can be relocated.

Table 5-1: Significance rating for potential noise impacts due to the construction phase of the project

Issue: increased noise levels		
Phases: Construction Phase		
Criteria	**Without Mitigation**	**With Mitigation (a)**
Intensity	High (H)	Moderate change (M)
Duration	Short-term (L)	Short-term (L)
Extent	Beyond the site boundary (M)	Beyond the site boundary (M)
Consequence	Medium (M)	Medium (M)
Probability	Probable (H)	Probable (H)
Significance	**Medium (M)**	**Medium (M)**
Nature of cumulative impacts	The proposed project could further increase noise levels in the area.	
Degree to which impact can be reversed	Impacts will cease if activities stop.	
Degree to which impact may cause irreplaceable loss of resources	Low.	
Residual impacts	No residual impacts are expected as noise levels due to activities will cease when activities stop.	

Notes:

(a) To reduce the nuisance effects of the proposed construction on the community, the following mitigation actions are to be applied:

- Routine monitoring of ambient noise and to comply with the relevant estimated background noise levels as provided in Section 3.3.1;
- Construction staff need to be trained on noise control plan during health & safety briefings;
- 'Low noise' equipment, or methods of work is to be selected;
- Avoid clustering of mobile plant near receptors and enforce rest periods for unavoidable maximum noise events;
- Investigate use of alternatives to audible reversing alarms (such as broadband noise emitting models) or configure to maximise forward movements of mobile plant;

- Regular inspection and maintenance of all equipment is to be established;
- Avoid unnecessary equipment idling;
- Where possible, limit activities to day-time working hours (6am – 6pm);
- Establish community engagement and ensure all affected persons have been consulted with prior to the commencement of and during activities.

5.2 Operation

The significance of operation phase noise impacts on nearby NSRs is considered high (without mitigation) (Table 5-2).

Table 5-2: Significance rating for potential noise impacts due to the operation phase of the project

Issue: increased noise levels		
Phases: Operation Phase		
Criteria	**Without Mitigation**	**With Mitigation (a)**
Intensity	High (H)	Moderate change (M)
Duration	Long-term (H)	Long-term (H)
Extent	Beyond the site boundary (M)	Beyond the site boundary (M)
Consequence	High (H)	Medium (M)
Probability	Probable (H)	Probable (H)
Significance	**High (H)**	**Medium (M) (b)**
Nature of cumulative impacts	The proposed project could further increase noise levels in the area.	
Degree to which impact can be reversed	Impacts will cease if activities stop.	
Degree to which impact may cause irreplaceable loss of resources	Low.	
Residual impacts	No residual impacts are expected as noise levels due to activities will cease when activities stop.	

Notes:

(a) To reduce the nuisance effects of the proposed operation on the community, the following mitigation actions are to be applied:
- Train operational staff on noise control plan during health & safety briefings;
- Investigate use of alternatives to audible reversing alarms (such as broadband noise emitting models) or configure to maximise forward movements of mobile plant;
- Avoid clustering of mobile plant near receptors and enforce rest periods for unavoidable maximum noise events;
- Ensure periods of respite are provided in the case of unavoidable maximum noise level events;
- Regular inspection and maintenance of all equipment.
- Maintain haul road surfaces regularly to avoid corrugations, potholes etc.
- Keep all roads well maintained and avoid steep inclines.
- Using rubber linings in for instance dump trucks to reduce impact noise of dropped material.

- Naturally, if noise activities can be minimised or avoided, the amount of noise reaching NSRs will be reduced.
- Noise reduction berms along the perimeter of the proposed West OG WRD.
- A noise complaints register must be kept.
- If complaints are received, noise sampling should be undertaken at the NSRs and source of noise should be investigated.
- Noise monitoring locations (as surveyed in 2021 and 2022) should be incorporated into the annual noise sampling network for Tharisa Mine.
- Monitored ambient noise levels should comply with the relevant estimated background noise levels as provided in Section 3.3.1.

(b) The significance can be further reduced to **low** by:

- Limiting operations to day-time hours only (with noise berm in place at West OG WRD), or
- Relocating close NSRs (i.e., Mmaditlhokwa Community (directly east of West OG WRD), NSR1 (farmstead ~650 m south of West OG WRD), NSR3 (Wolvaardt residence ~400 m south of West OG WRD) and NSR4 (van der Hoven residence ~470 m south of west OG WRD)).

It is recommended that the adoption of good practice noise mitigation and management measures be undertaken and that a noise berm be implemented along the perimeter of the West OG WRD. This would reduce the significance to medium but would still exceed IFC noise guidelines for residential areas at the closest NSRs to the West OG WRD. In order to reduce the significance to low, the project operations would have to (in addition to mitigation measures recommended, such as noise berm along the perimeter of the West OG WRD), limit project operations on West OG WRD to day-time hours only or relocate Mmaditlhokwa Community (directly east of West OG WRD), NSR1 (farmstead ~650 m south of West OG WRD), NSR3 (Wolvaardt residence ~400 m south of West OG WRD) and NSR4 (van der Hoven residence ~470 m south of west OG WRD)).

5.3 Closure

The significance of closure and decommissioning phase noise impacts on nearby NSRs (assuming no NSRs are relocated) is considered medium (without and with mitigation) (Table 5-3).

Table 5-3: Significance rating for potential noise impacts due to the closure phase of the project

Issue: increased noise levels		
Phases: Closure Phase		
Criteria	**Without Mitigation**	**With Mitigation (a)**
Intensity	High (H)	Moderate change (M)
Duration	Short-term (L)	Short-term (L)
Extent	Beyond the site boundary (M)	Beyond the site boundary (M)
Consequence	Medium (M)	Medium (M)
Probability	Probable (H)	Probable (H)
Significance	**Medium (M)**	**Medium (M)**
Nature of cumulative impacts	The proposed project could further increase noise levels in the area.	
Degree to which impact can be reversed	Impacts will cease if activities stop.	
Degree to which impact may cause irreplaceable loss of resources	Low.	
Residual impacts	No residual impacts are expected as noise levels due to activities will cease when activities stop.	

Notes:

(a) To reduce the nuisance effects of the proposed construction on the community, the following mitigation actions are to be applied:

- Routine monitoring of ambient noise and to comply with the relevant estimated background noise levels as provided in Section 3.3.1;
- Closure staff need to be trained on noise control plan during health & safety briefings;
- 'Low noise' equipment, or methods of work is to be selected;
- Avoid clustering of mobile plant near receptors and enforce rest periods for unavoidable maximum noise events;
- Investigate use of alternatives to audible reversing alarms (such as broadband noise emitting models) or configure to maximise forward movements of mobile plant;
- Regular inspection and maintenance of all equipment is to be established;
- Avoid unnecessary equipment idling;
- Where possible, limit activities to day-time working hours (6am – 6pm);
- Establish community engagement and ensure all affected persons have been consulted with prior to the commencement of and during activities.

6 Management Measures

In the quantification of noise emissions and simulation of noise levels as a result of the project, it was found that IFC environmental noise evaluation criteria for residential, educational, and institutional receptors is potentially exceeded at the closest NSRs. Noise levels due to project operations can be reduced through effective mitigation and management measures.

The measures discussed in this section are measures typically applicable to industrial sites and are considered good practice by the IFC (2007) and British Standard BSI (2014).

It should be noted that not all mitigation measures are to be implemented, but should the need arise the mitigation measures as discussed in this section can be considered.

6.1 Controlling Noise at the Source

6.1.1 General Good Practice Measures

Good engineering and operational practices will reduce levels of annoyance. For general activities, the following good engineering practice **should** be applied to **all project phases**:

- All diesel-powered equipment and plant vehicles should be kept at a **high level of maintenance**. This should particularly include the regular inspection and, if necessary, replacement of intake and exhaust silencers. Any change in the noise emission characteristics of equipment should serve as trigger for withdrawing it for maintenance.
- In managing noise specifically related to vehicle traffic, efforts **should** be directed at:
    - Minimising individual vehicle engine, transmission, and body noise/vibration. This is achieved through the implementation of an equipment maintenance program.
    - Maintain road surfaces regularly to repair potholes etc.
    - Keep all roads well maintained and avoid steep inclines or declines to reduce acceleration/brake noise.
    - Avoid unnecessary equipment idling at all times.
    - Minimising the need for trucks/equipment to reverse. This will reduce the frequency at which disturbing but necessary reverse warnings will occur. Alternatives to the traditional reverse 'beeper' alarm such as a 'self-adjusting' or 'smart' alarm could be considered. These alarms include a mechanism to detect the local noise level and automatically adjust the output of the alarm is so that it is 5 to 10 dB above the noise level near the moving equipment. The promotional material for some smart alarms does state that the ability to adjust the level of the alarm is of advantage to those sites 'with low ambient noise level' (Burgess & McCarty, 2009). Also, when reversing, vehicles should travel in a direction away from NSR's if possible.
- A noise complaints register must be kept.

6.1.2 Specifications and Equipment Design

As the site or activity is in close proximity to NSRs, equipment and methods to be employed should be reviewed to ensure the quietest available technology is used. Equipment with lower sound power levels must be selected in such instances and vendors/contractors should be required to guarantee optimised equipment design noise levels.

6.2 Controlling the Spread of Noise

Naturally, if noise activities can be minimised or avoided, the amount of noise reaching NSRs will be reduced. Alternatively, the distance between source and receiver must be increased, or noise reduction screens, barriers, or berms must be installed.

6.2.1 Distance

To increase the distance between source and receiver is often the most effective method of controlling noise since, for a typical point source at ground level, a 6 dB decrease can be achieved with every doubling in distance. It is however conceded that it might not always be possible.

6.2.2 Screening

If noise control at the source and the use of distance between source and receiver is not possible, screening methods may be considered. The effectiveness of a noise barrier is dependent on its length, effective height, and position relative to the source and receiver as well as material of construction. To optimize the effect of screening, screens should be located close to either the source of the noise, or the receiver.

The careful placement of barriers such as screens or berms can significantly reduce noise impacts but may result in additional visual impacts. Although vegetation such as shrubs or trees may improve the visual impact of construction sites, it will not significantly reduce noise impacts and should not be considered as a control measure.

Earth berms can be built to provide screening for large scale earth moving operations and can be landscaped to become permanent features once construction is completed. Care should be taken when constructing earth berms since it may become a significant source of dust.

From the modelled noise impacts assuming a 5 m berm on the perimeter of the WRDs, predicted noise impacts still exceed the IFC guidelines for residential areas at the closest NSRs for night-time. Noise attenuation by means of screening only will not be sufficient to reduce noise levels within IFC guidelines at close NSRs. Further attenuation measures will need to be investigated, such as operating during day-time hours only or the relocation of close receptors (i.e., Mmaditlhokwa Community, NSR1, NSR3 and NSR4).

6.3 Monitoring

Noise monitoring at sites where noise is an issue or may become an issue is essential. Annual noise sampling for day- and night-time at NSRs surrounding the project should be incorporated in an annual environmental noise monitoring programme. Noise monitoring should be undertaken at sampling sites as surveyed in 2021 and 2022 (as detailed in Section 3.3). An additional sampling site at NSR2 is recommended to be included in the survey points.

Also, in the event that noise related complaints are received short term ambient noise measurements should be conducted as part of investigating the complaints. The results of the measurements should be used to inform any follow up interventions. The investigation of complaints should include an investigation into equipment or machinery that likely result or resulted in noise levels annoying to the community. This could be achieved with source noise measurements.

The following procedure should be adopted for all noise surveys:

- Any surveys should be designed and conducted by a **trained specialist**.
- Sampling should be carried out using a **Type 1** Sound Level Meter (SLM) that meets all appropriate IEC standards and is subject to **annual calibration** by an accredited laboratory.
- The **acoustic sensitivity of the SLM should be tested** with a portable acoustic calibrator before and after each sampling session.
- Samples sufficient for statistical analysis should be taken with the use of portable SLM's capable of logging data continuously over the time period. Samples representative of the day- and night-time acoustic environment should be taken.
- The following acoustic indices should be recoded and reported: L_{Aeq} (T), statistical noise level $L_{A90,}$ L_{AFmin} and $L_{AFmax,}$ octave band or 3rd octave band frequency spectra.
- The SLM should be located approximately 1.5 m above the ground and no closer than 3 m to any reflecting surface.
- Efforts should be made to ensure that measurements are not affected by the residual noise and extraneous influences, e.g., wind, electrical interference and any other non-acoustic interference, and that the instrument is operated under the conditions specified by the manufacturer. It is good practice to avoid conducting measurements when the wind speed is more than 5 m/s, while it is raining or when the ground is wet.
- A detailed log and record should be kept. Records should include site details, weather conditions during sampling and observations made regarding the acoustic environment of each site.

7 Conclusion

The noise impacts due to the project are predicted to exceed calculated background levels and IFC guidelines at the closest residential dwellings to the project site. Mitigation measured (such as noise berm on the West OG WRD), as recommended in Section 6, may be implemented but potentially will not reduce noise levels sufficiently within calculated background levels and IFC guidelines at the closest NSRs for night-time conditions. Further attenuation measures will need to be implemented including operating the proposed WRDs during day-time hours only (with a 5m noise berm along the perimeter of the West OG WRD) or relocating the nearest NSRs (i.e., Mmaditlhokwa Community (directly east of West OG WRD), NSR1 (farmstead ~650 m south of West OG WRD), NSR3 (Wolvaardt residence ~400 m south of West OG WRD) and NSR4 (van der Hoven residence ~470 m south of west OG WRD)). A complaints register must be kept throughout the life of the operations.

It is the specialist opinion that, from an environmental noise perspective, the project may be authorised if, and only if:

- Activities on the proposed West OG WRD:
    - Operations are restricted to day-time hours only and a noise berm of at least 5m is implemented along the perimeter of the WRD; or,
    - That the Mmaditlhokwa Community, NSR1, NSR3 and NSR4 are relocated (as night-time activities due to West OG WRD exceed IFC residential guidelines at these NSR).
- Activities on the proposed East OG WRD:
    - Operations are restricted to day-time hours only; or,
    - That the Mmaditlhokwa Community is relocated (as night-time activities due to East OG WRD exceed IFC residential guidelines at this NSR).

8 References

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IFC, 2007. *General Environmental, Health and Safety Guidelines,* s.l.: s.n.

SANS 10103, 2008. *The measurement and rating of environmental noise with respect to annoyance and to speech communication,* Pretoria: Standards South Africa.

The Republic of South Africa, 1992. *Noise Control Regulations in terms of Section 25 of the Environment Conservation Act, Notice R154, Government Gazette 13717, 10 January 1992.* s.l.:Government Printing Works.

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Appendix A – Specialist Curriculum Vitae

CURRICULUM VITAE RENEÉ VON GRUENEWALDT

FULL CURRICULUM VITAE

Name of Firm	Airshed Planning Professionals (Pty) Ltd
Name of Staff	Reneé von Gruenewaldt (*nee* Thomas)
Profession	Air Quality and Environmental Noise Scientist
Position	Principal consultant
Date of Birth	13 May 1978
Years with Firm	Since January 2002
Nationalities	South African

MEMBERSHIP OF PROFESSIONAL SOCIETIES

- Registered Professional Natural Scientist (Registration Number 400304/07) with the South African Council for Natural Scientific Professions (SACNASP)
- Member of the National Association for Clean Air (NACA)

KEY QUALIFICATIONS

Reneé von Gruenewaldt (Air Quality Scientist): Reneé joined Airshed Planning Professionals (Pty) Ltd (previously known as Environmental Management Services cc) in 2002. She has, as a Specialist, attained over twenty (20) years of experience in the Earth and Natural Sciences sector in the field of Air Quality and nine (9) years of experience in the field of environmental noise assessments. As an environmental practitioner, she has provided solutions to both large-scale and smaller projects within the mining, minerals, and process industries.

She has developed technical and specialist skills in various air quality modelling packages including the AMS/EPA Regulatory Models (AERMOD and AERMET), UK Gaussian plume model (ADMS), EPA Regulatory puff-based model (CALPUFF and CALMET), puff-based HAWK model and line-based models. Her experience with air emission models includes Tanks 4.0 (for the quantification of tank emissions), WATER9 (for the quantification of wastewater treatment works) and GasSim (for the quantification of landfill emissions). Noise propagation modelling proficiency includes CONCAWE, South African National Standards (SANS 10210) for calculating and predicting road traffic noise and CadnaA for propagation of industrial, road and rail noise sources.

Having worked on projects throughout Africa (i.e., South Africa, Mozambique, Malawi, Kenya, Angola, Democratic Republic of Congo, Namibia, Madagascar and Egypt for Air Quality Impact Assessments and Mozambique, Namibia, Botswana, Kenya, Ghana, Suriname and Afghanistan for Environmental Noise Impact Assessments) Reneé has developed a broad experience base. She has a good understanding of the laws and regulations associated with ambient air quality and emission limits in South Africa and various other African countries, as well as the World Bank Guidelines, European Community Limits and World Health Organisation.

RELEVANT EXPERIENCE (AIR QUALITY)

Mining and Ore Handling

Reneé has undertaken numerous air quality impact assessments and management plans for coal, platinum, uranium, copper, cobalt, chromium, fluorspar, bauxite, manganese and mineral sands mines. These include: compilation of emissions databases for Landau and New Vaal coal collieries (SA), impact assessments and management plans for numerous mines over Mpumalanga (viz. Schoonoord, Belfast, Goedgevonden, Mbila, Evander South, Driefontein, Hartogshoop, Belfast, New Largo, Geluk, etc.), Mmamabula Coal Colliery (Botswana), Moatize Coal Colliery (Mozambique), Revuboe Coal Colliery (Mozambique), Toliera Sands Heavy Minerals Mine and Processing (Madagascar), Corridor Sands Heavy Minerals Mine monitoring assessment, El Burullus Heavy Minerals Mine and processing (Egypt), Namakwa Sands Heavy Minerals Mine (SA), Tenke Copper Mine and Processing Plant (DRC), Rössing Uranium (Namibia), Lonmin platinum mines including operations at Marikana, Baobab, Dwaalkop and Doornvlei (SA), Impala Platinum (SA), Pilannesburg Platinum (SA), Aquarius Platinum, Hoogland Platinum Mine (SA), Tamboti PGM Mine (SA), Sari Gunay Gold Mine (Iran), chrome mines in the Steelpoort Valley (SA), Mecklenburg Chrome Mine (SA), Naboom Chrome Mine (SA), Kinsenda Copper Mine (DRC), Kassinga Mine (Angola) and Nokeng Flourspar Mine (SA), etc.

Mining monitoring reviews have also been undertaken for Optimum Colliery's operations near Hendrina Power Station and Impunzi Coal Colliery with a detailed management plan undertaken for Morupule (Botswana) and Glencor (previously known as Xstrata Coal South Africa).

Air quality assessments have also been undertaken for mechanical appliances including the Durban Coal Terminal and Nacala Port (Mozambique) as well as rail transport assessments including BHP-Billiton Bauxite transport (Suriname), Nacala Rail Corridor (Mozambique and Malawi), Kusile Rail (SA) and WCL Rail (Liberia).

Metal Recovery

Air quality impact assessments have been carried out for Highveld Steel, Scaw Metals, Lonmin's Marikana Smelter operations, Saldanha Steel, Tata Steel, Afro Asia Steel and Exxaro's Manganese Pilot Plant Smelter (Pretoria).

Chemical Industry

Comprehensive air quality impact assessments have been completed for NCP (including Chloorkop Expansion Project, Contaminated soils recovery, C3 Project and the 200T Receiver Project), Revertex Chemicals (Durban), Stoppani Chromium Chemicals, Foskor (Richards Bay), Straits Chemicals (Coega), Tenke Acid Plant (DRC), and Omnia (Sasolburg).

Petrochemical Industry

Numerous air quality impact assessments have been completed for Sasol (including the postponement/exemption application for Synfuels, Infrachem, Natref, MIBK2 Project, Wax Project, GTL Project, re-commissioning of boilers at Sasol Sasolburg and Ekandustria), Engen Emission Inventory Functional Specification (Durban), Sapref refinery (Durban), Sasol (at Elrode) and Island View (in Durban) tanks quantification, Petro SA and Chevron (including the postponement/exemption application).

Pulp and Paper Industry

Air quality studies have been undertaken or the expansion of Mondi Richards Bay, Multi-Boiler Project for Mondi Merebank (Durban), impact assessments for Sappi Stanger, Sappi Enstra (Springs), Sappi Ngodwana (Nelspruit) and Pulp United (Richards Bay).

Power Generation

Air quality impact assessments have been completed for numerous Eskom coal fired power station studies including the ash expansion projects at Kusile, Kendal, Hendrina, Kriel and Arnot; Fabric Filter Plants at Komati, Grootvlei, Tutuka, Lethabo and Kriel Power Stations; the proposed Kusile, Medupi (including the impact assessment for the Flue Gas Desulphurization) and Vaal South Power Stations. Reneé was also involved and the cumulative assessment of the existing and return to service Eskom power stations assessment and the optimization of Eskom's ambient air quality monitoring network over the Highveld.

In addition to Eskom's coal fired power stations, various Eskom nuclear power supply projects have been completed including the air quality assessment of Pebble Bed Modular Reactor and nuclear plants at Duynefontein, Bantamsklip and Thyspunt.

Apart from Eskom projects, power station assessments have also been completed in Kenya (Rabai Power Station) and Namibia (Paratus Power Plant).

Waste Disposal

Air quality impact assessments, including odour and carcinogenic and non-carcinogenic pollutants were undertaken for the Waste Water Treatment Works in Magaliesburg, proposed Waterval Landfill (near Rustenburg), Tutuka Landfill, Mogale General Waste Landfill (adjacent to the Leipardsvlei Landfill), Cape Winelands District Municipality Landfill and the Tsoeneng Landfill (Lesotho). Air quality impact assessments have also been completed for the BCL incinerator (Cape Town), the Ergo Rubber Incinerator and the Ecorevert Pyrolysis Plant.

Cement Manufacturing

Impact assessments for ambient air quality have been completed for the Holcim Alternative Fuels Project (which included the assessment of the cement manufacturing plants at Ulco and Dudfield as well as a proposed blending platform in Roodepoort).

Management Plans

Reneé undertook the quantification of the baseline air quality for the first declared Vaal Triangle Airshed Priority Area. This included the establishment of a comprehensive air pollution emissions inventory, atmospheric dispersion modelling, focusing on impact area "hotspots" and quantifying emission reduction strategies. The management plan was published in 2009 (Government Gazette 32263).

Reneé has also been involved in the Provincial Air Quality Management Plan for the Limpopo Province.

RELEVANT EXPERIENCE (NOISE)

Mining

Reneé has undertaken numerous environmental noise assessments for mining operations. These include environmental noise impact assessments including baseline noise surveys for numerous coal, platinum, manganese, tin and zinc mines. Projects include, but are not limited to, Balama (Mozambique), Masama Coal (Botswana), Lodestone (Namibia), Osino (Namibia), Kurmuk (Ethiopia), Gamsberg (SA), Prieska (SA), Kolomela (SA), Heuningkranz (SA), Syferfontein (SA), South 32 (SA), Mamatwan (SA), Alexander (SA) and Marula Platinum Mine (SA), etc.

Power Generation

Environmental noise assessments have been completed for numerous Eskom coal fired power station studies in SA including the Kriel Fabric Filter Plant, Kendal ash facility, Medupi ash facility. Apart from Eskom projects, power plant assessments have also been completed in Botswana (Morupule), Kenya (Or Power geothermal power plants), Suriname (EBS power plant) and SA (Richards Bay combined cycle power plant).

Process Operations

Environmental noise assessments have been undertaken for various process operations including waste disposal facilities (Bon Accord in Gauteng), bottling and drink facilities (Imali and Isanti Project in Gauteng) and Smelter (Gamsberg in Northern Cape).

Transport

An environmental noise assessment was completed for the Obetsebi road expansion and flyover project in Ghana and the Scorpion Zinc Mine transport route in Namibia.

Gas Pipelines

An environmental noise assessment was completed for the Sheberghan gas pipeline in Afghanistan.

Baseline Noise Surveys

Baseline noise surveys have been undertaken for numerous mining and process operation activities (including Raumix quarries, Kolomela and Sibanye Stillwater Platinum Mines (SA)) in support of onsite Environmental Management Programmes.

OTHER EXPERIENCE (2001)

Research for B.Sc Honours degree was part of the "Highveld Boundary Layer Wind" research group and was based on the identification of faulty data from the Majuba Sodar. The project was THRIP funded and was a joint venture with the University of Pretoria, Eskom and Sasol (2001).

EDUCATION

M.Sc Earth Sciences	University of Pretoria, RSA, Cum Laude (2009) Title: *An Air Quality Baseline Assessment for the Vaal Airshed in South Africa*
B.Sc Hons. Earth Sciences	University of Pretoria, RSA, Cum Laude (2001) Environmental Management and Impact Assessments
B.Sc Earth Sciences	University of Pretoria, RSA, (2000) Atmospheric Sciences: Meteorology

ADDITIONAL COURSES

CALMET/CALPUFF	Presented by the University of Johannesburg, RSA (March 2008)
Air Quality Management	Presented by the University of Johannesburg, RSA (March 2006)
ARCINFO	GIMS, Course: Introduction to ARCINFO 7 (2001)

COUNTRIES OF WORK EXPERIENCE

South Africa, Mozambique, Botswana, Ghana, Suriname, Afghanistan, Malawi, Liberia, Kenya, Angola, Democratic Republic of Congo, Ethiopia, Afghanistan, Lesotho, Namibia, Madagascar, Egypt, Suriname and Iran.

EMPLOYMENT RECORD

January 2002 - Present

Airshed Planning Professionals (Pty) Ltd, (previously known as Environmental Management Services cc until March 2003), Principal Air Quality and Environmental Noise Scientist, Midrand, South Africa.

2001

University of Pretoria, Demi for the Geography and Geoinformatics department and a research assistant for the Atmospheric Science department, Pretoria, South Africa.

Department of Environmental Affairs and Tourism, assisted in the editing of the Agenda 21 document for the world summit (July 2001), Pretoria, South Africa.

1999 - 2000

The South African Weather Services, vacation work in the research department, Pretoria, South Africa.

CONFERENCE AND WORKSHOP PRESENTATIONS AND PAPERS

- Understanding the Synoptic Systems that lead to Strong Easterly Wind Conditions and High Particulate Matter Concentrations on The West Coast of Namibia, H Liebenberg-Enslin, R von Gruenewaldt, H Rauntenbach and L Burger. National Association for Clean Air (NACA) conference, October 2017.
- Topographical Effects on Predicted Ground Level Concentrations using AERMOD, R.G. von Gruenewaldt. National Association for Clean Air (NACA) conference, October 2011.
- Emission Factor Performance Assessment for Blasting Operations, R.G. von Gruenewaldt. National Association for Clean Air (NACA) conference, October 2009.
- Vaal Triangle Priority Area Air Quality Management Plan – Baseline Characterisation, R.G. Thomas, H Liebenberg-Enslin, N Walton and M van Nierop. National Association for Clean Air (NACA) conference, October 2007.
- A High-Resolution Diagnostic Wind Field Model for Mesoscale Air Pollution Forecasting, R.G. Thomas, L.W. Burger, and H Rautenbach. National Association for Clean Air (NACA) conference, September 2005.
- Emissions Based Management Tool for Mining Operations, R.G. Thomas and L.W. Burger. National Association for Clean Air (NACA) conference, October 2004.
- An Investigation into the Accuracy of the Majuba Sodar Mixing Layer Heights, R.G. Thomas. Highveld Boundary Layer Wind Conference, November 2002.

LANGUAGES

	Speak	Read	Write
English	Excellent	Excellent	Excellent
Afrikaans	Fair	Fair	Fair

CERTIFICATION

I, the undersigned, certify that to the best of my knowledge and belief, these data correctly describe me, my qualifications, and my experience.

Signature of staff member	Date (Day / Month / Year)
	11/07/2022
Full name of staff member:	Reneé Georgeinna von Gruenewaldt

Appendix B – Declaration of Independence

SPECIALIST DECLARATION

I, Reneé von Gruenewaldt, hereby declare that:

- I act as the independent specialist in this application.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant.
- I declare that there are no circumstances that may compromise my objectivity in performing such work.
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity.
- I will comply with the Act, Regulations and all other applicable legislation.
- I have not, and will not engage in, conflicting interests in the undertaking of the activity.
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority.
- All the particulars furnished by me in this form are true and correct.
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

15 July 2022

A detailed CV of the author is included in **Appendix A.**

Appendix C – Impact Assessment Methodology

PART A: DEFINITIONS AND CRITERIA*		
Definition of SIGNIFICANCE		Significance = consequence x probability
Definition of CONSEQUENCE		Consequence is a function of intensity, spatial extent and duration
Criteria for ranking of the INTENSITY of environmental impacts	**VH**	Severe change, disturbance or degradation. Associated with severe consequences. May result in severe illness, injury or death. Targets, limits and thresholds of concern continually exceeded. Substantial intervention will be required. Vigorous/widespread community mobilization against project can be expected. May result in legal action if impact occurs.
	H	Prominent change, disturbance or degradation. Associated with real and substantial consequences. May result in illness or injury. Targets, limits and thresholds of concern regularly exceeded. Will definitely require intervention. Threats of community action. Regular complaints can be expected when the impact takes place.
	M	Moderate change, disturbance or discomfort. Associated with real but not substantial consequences. Targets, limits and thresholds of concern may occasionally be exceeded. Likely to require some intervention. Occasional complaints can be expected.
	L	Minor (Slight) change, disturbance or nuisance. Associated with minor consequences or deterioration. Targets, limits and thresholds of concern rarely exceeded. Require only minor interventions or clean-up actions. Sporadic complaints could be expected.
	VL	Negligible change, disturbance or nuisance. Associated with very minor consequences or deterioration. Targets, limits and thresholds of concern never exceeded. No interventions or clean-up actions required. No complaints anticipated.
	VL+	Negligible change or improvement. Almost no benefits. Change not measurable/will remain in the current range.
	L+	Minor change or improvement. Minor benefits. Change not measurable/will remain in the current range. Few people will experience benefits.
	M+	Moderate change or improvement. Real but not substantial benefits. Will be within or marginally better than the current conditions. Small number of people will experience benefits.
	H+	Prominent change or improvement. Real and substantial benefits. Will be better than current conditions. Many people will experience benefits. General community support.
	VH+	Substantial, large-scale change or improvement. Considerable and widespread benefit. Will be much better than the current conditions. Favourable publicity and/or widespread support expected.
Criteria for ranking the DURATION of impacts	**VL**	Very short, always less than a year. Quickly reversible
	L	Short-term, occurs for more than 1 but less than 5 years. Reversible over time.
	M	Medium-term, 5 to 10 years.
	H	Long term, between 10 and 20 years (likely to cease at the end of the operational life of activity).
	VH	Very long, permanent, +20 years (Irreversible, Beyond closure).
Criteria for ranking the EXTENT of impacts	**VL**	A part of the site/property.
	L	Whole site.
	M	Beyond the site boundary, affecting immediate neighbours.
	H	Local area, extending far beyond site boundary.
	VH	Regional/National

PART B: DETERMINING CONSEQUENCE							
INTENSITY = VL							
DURATION	Very long	**VH**	Low	Low	Medium	Medium	High
	Long term	**H**	Low	Low	Low	Medium	Medium
	Medium term	**M**	Very Low	Low	Low	Low	Medium
	Short term	**L**	Very low	Very Low	Low	Low	Low
	Very short	**VL**	Very low	Very Low	Very Low	Low	Low
INTENSITY = L							
DURATION	Very long	**VH**	Medium	Medium	Medium	High	High
	Long term	**H**	Low	Medium	Medium	Medium	High
	Medium term	**M**	Low	Low	Medium	Medium	Medium
	Short term	**L**	Low	Low	Low	Medium	Medium
	Very short	**VL**	Very low	Low	Low	Low	Medium
INTENSITY = M							
DURATION	Very long	**VH**	Medium	High	High	High	Very High
	Long term	**H**	Medium	Medium	Medium	High	High
	Medium term	**M**	Medium	Medium	Medium	High	High
	Short term	**L**	Low	Medium	Medium	Medium	High
	Very short	**VL**	Low	Low	Low	Medium	Medium
INTENSITY = H							
DURATION	Very long	**VH**	High	High	High	Very High	Very High
	Long term	**H**	Medium	High	High	High	Very High
	Medium term	**M**	Medium	Medium	High	High	High
	Short term	**L**	Medium	Medium	Medium	High	High
	Very short	**VL**	Low	Medium	Medium	Medium	High
INTENSITY = VH							
DURATION	Very long	**VH**	High	High	Very High	Very High	Very High
	Long term	**H**	High	High	High	Very High	Very High
	Medium term	**M**	Medium	High	High	High	Very High
	Short term	**L**	Medium	Medium	High	High	High
	Very short	**VL**	Low	Medium	Medium	High	High
			VL	**L**	**M**	**H**	**VH**
			A part of the site/ property	Whole site	Beyond the site, affecting neighbours	Extending far beyond site but localised	Regional/ National
			EXTENT				

PART C: DETERMINING SIGNIFICANCE							
PROBABILITY (of exposure to impacts)	Definite/ Continuous	**VH**	Medium	Medium	High	Very High	Very High
	Probable	**H**	Low	Medium	Medium	High	Very High
	Possible/ frequent	**M**	Low	Low	Medium	Medium	High
	Conceivable	**L**	Very Low	Low	Low	Medium	Medium
	Unlikely/ improbable	**VL**	Negligible	Very Low	Low	Low	Medium
			VL	**L**	**M**	**H**	**VH**
			CONSEQUENCE				

PART D: INTERPRETATION OF SIGNIFICANCE	
Significance	**Decision guideline**
Very High	Potential fatal flaw unless mitigated to lower significance.
High	It must have an influence on the decision. Substantial mitigation will be required.
Medium	It should have an influence on the decision. Mitigation will be required.
Low	Unlikely that it will have a real influence on the decision. Limited mitigation is likely required.
Very Low	It will not have an influence on the decision. Does not require any mitigation
Negligible	Inconsequential, not requiring any consideration.

*VH = very high, H = high, M= medium, L= low and VL= very low and + denotes a positive impact.

Appendix D – Comments Raised by Interested and Affected Parties

Table D-1: Comments relating to noise impacts raised by interested and affected parties and responses provided

Item	Interested and affected party	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
1	Elias (Did not sign the register)	15 August 2021	Are you aware of the impacts of the proposed Waste Rock Dumps (WRDs) to the community? The community is currently suffering from the impacts as a result of the existing WRDs and other mining operations. What measures will be in put in place to manage the dust, noise and air quality impacts experienced by the community.	It is evident from the baseline noise surveys undertaken for the mine that noise levels are above calculated background levels and expected to be of annoyance. Management measures for the project activities have been proposed in the environmental noise impact assessment.	Section 3.3 Section 6
2	Thabo Maluleka (Lapologang)	8 December 2021	We do not sleep at night because of the noise from the blasting and the vehicles. The dust is also unbearable.	Comments on baseline noise levels addressed under item 1.	Section 3.3
3	Zanethemba Badula (Bokamoso)	14 December 2021	Since 2015, Tharisa started with the blasting. The trucks have been making a lot of noise and the dust has been excessive and we have reported all these issues to the councillor, and we do not receive any responses. Tharisa has not even provided us with assistance with these issues since. The proposed WRD will not go ahead in our community if you do not take our issues and concerns seriously.	Comments on baseline noise levels addressed under item 1. Although it is noted, this environmental noise assessment focuses on the potential impact from the project operations and not the current noise complaints received at the mine.	Section 3.3
4	Lesiba Mookamedi (Bokamoso)	15 August 2021	SLR should undertake an assessment to identify the environmental issues such as noise from blasting, air quality issues etc. This would inform the discussion with the	The potential noise impacts due to project activities and recommended management measures has been provided in this	Section 4 and Section 6

Item	Interested and affected party	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
			community leadership. The leadership cannot convince the community to accept the project when people are suffering from the impacts as a result of the existing WRDs and other mining operations. This project will not be supported without answers. The students from communities will be affected by the noise from the Proposed Project. Please provide the leadership with mitigation measures to address the noise and air quality issues from Tharisa	environmental noise impact assessment. Blasting activities will not take place at the proposed WRDs (project operations).	
5	John Salang (Mmaditlhokwa Community Leadership)	29 April 2022	The proposed infrastructure is close to the Lapologang community. There are already existing mining activities that affect the community e.g., noise pollution from the blasting and dust – how do you as a consultant expect that the new infrastructure will affect us?	Noise impacts due to the proposed project operations have been assessed in this environmental noise impact assessment.	Section 4
6	Councillor Ellen Dikgang (Bokamoso)	30 July 2021	We have made attempts to engage with Tharisa regarding environmental issues such as the blasting methods used (which is very dangerous), noise and dust and we did not get any assistance. We, therefore, cannot sit here and approve the project. The communities will be asking questions which we are not able to answer. We, therefore, please with SLR and Tharisa to meet us halfway.	All complaints received by the surrounding communities need to be addressed. The noise complaints register and monitoring protocol (as detailed in this report) needs to be established as part of the Environmental Management Plan.	Section 6
7	Richard Spoor (Richard Spoor Inc. Attorneys). Was not on the	02/12/2021	We represent a number of property owners within the Tharisa Mining Rights Area. They are: 1. Portion 110 – Mr PHC Wolvaardt and Mrs HM Wolvaardt	Baseline noise levels are addressed under item 1. Blasting is addressed under item 4.	

Item	Interested and affected party	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
	database - added.		2. Portion 139 – Mr GJC Pretorius and Mrs SC Pretorius 3. Portion 196 – Ms N van der Hoven 4. Portion 305 – Mr GJC du Preez and Mrs MD du Preez The content of the notice issued to the DMRE in terms of Section 54 of the MPRDA (in terms of noise issues) is as follows: • The mining activities have caused structural cracking of dwelling houses and cracked and broken windows. They are literally falling apart. Persons living on the properties are exposed to noise and severe dust daily, to the extent that their health is being seriously affected thereby.		
8	Gwendolyn Wellmann	Letter via email on the 17th of June 2022	Comments on Scoping Report for the "Additional Waste Rock Storage Project" application by Tharisa Minerals (SLR Project No: 720.20002.00065) I am submitting comments on the Scoping Report for the "Additional Waste Rock Storage Project" EIA process for Tharisa, your project number: 720.20002.00065, on behalf of the following persons: 1) Myself, Gwendolyn Wellmann, who is a shareholder of Tharisa Minerals 2) Junicia Morongwe Ncheche, erf: 3, Lapologang 3) Magdeline Salang, erf: 5, Lapologang 4) Lydia Lebogang Lebelo, erf: 7, Lapologang	The noise impacts due to the project operations is provided in this environmental noise impact assessment and it is found to be of unacceptable levels at potential NSRs surrounding the proposed WRDs.	Section 4

Item	Interested and affected party	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
			5) Amelia Nana Skosana, erf: 12, Lapologang 6) Tieho Losianes Ncheche, erf: 14, Lapologang 7) Chimane Boetie Lebelo, erf: 18, Lapologang 8) Alice Puleng Mokoena, erf: 23, Lapologang 9) Thobi Johannes Serunye and Meite Catherine Serunye, erf: 24, Lapologang 10) SC Pretorius, Portion 139 Kafferskraal (342 JQ); 11) GJ du Preez and MD du Preez, Portion 305 Kafferskraal (342 JQ); 12) N van der Hoven, Portion 196 Kafferskraal (342 JQ); 13) PHC Wolvaardt and HM Wolvaardt, Portion 110 Kafferskraal (342 JQ); 14) Nkoko Francina Mashabela, Portion 139 Kafferskraal (342 JQ); 15) Jan Hendrik Pretorius and Sindie Hendriena Pretorius, Portion 139 Kafferskraal (342 JQ); 16) Tlhopi Sanah Mashabela, Portion 139 Kafferskraal (342 JQ); 17) Petrus Molekwa, Portion 139 Kafferskraal (342 JQ); 18) Louis De Beer, Portion 139 Kafferskraal (342 JQ); 19) Johannes Lodewyk de Beer and Patricia de Beer; Portion 196 Kafferskraal (342 JQ) 20) George Msokoli; 354 Maditlokwa		

Item	Interested and affected party	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
			All those mentioned above have the following comments related to the EIA process, the Scoping Report and Tharisa's application for the "Additional Waste Rock Storage Project" *(only comments related to noise have been captured below)*: A) Tharisa Mine has not adhered to the mitigation measures listed in the DMRE approved 2014 Environmental Impact Assessment (EIA). There is already a growing dump right on the doorstep of the Lapologang community and the van den Hoven and Wolfaardt properties. This dump is labeled "Far West WRD 1" on Figure 2 in the Scoping Report. This dump creates dust and noise pollution, is an eye sore and recently has started to block cell phone reception in Lapologang and at the van den Hoven and Wolfaardt properties, which is a risk, especially for vulnerable persons who rely on their cell phones in case of an emergency. The existing Far West WRD1 is incredibly close to Lapologang and the van den Hoven and Wolfaardt properties. It is approximately 100m from the house on the Wolfaardt property, where three young children reside, exposed daily (and often at night too) to noise and dust and fumes. SLR and Tharisa Minerals appear to believe that it is acceptable to apply for an expansion (proposed West OG WRD) to this mine dump (Far West WRD1). In the Scoping		

Item	Interested and affected party	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
			Report the affected properties and communities' distances from the proposed West OG WRD is listed (pg 140 and 141). That list demonstrates how near in reality the existing dump is and that the expansion will only add to the misery of the people living there: • "Lapologang located approximately 640 m south of the proposed West OG WRD; • Maditlhokwa located immediately north of the proposed West OG WRD; • Private property owner of Portion 110 – Mr PHC Wolvaardt and Mrs HM Wolvaardt located approximately 500m south of the proposed West OG WRD; • Private property owner Portion 139 – Mr GJC Pretorius and Mrs SC Pretorius located approximately 1.1km south of the proposed West OG WRD; • Private property owner Portion 196 – Ms N van der Hoven located approximately 550m south of the proposed West OG WRD; • Private property owner Portion 305 – Mr GJC du Preez2 and Mrs MD du Preez located approximately 1.8km south of the proposed West OG WRD"		
9	Kelebogile Mekgoe	Via email on the	The Unit: IEM will support the proposed development;	The recommended noise management	Section 6

Item	Interested and affected party	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
	Rustenburg Local Municipality	17th of June 2022	however, the following recommendations must be taken into consideration *(only noise related items have been included below):* • For the proposed Waste rock dump expansion, mitigation measures must be implemented to minimise health hazard and risk to Lapologang and Maditlhowa Village, and nearby landowners (i.e., noise, dust and ground vibration).	measures are provided in this environmental noise impact assessment.	