Sekoko Resources (Pty) Ltd

NOISE REPORT

FOR SCOPING PURPOSES

Establishment of the Sekoko Coal Colliery near Lephalale, Limpopo

Study done for:

Savannah ENVIRONMENTAL (PTY) LTD

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Title:

Noise Report for Scoping purposes: Establishment of the Sekoko Waterberg Colliery near Lephalale, Limpopo

Client:

Savannah Environmental (Pty) Ltd
for Sekoko Resources (Pty) Ltd

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EXECUTIVE SUMMARY

M2 Environmental Connections CC (also known as MENCO) was contracted by Savannah Environmental (Pty) Ltd to determine the potential noise impact on the surrounding environment due to the development of the proposed Sekoko Waterberg Colliery by Sekoko Resources (Pty) Ltd. The proposed mine is west of the town of Lephalale in the Limpopo Province.

The mine is projected to be an opencast mine initially, with the run-of-mine processed onsite before send to the market via a railway line.

The Sekoko Waterberg Colliery will initially consist of the following main components:

- Mining Infrastructure for mining operations;
- Mine pit, exploration area and support activities;
- Railway siding;
- Contractors camp site;
- Process plant and associate infrastructure;
- ESKOM daily stockpile area and facilities; and
- Support Facilities and Buildings: Admin offices, Change houses, Clinic, etc.

With the preliminary input data as used, this assessment indicated that:

- Considering maximum noise emission levels, that the construction activities could be audible over a distance of more than 2,000 meters. These levels were higher than the equivalent ambient sound levels recorded on the site;
- Considering equivalent (average) noise emission levels, activities could influence the ambient sound levels over a distance greater than 2,000 meters.

A potential risk exist that a noise impact could occur and it is recommended that the noise impact be investigated in more detail during the Environmental Impact Assessment phase.

Additional information required would be:

- Exact location of the various activities (i.e. opencast areas, plant areas, haul roads, siding alignment, etc.). In the case of equipment installed on buildings/structures the height of these equipment will be required.

- Project design (which equipment will be in buildings, what materials will be used to build these buildings).
- A more accurate description of equipment to be used in and around the proposed facility. This would include data such as the type of equipment, but also the number of that equipment to be used, focusing specifically on noisy activities such as crushers and screens;
- Alignment of various roads and projected routes that equipment and material/coal will use
- Quantity of coal hauled and transported to markets; and
- Locations of any significant (higher than 5 meters) berms, stockpiles and dumps.

Information not provided or available will be estimated using internet sources.

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GLOSSARY OF ABBREVIATIONS

EAP	Environmental Assessment Practitioner
ECA	Environment Conservation Act (Act 78 of 1989)
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management System
FEL	Front End Loader
IAPs	Interested and Affected Parties
I.e.	that is
IEM	Integrated Environmental Management
km	kilometres
LDV	Light Delivery Vehicle
LHD	Load haul dumper
m	Meters (measurement of distance)
m^2	Square meter
m^3	Cubic meter
mamsl	Meters above mean sea level
MW	Megawatts
MENCO	M² Environmental Connections cc
NEMA	National Environmental Management Act, 1998
NGO	Non-government Organisation
PPE	Personal Protective Equipment
PPP	Public Participation Process
SABS	South African Bureau of Standards
SANS	South African National Standards
SHEQ	Safety Health Environment and Quality
TLB	Tip Load Bucket
WHO	World Health Organisation

GLOSSARY OF TERMS

1/3-Octave Band	A filter with a bandwidth of one-third of an octave representing four semitones, or notes on the musical scale. This relationship is applied to both the width of the band, and the centre frequency of the band. See also definition of octave band.
A – Weighting	An internationally standardised frequency weighting which approximates the frequency response of the human ear and gives an objective reading, which therefore agrees with the subjective human response to that sound.
Air Absorption	The phenomena of attenuation of sound waves with distance propagated in air, due to dissipative interaction within the gas molecules.
Alternatives	A possible course of action, in place of another, that would meet the same purpose and need (of proposal). Alternatives can refer to any of the following but are note limited hereto: alternative sites for development, alternative site layouts, alternative designs, alternative processes and materials. In Integrated Environmental Management the so-called "no go" alternative refers to the option of not allowing the development and may also require investigation in certain circumstances.
Ambient	The conditions surrounding an organism or area.
Ambient Noise	The all-encompassing sound at a point being composed of sounds from many sources both near and far. It includes the noise from the noise source under investigation.
Ambient Sound	The all-encompassing sound at a point being composite of sounds from near and far.
Ambient Sound Level	Means the reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such a meter was put into operation. In this report the term Background Ambient Sound Level will be used.
Amplitude Modulated Sound	A sound which noticeably fluctuates in loudness over time.
Applicant	Any person who applies for an authorisation to undertake a listed activity or to cause such activity in terms of the relevant environmental legislation.
Assessment	The process of collecting, organising, analysing, interpreting and communicating data that is relevant to some decision.
Audible Frequency Range	Generally assumed to be the range from about 20 Hz to 20,000 Hz, the range of frequencies which our ears perceive as sound.
Background Ambient Sound Level	The level of the ambient sound indicated on a sound level meter in the absence of the sound under investigation (e.g. sound from a particular noise source or sound generated for test purposes). Ambient sound level as per Noise Control Regulations.
C-Weighting	This is an international standard filter, which can be applied to a pressure signal or to a *SPL* or *PWL* spectrum, and which is essentially a pass-band filter in the frequency range of approximately 63 to 4000 Hz. This filter provides a more constant, flatter, frequency response, providing significantly less adjustment than the A-scale filter for frequencies less than 1000 Hz.
dB(A)	Sound Pressure Level in decibel which has been A-weighted, or filtered, to match the response of the human ear.
Decibel (db)	A logarithmic scale for sound corresponding to a multiple of 10 of the threshold of hearing. Decibels for sound levels in air are referenced to an atmospheric pressure of 20 μ Pa.
Diffraction	Modification of the progressive wave distribution due to the presence of obstacles in the field. Reflection and refraction are special cases of diffraction.
Direction of Propagation	The direction of flow of energy associated with a wave.
Disturbing noise	Means 'n noise level which exceeds the zone sound level or, if no zone sound level has been designated, a noise level which exceeds the ambient sound level

	at the same measuring point by 7 dBA or more.
Environment	The external circumstances, conditions and objects that affect the existence and development of an individual, organism or group; these circumstances include biophysical, social, economic, historical, cultural and political aspects.
Environmental Control Officer	Independent officer employed by the applicant to ensure the implementation of the Environmental Management Plan (EMP) and manage any further environmental issues that may arise.
Environmental impact	A change resulting from the effect of an activity on the environment, whether desirable or undesirable. Impacts may be the direct consequence of an organisation's activities or may be indirectly caused by them.
Environmental Impact Assessment	An Environmental Impact Assessment (EIA) refers to the process of identifying, predicting and assessing the potential positive and negative social, economic and biophysical impacts of any proposed project, plan, programme or policy which requires authorisation of permission by law and which may significantly affect the environment. The EIA includes an evaluation of alternatives, as well as recommendations for appropriate mitigation measures for minimising or avoiding negative impacts, measures for enhancing the positive aspects of the proposal, and environmental management and monitoring measures.
Environmental issue	A concern felt by one or more parties about some existing, potential or perceived environmental impact.
Equivalent continuous A-weighted sound exposure level ($L_{Aeq,T}$)	The value of the average A-weighted sound pressure level measured continuously within a reference time interval *T*, which have the same mean-square sound pressure as a sound under consideration whose level varies with time.
Equivalent continuous A-weighted rating level ($L_{Req,T}$)	The Equivalent continuous A-weighted sound exposure level *($L_{Aeq,T}$)* to which various adjustments has been added. More commonly used as ($L_{Req,d}$) over a time interval 06:00 – 22:00 (T=16 hours) and ($L_{Req,n}$) over a time interval of 22:00 – 06:00 (T=8 hours).
Footprint area	Area to be used for the construction of the proposed development, which does not include the total study area.
Frequency	The rate of oscillation of a sound, measured in units of Hertz (Hz) or kilohertz (kHz). One hundred Hz is a rate of one hundred times per second. The frequency of a sound is the property perceived as pitch: a low-frequency sound (such as a bass note) oscillates at a relatively slow rate, and a high-frequency sound (such as a treble note) oscillates at a relatively high rate.
Green field	A parcel of land not previously developed beyond that of agriculture or forestry use; virgin land. The opposite of Greenfield is brownfield, which is a site previously developed and used by an enterprise, especially for a manufacturing or processing operation. The term brownfield suggests that an investigation should be made to determine if environmental damage exists.
G-Weighting	An International Standard filter used to represent the infrasonic components of a sound spectrum.
Infrasound	Sound with a frequency content below the threshold of hearing, generally held to be about 20 Hz. Infrasonic sound with sufficiently large amplitude can be perceived, and is both heard and felt as vibration. Natural sources of infrasound are waves, thunder and wind.
Integrated Development Plan	A participatory planning process aimed at developing a strategic development plan to guide and inform all planning, budgeting, management and decision-making in a Local Authority, in terms of the requirements of Chapter 5 of the Municipal Systems Act, 2000 (Act 32 of 2000).
Integrated Environmental Management	IEM provides an integrated approach for environmental assessment, management, and decision-making and to promote sustainable development and the equitable use of resources. Principles underlying IEM provide for a democratic, participatory, holistic, sustainable, equitable and accountable approach.
Interested and affected parties	Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors,

	work force, consumers, environmental interest groups and the general public.
Key issue	An issue raised during the Scoping process that has not received an adequate response and which requires further investigation before it can be resolved.
Listed activities	Development actions that is likely to result in significant environmental impacts as identified by the delegated authority (formerly the Minister of Environmental Affairs and Tourism) in terms of Section 21 of the Environment Conservation Act.
Loudness	The attribute of an auditory sensation which describes the listener's ranking of sound in terms of its audibility.
Magnitude of impact	Magnitude of impact means the combination of the intensity, duration and extent of an impact occurring.
Masking	The raising of a listener's threshold of hearing for a given sound due to the presence of another sound.
Mitigation	To cause to become less harsh or hostile.
Negative impact	A change that reduces the quality of the environment (for example, by reducing species diversity and the reproductive capacity of the ecosystem, by damaging health, or by causing nuisance).
Noise	a. Sound which a listener does not wish to hear (unwanted sounds). b. Sound from sources other than the one emitting the sound it is desired to receive, measure or record. c. A class of sound of an erratic, intermittent or statistically random nature.
Noise Level	The term used in lieu of sound level when the sound concerned is being measured or ranked for its undesirability in the contextual circumstances.
Octave Band	A filter with a bandwidth of one octave, or twelve semi-tones on the musical scale representing a doubling of frequency.
Positive impact	A change which improves the quality of life of affected people or the quality of the environment.
Property	Any piece of land indicated on a diagram or general plan approved by the Surveyor-General intended for registration as a separate unit in terms of the Deeds Registries Act and shall include an erf, a site and a farm portion as well as the buildings erected thereon
Public Participation Process	A process of involving the public in order to identify needs, address concerns, choose options, plan and monitor in terms of a proposed project, programme or development
Rating Level	Means a derived dBA value determined indirectly by means of a series of measurements, calculations or table readings and designated by a local authority for an area as defined in SANS10103. In this document the Zone Sound Level (Noise Control Regulation) will be used instead of the Rating Level.
Reverberant Sound	The sound in an enclosure excluding that which is received directly from the source.
Reverberation	The persistence, after emission of a sound has stopped, of a sound field within an enclosure.
Significant Impact	An impact can be deemed significant if consultation with the relevant authorities and other interested and affected parties, on the context and intensity of its effects, provide reasonable grounds for mitigating measures to be included in the environmental management report. The onus shall be on the applicant to include the relevant authorities and other interested and affected parties in the consultation process. Present and potential future, cumulative and synergistic effects should all be taken into account.
Sound Level	The level of the frequency weighted and time weighted sound pressure as determined by a sound level meter.
Sound Power	Of a source, the total sound energy radiated per unit time.
Sound Pressure Level (SPL)	Of a sound, 20 times the logarithm to the base 10 of the ratio of the RMS sound pressure level to the reference sound pressure level. International values for the reference sound pressure level are 20 micropascals in air and 100 millipascals in water. SPL is reported as L_p in dB (not weighted) or in various other weightings.
Soundscape	Sound or combination of sounds that forms or arises from an immersive

	environment. The study of soundscape is the subject of acoustic ecology. The idea of soundscape refers to both the natural acoustic environment, consisting of natural sounds, including animal vocalizations and, for instance, the sounds of weather and other natural elements; and environmental sounds created by humans, through musical composition, sound design, and other ordinary human activities including conversation, work, and sounds of mechanical origin resulting from use of industrial technology. The disruption of these acoustic environments results in noise pollution.
Study area	Refers to the entire study area encompassing all the alternative routes as indicated on the study area map.
Sustainable Development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: the concept of "needs", in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and the future needs (Brundtland Commission, 1987).
Zone of Potential Influence	The area defined as the radius about an object, or objects beyond which the noise impact will be insignificant.
Zone Sound Level	Means a derived dBA value determined indirectly by means of a series of measurements, calculations or table readings and designated by a local authority for an area. In this document this will be used instead of the Rating Level as defined in SANS10103.

1 INTRODUCTION

1.1 INTRODUCTION AND PURPOSE

M2 Environmental Connections CC (also known as MENCO) was contracted by Savannah Environmental (Pty) Ltd to determine the potential noise impact on the surrounding environment due to the development of the proposed Sekoko Waterberg Colliery. The proposed mine is west of the town of Lephalale in the Limpopo Province (see **Figure 1-1**).

This Scoping Report is the result of a first phase study of the potential noise impacts that such a facility may have on the surrounding environment, highlighting methodologies, potential issues to be investigated, as well as preliminary findings and recommendations. This study would also conform to the Equator Principles and the terms of reference as set by SANS 10328:2008 will be used as a guideline to allow for a comprehensive Environmental Noise Impact Assessment.

1.2 BRIEF PROJECT DESCRIPTION

The project description provided was obtained from the EIA/EMP Report compiled for the Sekoko Waterberg Colliery by Cabana Concepts during the 2010/2011 EIA process.

The focus during the previous EIA was the opencast mining of coal on the farm Smitspan. During this first stage (estimated at 20 years) only a 1-stage wash plant will be required. From year 20 opencast mining will be accompanied by underground mining, at which point a 2-stage plant will be required. During this period it is highly likely that opencast and possibly underground mining will commence on other areas within the mining right boundary.

Apart from the highlighted mining, the plant is to be developed in the farm Minnasvlakte. The coal product is likely to be transported to the markets via a railway line.

The Sekoko Waterberg Colliery will initially consist of the following main components:

- Mining Infrastructure for mining operations;
- Mine pit, exploration area and support activities;
- Railway siding;
- Contractors camp site;
- Process plant and associate infrastructure;
- ESKOM daily stockpile area and facilities; and

- Support Facilities and Buildings: Admin offices, Change houses, Clinic, etc.

1.3 TERMS OF REFERENCE

In South Africa the document that addresses the issues concerning environmental noise is SANS 10103:2008. It has recently been thoroughly revised and brought in line with the guidelines of the World Health Organisation (WHO). It provides the maximum average ambient noise levels during the day and night to which different types of developments indoors may be exposed.

In addition, the South African National Standard (SANS) 10328:2008 (Edition 2) specifies the methodology to assess the potential noise impacts on the environment due to a proposed activity that might impact on the environment. This standard also stipulates the minimum requirements to be investigated for Scoping purposes. These minimum requirements are:

1. The purpose of the investigation;
2. A brief description of the planned development or the changes that are being considered;
3. A brief description of the existing environment;
4. The identification of the noise sources that may affect the particular development, together with their respective estimated sound pressure levels or sound power levels (or both);
5. The identified noise sources that were not taken into account and the reasons why they were not investigated;
6. The identified noise-sensitive developments and the estimated impact on them;
7. Any assumptions made with regard to the estimated values used;
8. An explanation, either by a brief description or by reference, of the methods that were used to estimate the existing and predicted rating levels;
9. The location of the measurement or calculation points, i.e. a description, sketch or map;
10. Estimation of the environmental noise impact;
11. Alternatives that were considered and the results of those that were investigated;
12. A list of all the interested or affected parties that offered any comments with respect to the environmental noise impact investigation;
13. A detailed summary of all the comments received from interested or affected parties as well as the procedures and discussions followed to deal with them;
14. Conclusions that were reached;

15. Recommendations, i.e. if there could be a significant impact, or if more information is needed, a recommendation that an environmental noise impact assessment be conducted.
16. If remedial measures will provide an acceptable solution which would prevent a significant impact, these remedial measures should be outlined in detail and included in the final record of decision if the approval is obtained from the relevant authority. If the remedial measures deteriorate after time and a follow-up auditing or maintenance programme (or both) is instituted, this programme should be included in the final recommendations and accepted in the record of decision if the approval is obtained from the relevant authority.

In addition, the Scoping report should contain sufficient information to allow the Environmental Assessment Practitioner (EAP) to compile the Plan of Study (PoS) for Environmental Impact Assessment (EIA), including the Noise component.

In this regard the following is included to assist the EAP in the compilation of the PoS for the EIA:

- The potential impact will be evaluated (where possible) in terms of the nature (description of what causes the effect, what/who might be affected and how it/they might be affected) as well as the extent of the impact. This will be done by means of a site visit, where appropriate background ambient sound levels will be determined and the identification of potential sensitive areas.
- A statement regarding the potential significance of the identified issues based on the evaluation of the issues/impacts.
- The identification of issues to be investigated in more detail during the Environmental Impact Assessment phase,
- Details regarding the methodology followed to estimate and assess the potentially significant impacts during the EIA phase.

1.4 STUDY AREA

The proposed facility is located approximately 30 km west of Lephalale, lying just west of the existing Grootegeluk Coal Colliery and about 15 km from the Matimba (existing) and the Medupi (under construction) Power Stations. A site locality map is presented in **Figure 1-1**. The study area is further described in terms of environmental components that may contribute or change the sound character in the area.

1.4.1 Topography

The area is relatively flat plains.

1.4.2 Surrounding Land Use

The area in the vicinity of the proposed development is currently classified as Vacant or Unspecified. The previous site visit revealed that the area is mainly wilderness with game ranches forming a large part of the agricultural activities. The land use east of the development is mining.

1.4.3 Roads

There are two gravel district roads that traverse the area. There are no other roads or railway lines within 2,000 m from the proposed development. The existing road does not carry any traffic of acoustic significance.

1.4.4 Residential areas

Excluding farm dwellings, there are no residential areas within 5,000 m.

1.4.5 Other industrial Activities

The Grootegeluk Coal Colliery is approximately 10 km east south-east from the proposed development. It is too far to influence the ambient sound levels in the vicinity of the proposed development.

1.4.6 Ground conditions and vegetation

The area falls within the Savannah biome, with the vegetation type being bushveld. The ground is relatively well covered with grasses, shrubs and trees.

1.4.7 Existing Ambient Sound Levels

Ambient sound levels were measured during the Environmental Noise Impact Assessment process for the Sekoko Railway Siding along the D1673 district road. The ambient sound levels should be similar at the location of the proposed development. Additional measurements was collected during the site assessment phase of the ENIA.

Night-time measurements

Previous measurements indicated that ambient sound levels ranged between 18 ($L_{A,min}$) and 45 ($L_{A,max}$) dBA (no traffic). $L_{Aeq,10min(i)}$ levels were less than 31 dBA with sound levels being less than 26 dBA for 90% of the time. There were a number of impulsive sounds (birds and some jackal) with the character defined by natural noises (birds, insects and other animals). There were no wind-induced noises during the Sekoko Railway Siding monitoring date.

It should be noted that the L_{A90} levels increased as the measurement points approached the Grootgeluk coal mine. All night-time samples however confirmed the rural character of the area.

Day time measurements

The ambient sound levels ranged between 25 ($L_{A,min}$) and 85 ($L_{A,max}$) dBA. $L_{Aeq,10min(i)}$ levels were more than 45 dBA although sound levels in the area were still less than 33 dBA for 90% of the time (L_{A90}). Wind gusts with speeds up to 7.2 m/s unfortunately did influence the daytime measurements, as well as motor vehicles that passed the measurement points at significant speeds. Insect and bird sounds however were still defining the ambient soundscape. Only seven vehicles were observed over a 2 hour period on the D1673 road. Traffic on the road was considered relative insignificant.

1.5 POTENTIALLY SENSITIVE RECEPTORS

Potentially sensitive receptors were identified using GoogleEarth® as well as during a site visit 31 October – 2 November 2012. The reason for the site visit, apart from measuring ambient sound levels, is that there could be a number of derelict or abandoned dwellings that are not seen as a potential noise-sensitive developments, small dwellings that could not be identified on the aerial image, dwellings that were built after the date of the aerial photograph or dwellings identified as NSD may be in disuse. Potentially sensitive receptors identified are illustrated in **Figure 1-2**.

Note:

- **NSD18** is a dwelling for workers on this farm;
- **NSD19** is a campsite or hunters cabin, and although fully furnished was not occupied during the site investigational date;
- The gates at most farms were locked or closed. In instances where permission to enter the property was not granted (due to the farm owner not being available) the farm was not accessed and the status of the dwelling discussed with an adjacent resident.

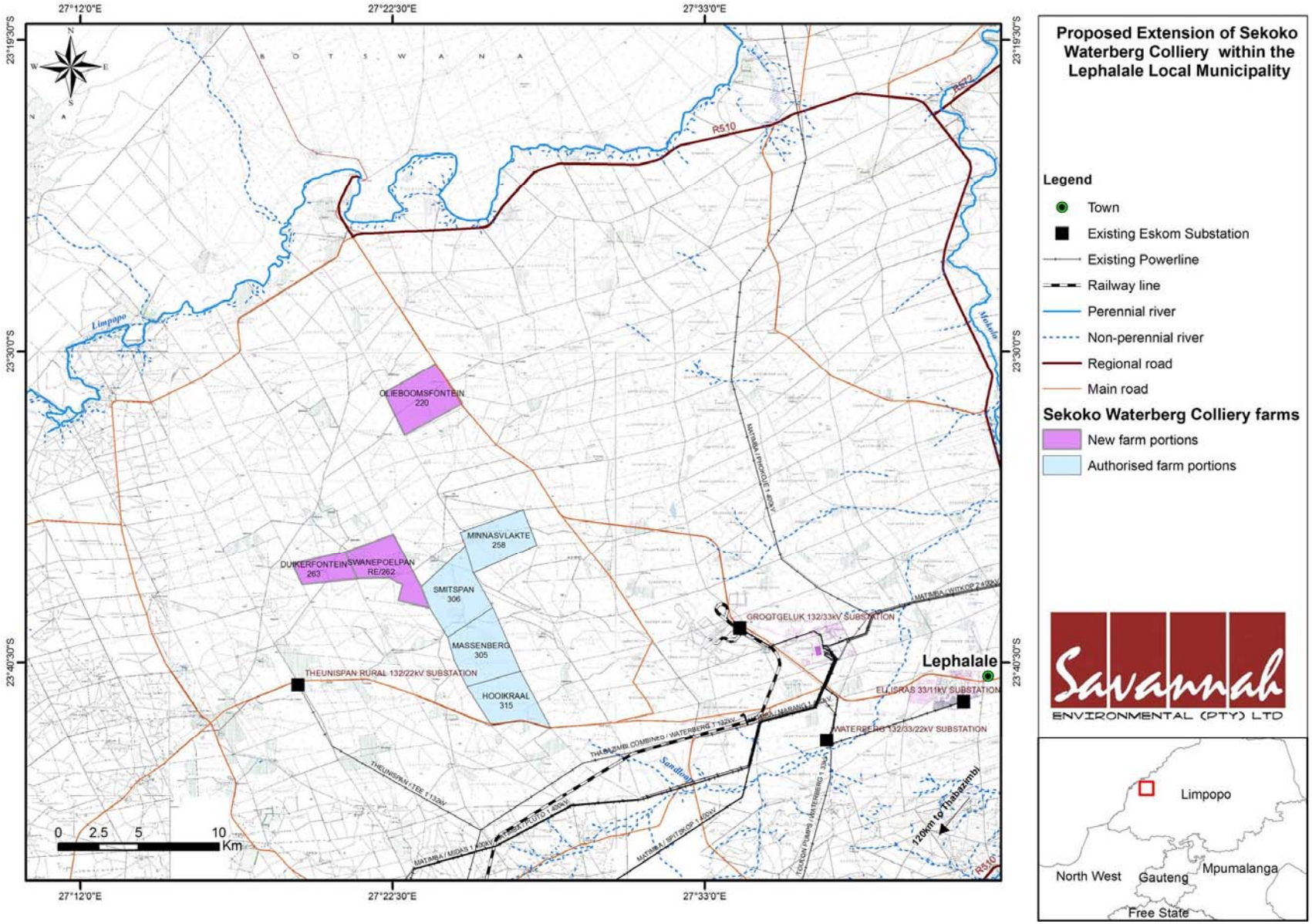

Figure 1-1: Site map indicating location of proposed facility

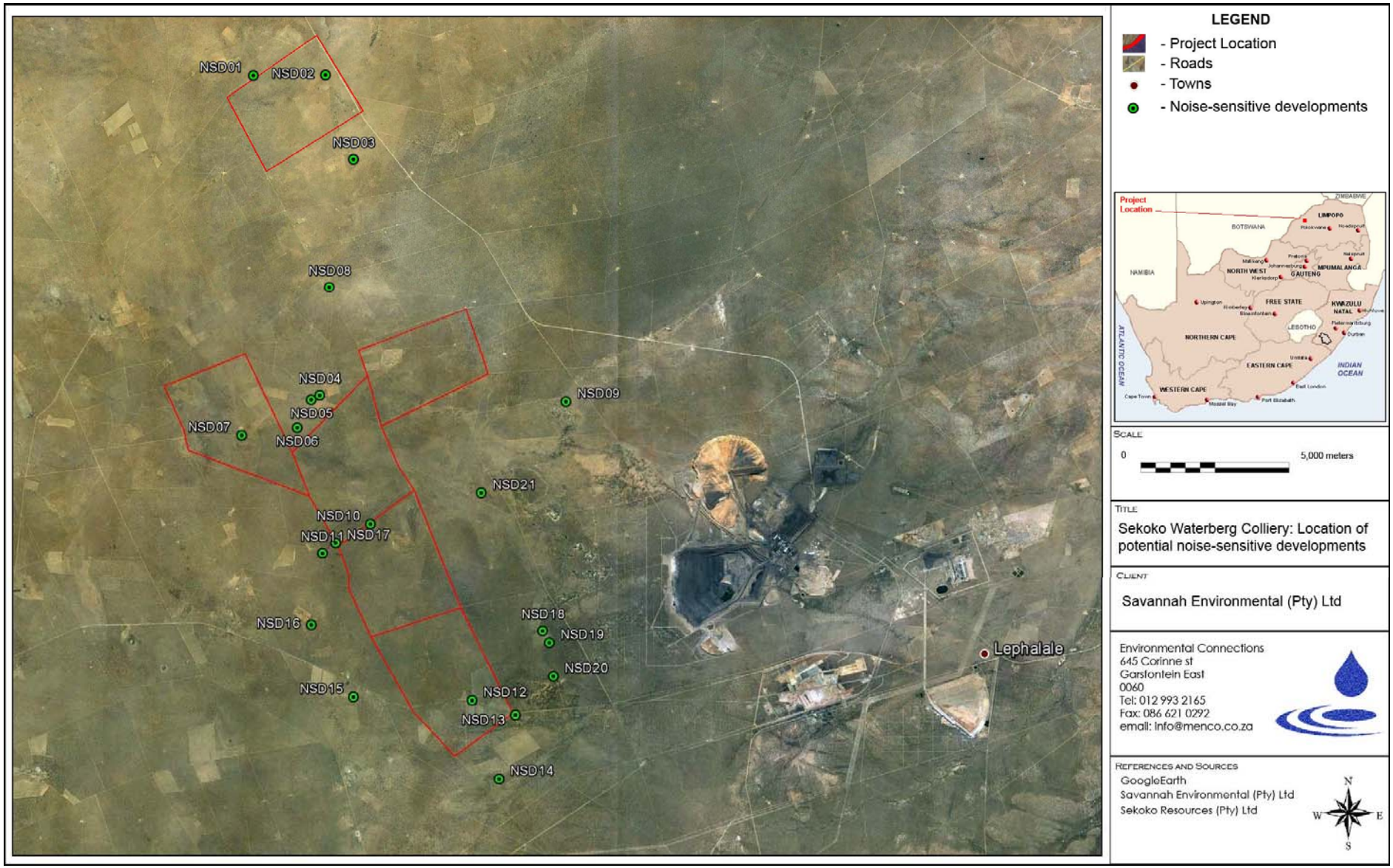

Figure 1-2: Important Potentially Sensitive Receptors and Areas.

2 LEGAL CONTEXT, POLICIES AND GUIDELINES

2.1 THE REPUBLIC OF SOUTH AFRICA CONSTITUTION ACT ("THE CONSTITUTION")

The environmental rights contained in section 24 of the Constitution provide that everyone is entitled to an environment that is not harmful to his or her well-being. In the context of noise, this requires a determination of what level of noise is harmful to well-being. The general approach of the common law is to define an acceptable level of noise as that which the reasonable person can be expected to tolerate in the particular circumstances. The subjectivity of this approach can be problematic which has led to the development of noise standards (see **Section 2.7**).

"Noise pollution" is specifically included in Part B of Schedule 5 of the Constitution, which means that noise pollution control is a local authority competence, provided that the local authority concerned has the capacity to carry out this function.

2.2 THE ENVIRONMENT CONSERVATION ACT

The Environment Conservation Act ("ECA") allows the Minister of Environmental Affairs and Tourism ("now the Ministry of Water and Environmental Affairs") to make regulations regarding noise, among other concerns. The Minister has made noise control regulations under the ECA adopted by the Gauteng, Free State and Western Cape Provinces.

2.3 THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT

The National Environmental Management Act ("NEMA") defines "pollution" to include any change in the environment, including noise. A duty therefore arises under section 28 of NEMA to take reasonable measures while establishing and operating the operation to prevent noise pollution occurring. NEMA sets out measures which may be regarded as reasonable. They include the following measures:

1. to investigate, assess and evaluate the impact on the environment
2. to inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution or degradation of the environment
3. to cease, modify or control any act, activity or process causing the pollution or degradation
4. to contain or prevent the movement of the pollution or degradation
5. to eliminate any source of the pollution or degradation

6. to remedy the effects of the pollution or degradation

2.4 NATIONAL ENVIRONMENTAL MANAGEMENT: AIR QUALITY ACT ("AQA")

Section 34 of the National Environmental Management: Air Quality Act (Act 39 of 2004) makes provision for:

(1) the Minister to prescribe essential national noise standards -

(a) for the control of noise, either in general or by specified machinery or activities or in specified places or areas; or

(b) for determining –

(i) a definition of noise

(ii) the maximum levels of noise

(2) When controlling noise the provincial and local spheres of government are bound by any prescribed national standards.

Model regulations have been promulgated for adoption by Local Authorities. An atmospheric emission licence issued in terms of section 22 of this Act may also contain conditions in respect of noise.

2.5 MODEL AIR QUALITY MANAGEMENT BY-LAW FOR ADOPTION AND ADAPTATION BY MUNICIPALITIES

Model Air Quality Management By-Laws for adoption and adaptation by municipalities was published by the Department of Water and Environmental Affairs in the Government Gazette of 2 July 2010 as Government Notice 579 of 2010.

The main aim of the model air quality management by-law is to assist municipalities in the development of their air quality management by-law within their jurisdictions. It is also the aim of the model by-law to ensure uniformity across the country when dealing with air quality management challenges. Therefore, the model by-law is developed to be generic in order to deal with most of the air quality management challenges.

- **IT IS NOT** the aim of the model by-law to have legal force and effect on municipalities when published in the Gazette; and
- **IT IS NOT** the aim of the model by-law to impose the by-law on municipalities.

Therefore, a municipality will have to follow the legal process set out in the Local Government: Municipal Systems Act, 2000 (Act No. 32 of 2000) when adopting and adapting the model by-law to its local jurisdictions.

2.6 NOISE CONTROL REGULATIONS

In terms of section 25 of the ECA, the national noise-control regulations (GN R154 in *Government Gazette* No. 13717 dated 10 January 1992) were promulgated. The NCRs were revised under Government Notice Number R. 55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations.

Subsequently, in terms of Schedule 5 of the Constitution of South Africa of 1996, legislative responsibility for administering the noise control regulations was devolved to provincial and local authorities. Provincial Noise Control Regulations exist in the Free State, Western Cape and Gauteng provinces.

2.7 NOISE STANDARDS

Four South African Bureau of Standards (SABS) scientific standards are considered relevant to noise from a coal mine. They are:

- SANS 10103:2008. 'The measurement and rating of environmental noise with respect to annoyance and to speech communication'.
- SANS 10210:2004. 'Calculating and predicting road traffic noise'.
- SANS 10328:2008. 'Methods for environmental noise impact assessments'.
- SANS 10357:2004. 'The calculation of sound propagation by the Concave method'.

The relevant standards use the equivalent continuous rating level as a basis for determining what is acceptable. The levels may take single event noise into account, but single event noise by itself does not determine whether noise levels are acceptable for land use purposes. The recommendations that the standards make are likely to inform decisions by authorities, but non-compliance with the standards will not necessarily render an activity unlawful *per se.*

2.8 INTERNATIONAL GUIDELINES

While there exist a number of international guidelines and standards that could encompass a document in itself, the WHO guidelines are important as they are used by different countries in the subject of environmental noise management.

2.8.1 Guidelines for Community Noise (WHO, 1999)

This WHO document on the *Guidelines for Community Noise* is the outcome of the WHO-expert task force meeting held in London, United Kingdom, in April 1999. It bases on the document entitled "Community Noise" that was prepared for the World Health Organization and published in 1995 by the Stockholm University and Karolinska Institute.

The scope of WHO's effort to derive guidelines for community noise is to consolidate actual scientific knowledge on the health impacts of community noise and to provide guidance to environmental health authorities and professionals trying to protect people from the harmful effects of noise in non-industrial environments.

Guidance on the health effects of noise exposure of the population has already been given in an early publication of the series of Environmental Health Criteria. The health risk to humans from exposure to environmental noise was evaluated and guidelines values derived. The issue of noise control and health protection was briefly addressed.

The document uses the L_{Aeq} and $L_{A,max}$ noise descriptors to define noise levels.

2.8.2 Night Noise Guidelines for Europe (WHO, 2009)

Refining previous Community Noise Guidelines issued in 1999, and incorporating more recent research, the World Health Organization has released a comprehensive report on the health effects of night time noise, along with new (non-mandatory) guidelines for use in Europe. Rather than a maximum of 30dB inside at night (which equals 45-50dB max inside), the WHO now recommends a maximum year-round outside night-time noise average of 40db to avoid sleep disturbance and its related health effects. The report notes that only below 30dB (outside annual average) are "*no significant biological effects observed*," and that between 30 and 40dB, several effects are observed, with the chronically ill and children being more susceptible; however, "*even in the worst cases the effects seem modest*." Elsewhere, the report states more definitively, "*There is no sufficient evidence that the biological effects observed at the level below 40 dB (night, outside) are harmful to health*." At levels over 40dB, "*Adverse health effects are observed*" and "*many people have to adapt their lives to cope with the noise at night. Vulnerable groups are more severely affected*."

The 184-page report offers a comprehensive overview of research into the various effects of noise on sleep quality and health (including the health effects of non-waking sleep arousal), and is recommended reading for anyone working with noise issues. The use of an outdoor noise standard is in part designed to acknowledge that people do like to leave windows open when sleeping, though the year-long average may be difficult to obtain (it

would require longer-term sound monitoring than is usually budgeted for by either industry or neighbourhood groups).

While recommending the use of the average level, the report notes that some instantaneous effects occur in relation to specific maximum noise levels, but that the health effects of these "cannot be easily established."

2.8.3 Equator Principles

The **Equator Principles** (EPs) are a voluntary set of standards for determining, assessing and managing social and environmental risk in project financing. Equator Principles Financial Institutions (EPFIs) commit to not providing loans to projects where the borrower will not or is unable to comply with their respective social and environmental policies and procedures that implement the EPs.

The Equator Principles were developed by private sector banks and were launched in June 2003. The banks chose to model the Equator Principles on the environmental standards of the World Bank and the social policies of the International Finance Corporation (IFC). 67 financial institutions (October 2009) have adopted the Equator Principles, which have become the de facto standard for banks and investors on how to assess major development projects around the world. The environmental standards of the World Bank have been integrated into the social policies of the IFC since April 2007 as the International Finance Corporation Environmental, Health and Safety (EHS) Guidelines.

2.8.4 IFC: General EHS Guidelines – Environmental Noise Management

These guidelines are applicable to noise created beyond the property boundaries of a development that conforms to the Equator Principle.

It states that noise prevention and mitigation measures should be applied where predicted or measured noise impacts from a project facility or operations exceed the applicable noise level guideline at the most sensitive point of reception. The preferred method for controlling noise from stationary sources is to implement noise control measures at source.

It goes as far as to proposed methods for the prevention and control of noise emissions, including:

- Selecting equipment with lower sound power levels;
- Installing silencers for fans;
- Installing suitable mufflers on engine exhausts and compressor components;
- Installing acoustic enclosures for equipment casing radiating noise;

- Improving the acoustic performance of constructed buildings, apply sound insulation;
- Installing acoustic barriers without gaps and with a continuous minimum surface density of 10 kg/m^2 in order to minimize the transmission of sound through the barrier. Barriers should be located as close to the source or to the receptor location to be effective;
- Installing vibration isolation for mechanical equipment;
- Limiting the hours of operation for specific pieces of equipment or operations, especially mobile sources operating through community areas ;
- Re-locating noise sources to less sensitive areas to take advantage of distance and shielding;
- Siting permanent facilities away from community areas if possible;
- Taking advantage of the natural topography as a noise buffer during facility design;
- Reducing project traffic routing through community areas wherever possible;
- Planning flight routes, timing and altitude for aircraft (airplane and helicopter) flying over community areas; and
- Developing a mechanism to record and respond to complaints.

It sets noise level guidelines () as well as highlighting the certain monitoring requirements pre- and post-development.

Table 2.1: IFC Table .7.1-Noise Level Guidelines

Receptor type	**One hour L_{Aeq} (dBA)**	
	Daytime 07:00 - 22:00	Night-time 22:00 – 07:00
Residential; institutional; educational	55	45
Industrial; commercial	70	70

The document uses the $L_{Aeq,1\ hr}$ noise descriptors to define noise levels. It does not determine the detection period, but refers to the IEC standards, which requires the fast setting for Europe.

3 CURRENT ENVIRONMENTAL SOUND CHARACTER

3.1 MEASUREMENT PROCEDURE

Ambient (background) noise levels were measured at appropriate times in accordance with the South African National Standard SANS 10103:2008 "***The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication***". The standard specifies the acceptable techniques for sound measurements including:

- type of equipment;
- minimum duration of measurement;
- microphone positions;
- calibration procedures and instrument checks; and
- weather conditions.

The location of the ambient sound measurement locations are illustrated in **Figure 3-1**. Wind conditions ranged from low to medium during the measurement dates.

3.2 ON-SITE MEASUREMENTS (DW01 – NSD09): MR. VAN WYK – VAN DER WALTSPAN

A number of 10 minute measurements were taken over 18 hours from the afternoon of the 01st November till the morning of the 02nd November 2012. The sound level meter was referenced at 1,000 Hz directly before and after the measurements were taken. In all cases drift was less than 0.2 dBA. The equipment defined in **Table 3-1** was used for gathering data.

Table 3-1: Equipment used to gather data

Equipment	Model	Serial no	Calibration
SLM	Rion NL-32	01182945	23 January 2012
Microphone	Rion UC-53A	315479	23 January 2012
Preamplifier	Rion NH-21	28879	23 January 2012
Calibrator	Rion NC-74	34494286	24 February 2012
Weather Station	WH3081PC	-	-

* Microphone fitted with the appropriate windshield (WS-03).

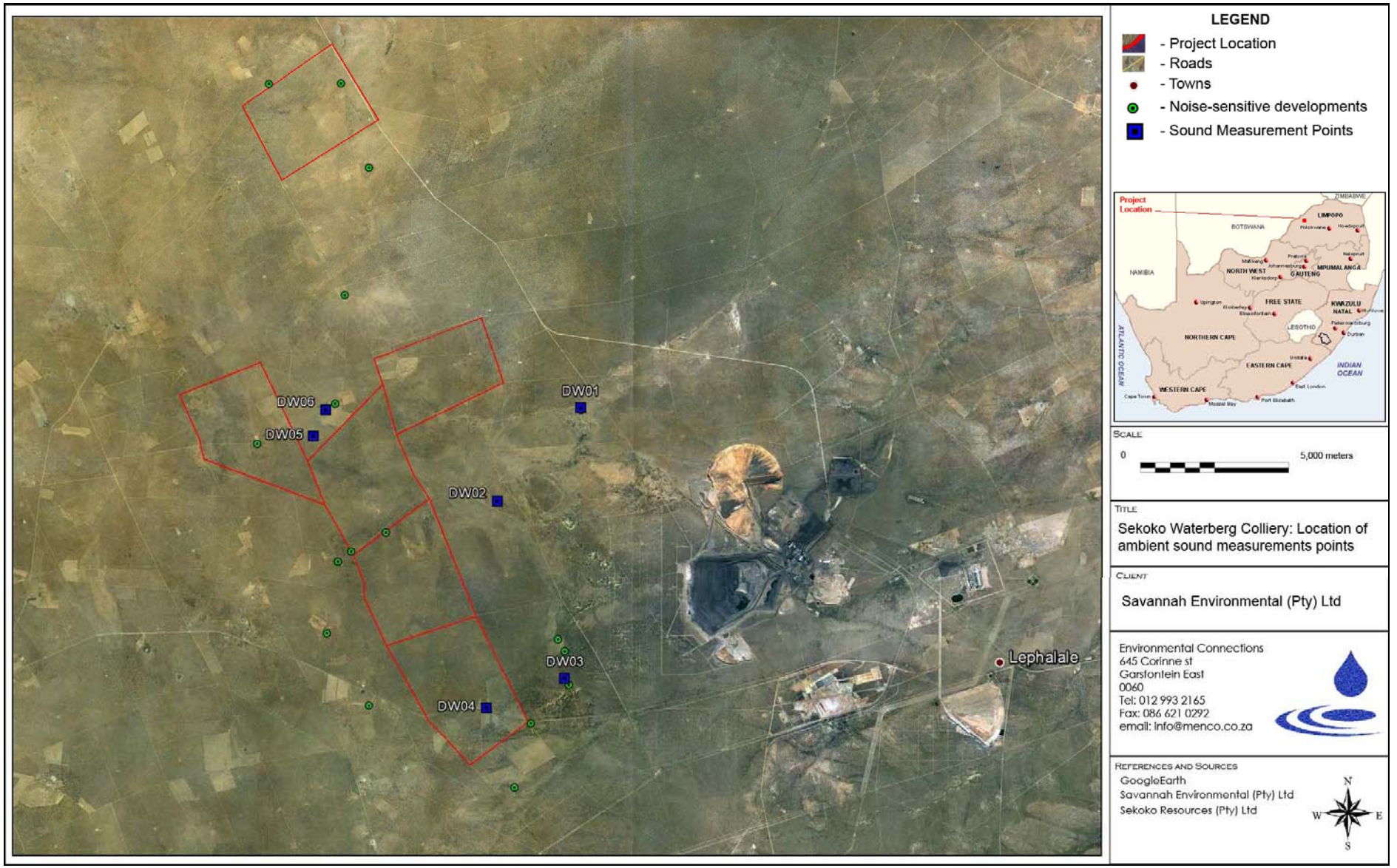

Figure 3-1: Localities of ambient sound measurement points

The measurement location was selected to be reflective of the typical ambient sound levels that this NSD may experience in the area. As a result a Sound Level Meter was erected in an area close to the dwelling where the resident may spend time. Daytime ambient sounds were mainly natural comprising of wind induced noises and bird song, with little sounds of anthropogenic origin impacting on the area.

Unfortunately, most of the data at this point is not usable as the extension cable connecting sound level meter to microphone was damaged soon after the measurement equipment was erected. It is assumed monkeys bit into the cable destroying it, as a troupe of them were seen at this premises during the site investigational date. Only 6 measurements were collected, with L_{Aeq} levels ranging between 45 and 59 dBA. $L_{A,max}$ and $L_{A,min}$ levels for this hour period were 81.6 and 32.2 dBA respectively. L_{A90} values ranged between 34.5 and 38.1 dBA90.

3.3 On-site Measurements (DW02 – NSD21): Mr/Mrs. Erasmus – Zaagput

A number of 10 minute measurements were taken over 18 hours from the afternoon of the 01st November till the morning of the 02nd November 2012. The sound level meter was referenced at 1,000 Hz directly before and after the measurements were taken. In all cases drift was less than 0.2 dBA. The equipment defined in **Table 3-2** was used for gathering data.

Table 3-2: Equipment used to gather data

Equipment	Model	Serial no	Calibration
SLM	Rion NA-28	00901489	1 June 2012
Microphone	Rion UC-59	02087	1 June 2012
Calibrator	Rion NC-74	34494286	24 February 2012
Weather Station	WH3081PC	-	-

* Microphone fitted with the appropriate windshield.

The measurement location was selected to be reflective of the typical ambient sound levels that this NSD may experience in the area. As a result a sound level meter was erected on the lawn in front of the house. The owner of this property does have dogs on the premises and a gravel road passes near the premises (insignificant traffic volumes in terms of acoustics).

The ambient sound levels as measured are shown on **Figure 3-2** illustrated an almost sub-urban area in terms of sound levels. **Figure 3-3** illustrates the spectral analysis conducted at this receptor, indicating no issues with lower frequency, tonality or any significant acoustical trends or concerns. Measurements indicated more energy surrounding the audible (human) range of 1000 Hz[1], commonly associated with human communication (e.g. human speech ranges from 300 – 3000 Hz[2]) with animal and insects dominating frequencies above 2,000 Hz.

During the daytime the average $\mathbf{L_{AIeq}}$ value were 46.2 dBA (34.3 – 75.7 dBA) with $\mathbf{L_{A90}}$ being 36.4 dBA90 (29.5 – 45.2 dBA90). The average difference between $\mathbf{L_{AIeq}}$ and $\mathbf{L_{A90}}$ was 9.80 dB indicating impulsive noise dominating. During night-times, $\mathbf{L_{AIeq}}$ values ranged from 30.9 to 54.8 dBA averaging at 38.9 dBA. $\mathbf{L_{A90}}$ values ranged from 26.6 to 38.4 dBA, averaging approximately 30.9 dBA. The average difference between $\mathbf{L_{AIeq}}$ and $\mathbf{L_{A90}}$ was 8.5 dBA. Day and night-time sounds at this receptor were for the most part inconsistent and impulsive during measurement times. Since there are no external noise sources of significance near this receptor, it could only be attributed to sounds near the microphone such as possible wind gusts, domesticated animals (dogs barking) or a vehicle noise.

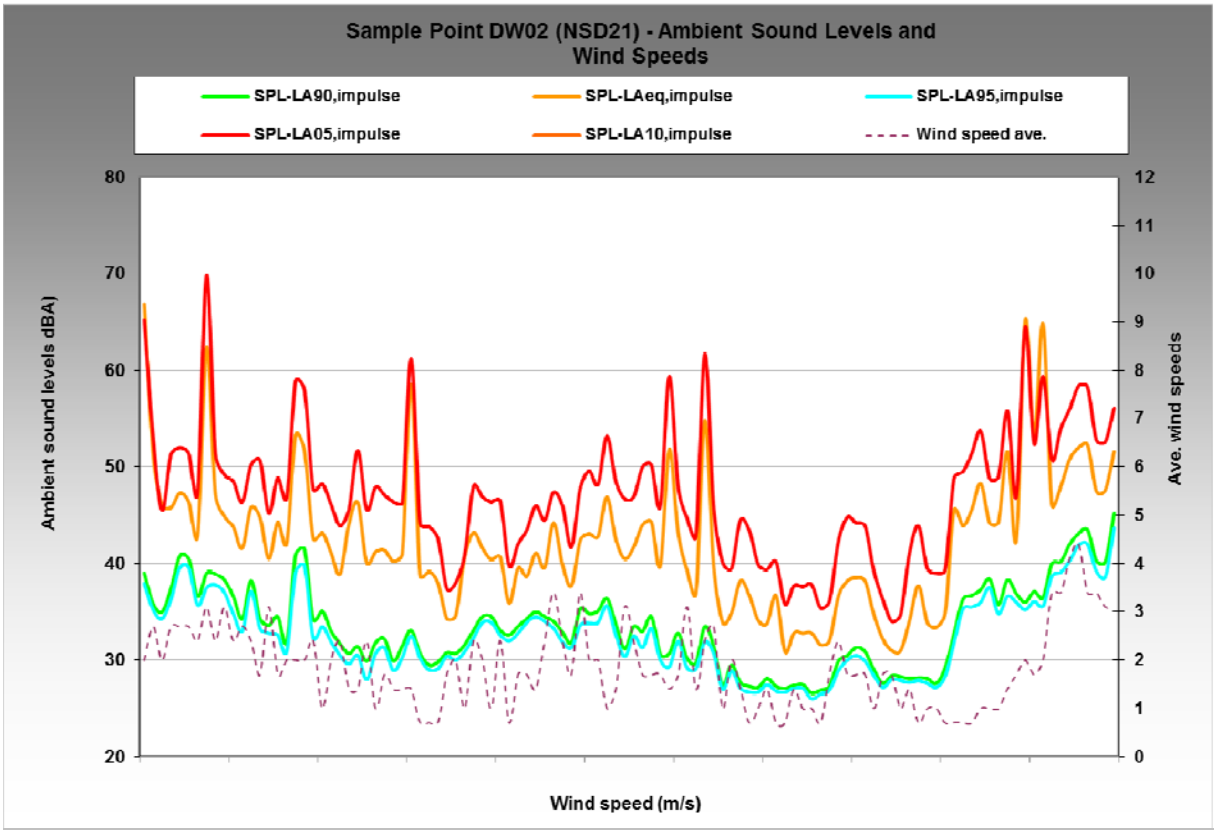

Figure 3-2: Ambient Sound Levels at DW02

[1] F. Alton Everest & Ken C. Pohlmann: Master Handbook of Acoustics, Fifth Edition.
[2] Titze, I.R. (1994). Principles of Voice Production, Prentice Hall (currently published by NCVS.org) (pp. 188)

The site can be considered rural in terms of development and character, with daytime ambient sound levels confirming the rural nature. However, night-time ambient sound level measurements show an area impacted by a number of external noises with an impulsive nature. Noises from the residences typically quiet down after dusk (20:00 – 22:00) and as no other industrial noises were identified during the site visit, it is assumed that faunal noises dominate the sound character at night.

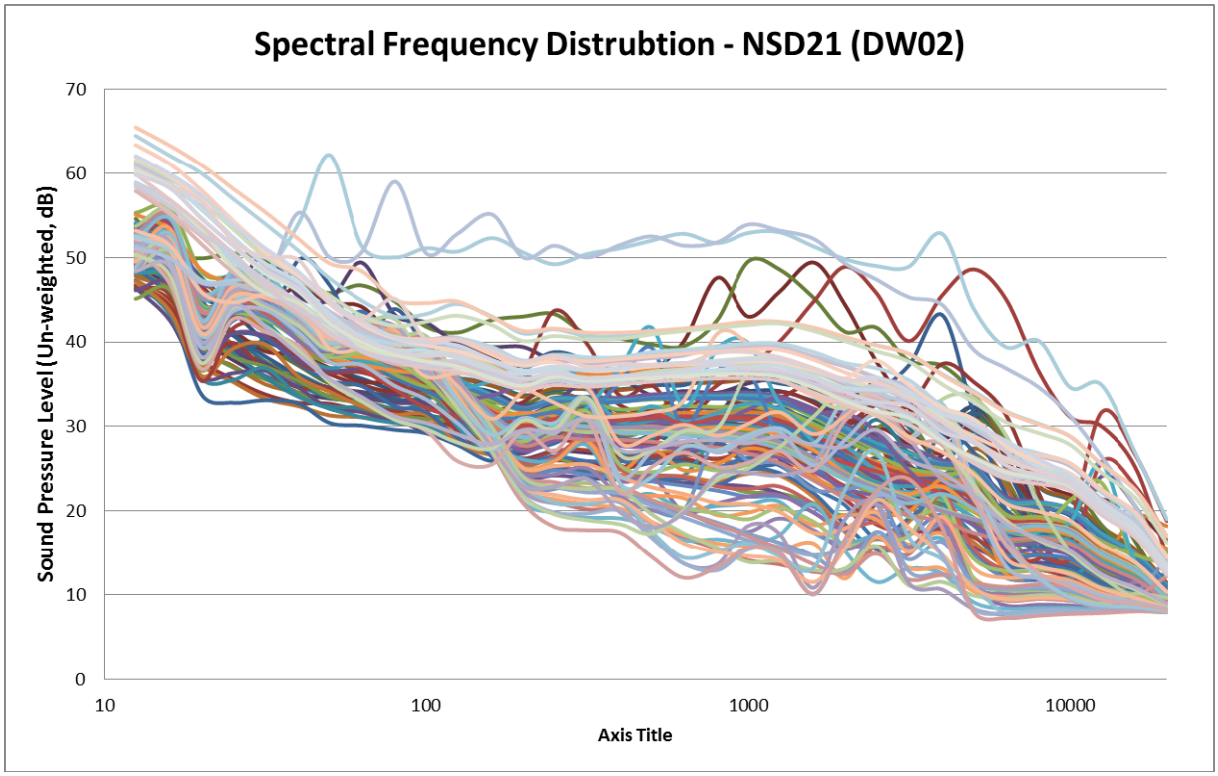

Figure 3-3: Spectral Frequency Distribution as measured on-site at DW02

3.4 On-site Measurements (DW03 – NSD20): Dr Vasti Retief / Du Toit – Vaalpensloop

A number of 10 minute measurements were taken over 11 hours from the evening of the 01st November till the morning of the 02nd November 2012. The sound level meter was referenced at 1,000 Hz directly before and after the measurements were taken. In all cases drift was less than 0.2 dBA.

The equipment defined in **Table 3-3** was used for gathering data. Only night-time and early morning measurements were obtained at this receptor, as the owner of this premises was only available at that time.

Table 3-3: Equipment used to gather data

Equipment	Model	Serial no	Calibration
SLM	Svan 955	27637	25 July 2012
Microphone	ACO 7052E	49596	25 July 2012
Calibrator	Rion NC-74	34494286	24 February 2012
Weather Station	WH3081PC	-	-

* Microphone fitted with the appropriate windshield.

The ambient sound levels as measured are shown on **Figure 3-4** and illustrate an area with sound levels typical of a rural to sub-urban community. During night-times (and early morning hours), $\mathbf{L_{AIeq}}$ values ranged from 36.9 to 58.4 dBA with an average of 44.2 dBA.

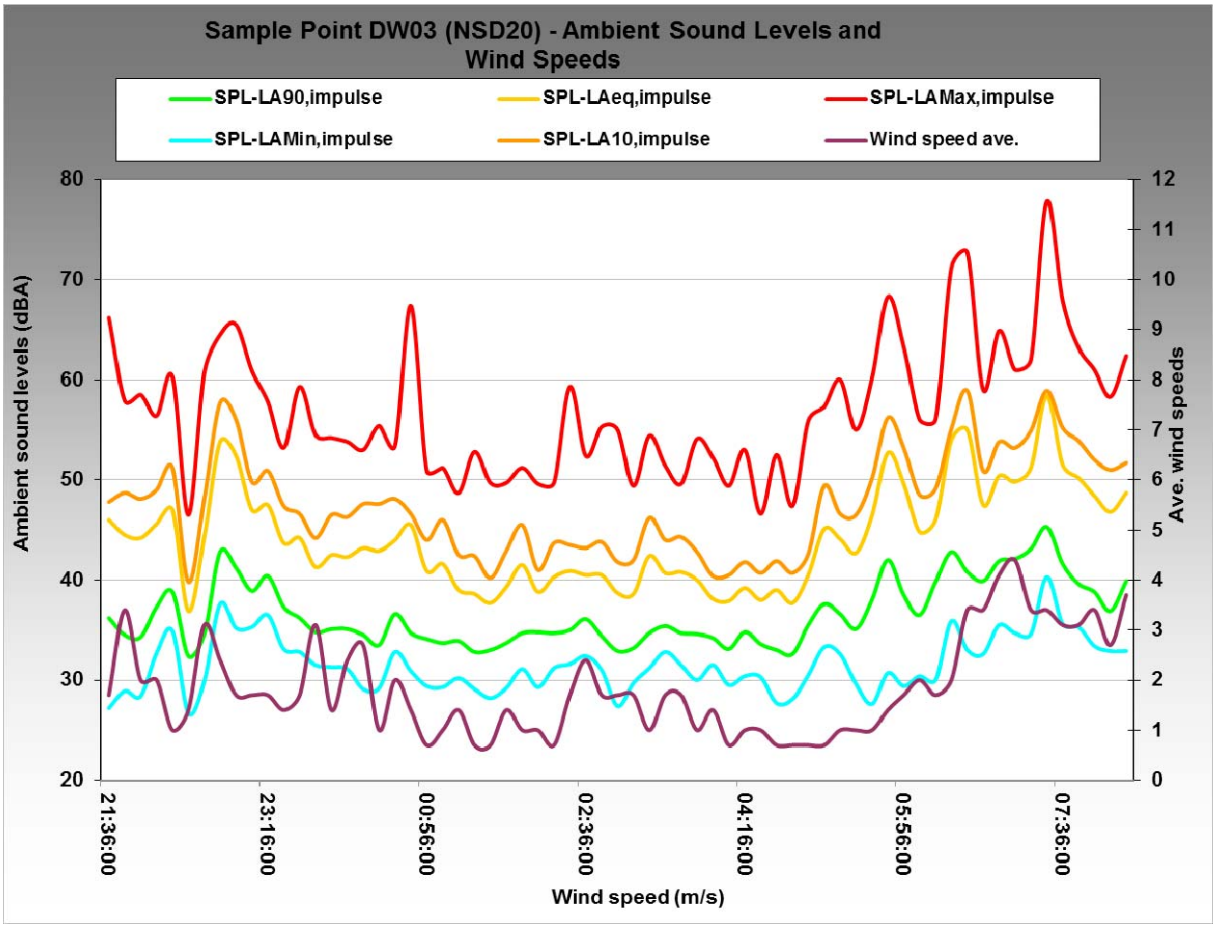

Figure 3-4: Ambient Sound Levels at DW03

$\mathbf{L_{A90}}$ values ranged from 32.40 to 45.30 dBA, averaging at approximately 36.6 dBA90, similar to DW02. The average difference between $\mathbf{L_{AIeq}}$ and $\mathbf{L_{A90}}$ was 7.6 dBA. The noise sources as measured were very inconsistent and impulsive (most notably due to wind and faunal activity). If any significant consistent noises such as mining activities (4 km to the

west of this receptor) were measured, they would be faint or masked by other noises at the receptors dwelling.

The site can be considered rural in terms of development and character, with daytime ambient sound levels confirming the rural nature. However, night-time ambient sound level measurements show an area impacted by a number of external noises with an impulsive nature. Noises from the residences typically quiet down after dusk (20:00 – 22:00) and as no other industrial noises were identified during the site visit, it is assumed that faunal noises dominate the sound character at night.

3.5 ON-SITE MEASUREMENTS (DW04 – NSD12)

A number of 10 minute measurements were taken over 18 hours from the afternoon of the 31st October till the morning of the 01st November 2012. The sound level meter was referenced at 1,000 Hz directly before and after the measurements were taken. In all cases drift was less than 0.2 dBA. The equipment defined in **Table 3-4** was used for gathering data.

Table 3-4: Equipment used to gather data

Equipment	Model	Serial no	Calibration
SLM	Rion NA-28	00901489	1 June 2012
Microphone	Rion UC-59	02087	1 June 2012
Calibrator	Rion NC-74	34494286	24 February 2012
Weather Station	WH3081PC	-	-

* Microphone fitted with the appropriate windshield.

The ambient sound levels as measured are shown on **Figure 3-5** illustrating a quiet area besides sounds from the receptors dwelling and wind noise. **Figure 3-6** illustrates the spectral analysis conducted at this receptor, indicating no issues with lower frequency, tonality or any significant acoustical trends or concerns. Measurements indicated more energy surrounding the audible (human) range of 1000 Hz[3], commonly associated with human communication (e.g. human speech ranges from 300 – 3000 Hz[4]) and animal and insects dominating frequencies higher than 2,000 Hz.

[3] F. Alton Everest & Ken C. Pohlmann: Master Handbook of Acoustics, Fifth Edition.

[4] Titze, I.R. (1994). Principles of Voice Production, Prentice Hall (currently published by NCVS.org) (pp. 188)

During the daytime **L_{AIeq}** values ranged from 32.20 to 60.80 dBA with an average of 48.0 dBA. **L_{A90}** values ranged from 28.40 to 50.80 dBA90 with an average of 38.1 dBA90. The average difference between **L_{AIeq}** and **L_{A90}** was 9.9 dBA.

During night-times, **L_{AIeq}** values ranged from 37.9 to 57.9 dBA with an average of 45.0 dBA. **L_{A90}** values ranged from 30.9 to 44.1 dBA90 averaging at 36.5 dBA90. The average difference between **L_{AIeq}** and **L_{A90}** was 8.5 dBA.

Day and night-time sounds at this receptor were for the most part inconsistent and impulsive during measurement times. The paved road near this receptor was used infrequently with traffic using this road at all hours.

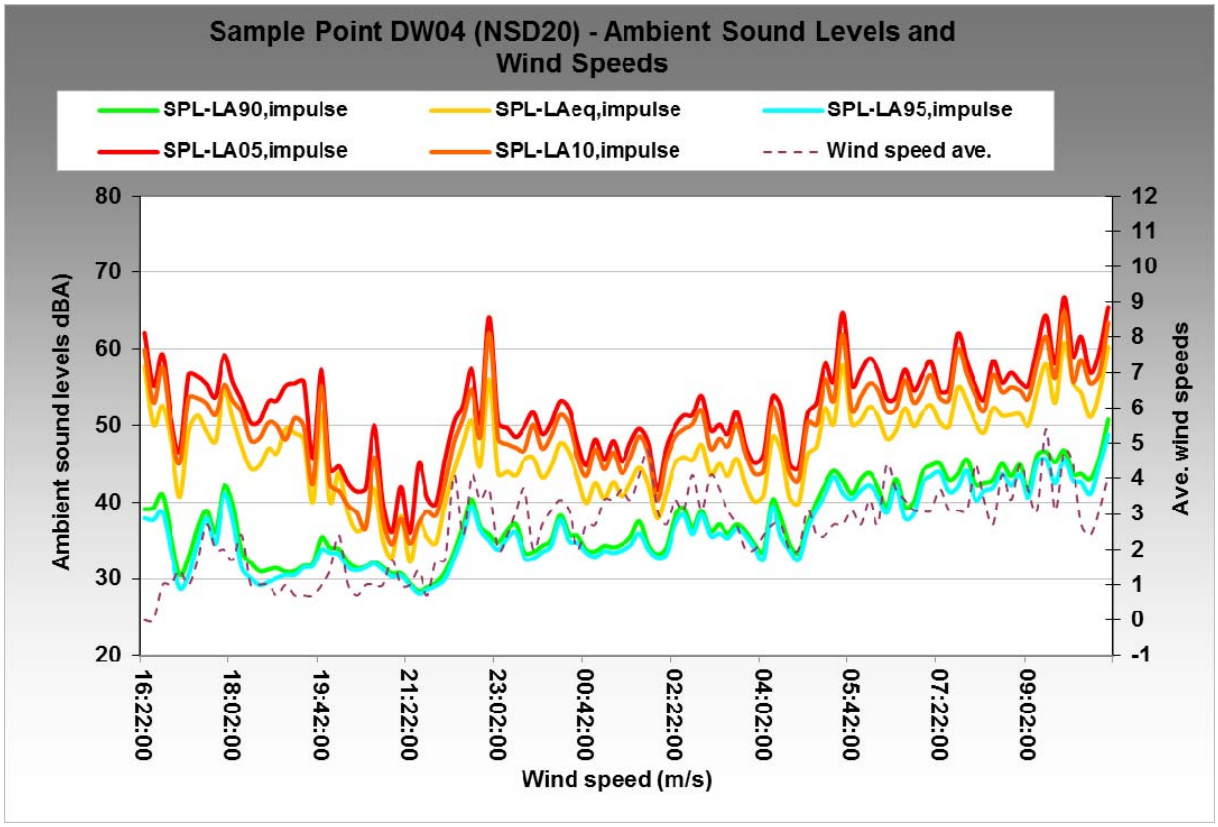

Figure 3-5: Ambient Sound Levels at DW04

The site can be considered rural in terms of development and character, with daytime ambient sound levels confirming the rural nature. However, night-time ambient sound level measurements show an area impacted by a number of external noises with an impulsive nature. It should be noted that wind speeds increased from 22:00, at the same time influencing the L_{A90} and $L_{A,min}$ level measurements. This is likely the reason for the increased **L_{AIeq}** levels, which, at 45 dBA is more reflective of an urban area. Noises from the residences typically quiet down after dusk (20:00 – 22:00) and as no other industrial

noises were identified during the site visit, it is assumed that faunal noises dominate the sound character at night.

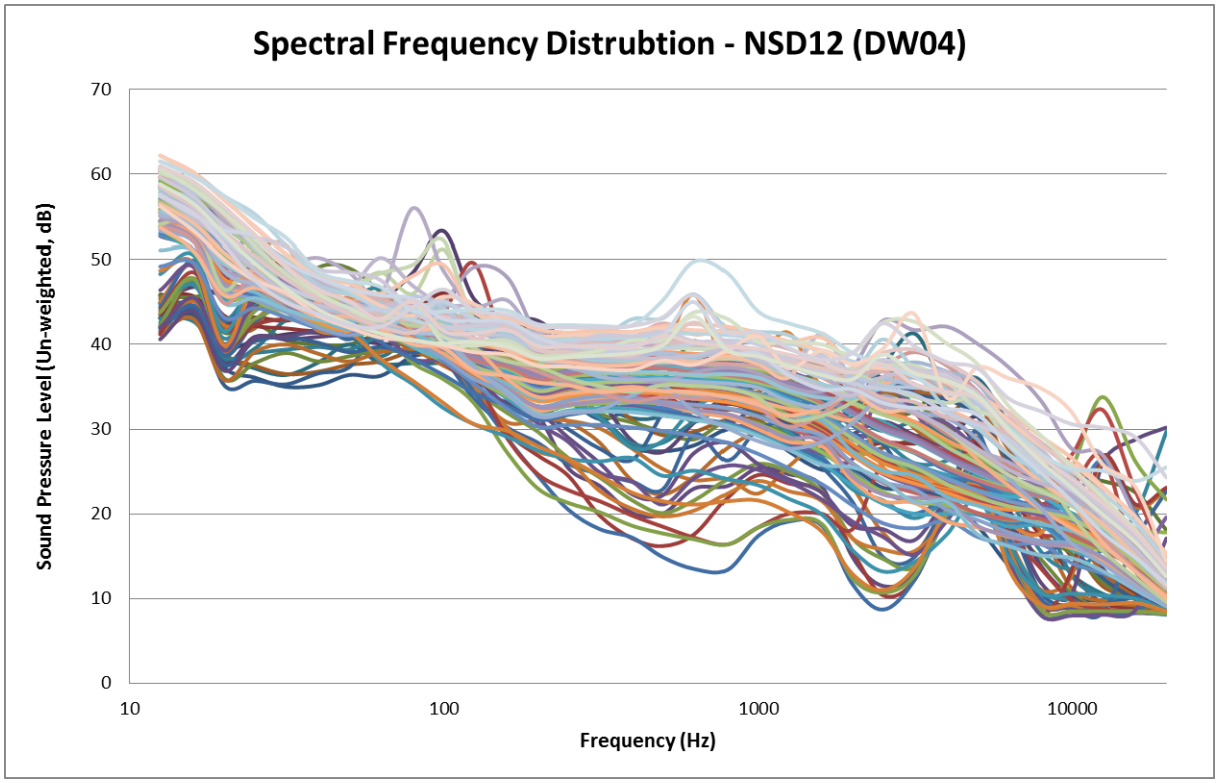

Figure 3-6: Spectral Frequency Distribution as measured onsite at DW04

3.6 On-site Measurements (DW05): Hardus/ Boeta Steenkamp

A number of 10 minute measurements were taken over 18 hours from the afternoon of the 31st October till the morning of the 01st November 2012. The sound level meter was referenced at 1,000 Hz directly before and after the measurements were taken. In all cases drift was less than 0.2 dBA. The equipment defined in **Table 3-5** was used for gathering data. The monitoring location was near a dirt track used by the farmer as well as a workshop (app. 70 meters).

Table 3-5: Equipment used to gather data

Equipment	Model	Serial no	Calibration
SLM	Svan 955	27637	25 July 2012
Microphone	ACO 7052E	49596	25 July 2012
Calibrator	Rion NC-74	34494286	24 February 2012
Weather Station	WH3081PC	-	-

* Microphone fitted with the appropriate windshield.

The measurement location was selected to be reflective of the typical ambient sound levels that this NSD may experience in the area. As a result a sound level meter was erected near the entrance to the dwelling. The ambient sound levels as measured are shown on **Figure 3-7**.

During the daytime $\mathbf{L_{AIeq}}$ values ranged from 41.8 to 65.2 dBA, averaging at 50.0 dBA. $\mathbf{L_{A90}}$ values ranged from 24.9 to 53.5 dBA90, averaging at 41.3 dBA90. The average difference between $\mathbf{L_{AIeq}}$ and $\mathbf{L_{A90}}$ was 8.63 dBA. During night-times, $\mathbf{L_{AIeq}}$ values ranged from 31.4 to 60.9 dBA (average 43.3 dBA). $\mathbf{L_{A90}}$ values ranged from 23.4 to 42.4 dBA90 averaging at 33.8 dBA90. The average difference between $\mathbf{L_{AIeq}}$ and $\mathbf{L_{A90}}$ was 10.03 dBA. Day and night-time sounds at this receptor were for the most part inconsistent and impulsive during measurement times.

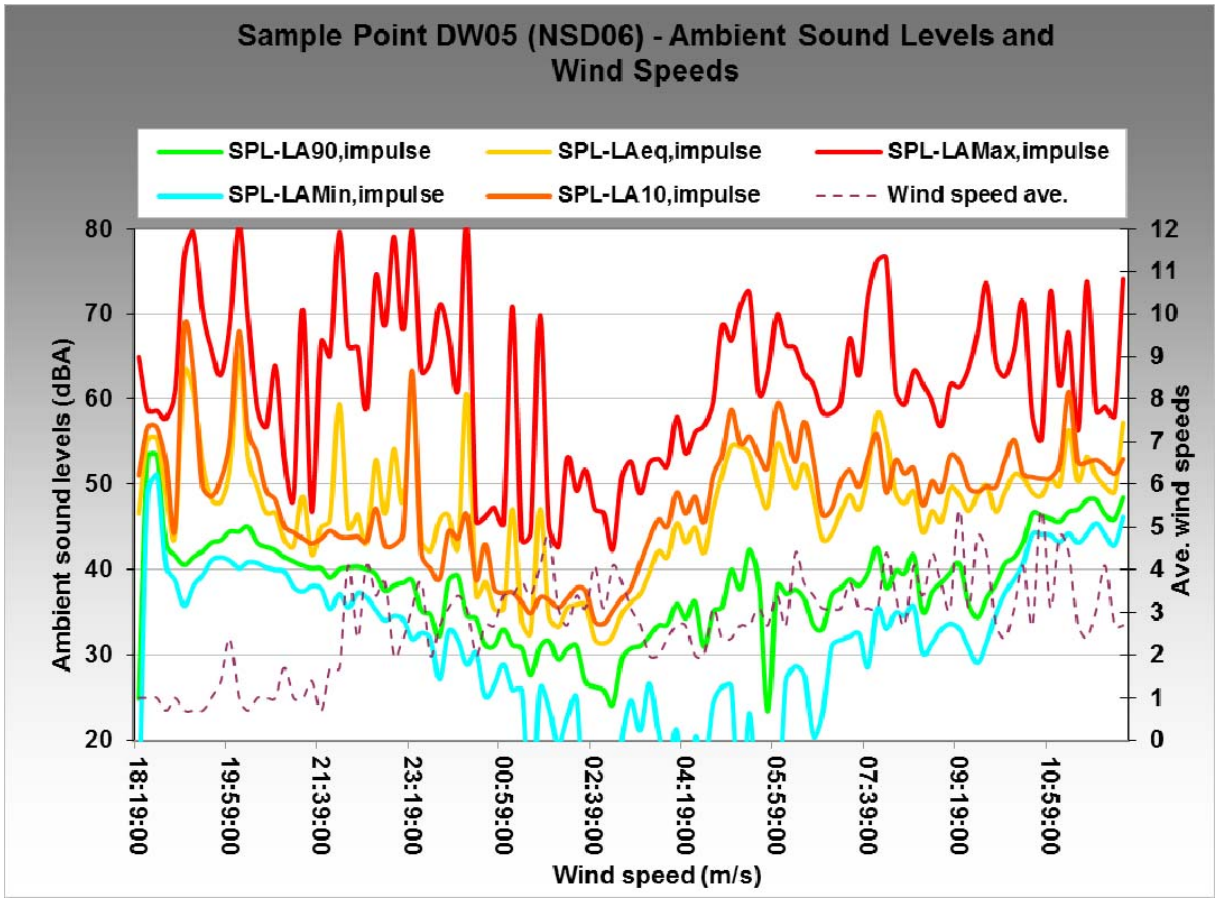

Figure 3-7: Ambient Sound Levels at DW05

The site can be considered rural in terms of development and character, with daytime ambient sound levels highlighting an area with a sub-urban sound level character. However, night-time ambient sound level measurements show an area impacted by a number of external noises with an impulsive nature (typical of animal calls). Noises from the residences typically quiet down after dusk (20:00 – 22:00) and as no other industrial

noises were identified during the site visit, it is assumed that faunal noises dominate the sound character at night.

3.7 ON-SITE MEASUREMENTS (DW06): HARDUS/ BOETA STEENKAMP

A number of 10 minute measurements were taken over 18 hours from the afternoon of the 31st October till the morning of the 01st November 2012. The sound level meter was referenced at 1,000 Hz directly before and after the measurements were taken. In all cases drift was less than 0.2 dBA. The equipment defined in **Figure 3-7** was used for gathering data.

Table 3-6: Equipment used to gather data

Equipment	Model	Serial no	Calibration
SLM	Rion NL-32	01182945	23 January 2012
Microphone	Rion UC-53A	315479	23 January 2012
Preamplifier	Rion NH-21	28879	23 January 2012
Calibrator	Rion NC-74	34494286	24 February 2012
Weather Station	WH3081PC	-	-

* Microphone fitted with the appropriate windshield (WS-03).

The measurement location was selected to be reflective of the typical ambient sound levels that this NSD may experience in the area. As a result a sound level meter was erected near the front entrance to the dwelling. The owner of this property does have dogs on the premises. The ambient sound levels as measured are shown on **Figure 3-8** illustrates a quiet area.

During the daytime $\mathbf{L_{AIeq}}$ values ranged from 33.9 to 59.7 dBA (average of 45.7 dBA) with $\mathbf{L_{A90}}$ values ranged from 25.3 to 44.5 dBA90 (average is 34.2 dBA90). The average difference between $\mathbf{L_{AIeq}}$ and $\mathbf{L_{A90}}$ was 11.59 dBA. During night-times, $\mathbf{L_{AIeq}}$ values ranged from 32.00 to 49.80 dBA (average 42.0 dBA) and $\mathbf{L_{A90}}$ values ranged from 24.6 to 39.9 dBA90 (average 29.5 dBA90). The average difference between $\mathbf{L_{AIeq}}$ and $\mathbf{L_{A90}}$ was 12.44 dBA. Day and night-time sounds at this receptor were for the most part inconsistent and impulsive during measurement times.

As with the other sites, this site can be considered rural in terms of development and character, with daytime ambient sound levels confirming the rural nature. However, night-time ambient sound level measurements show an area impacted by a number of external noises with an impulsive nature. Noises from the residences typically quiet down after

dusk (20:00 – 22:00) and as no other industrial noises were identified during the site visit, it is assumed that faunal noises dominate the sound character at night.

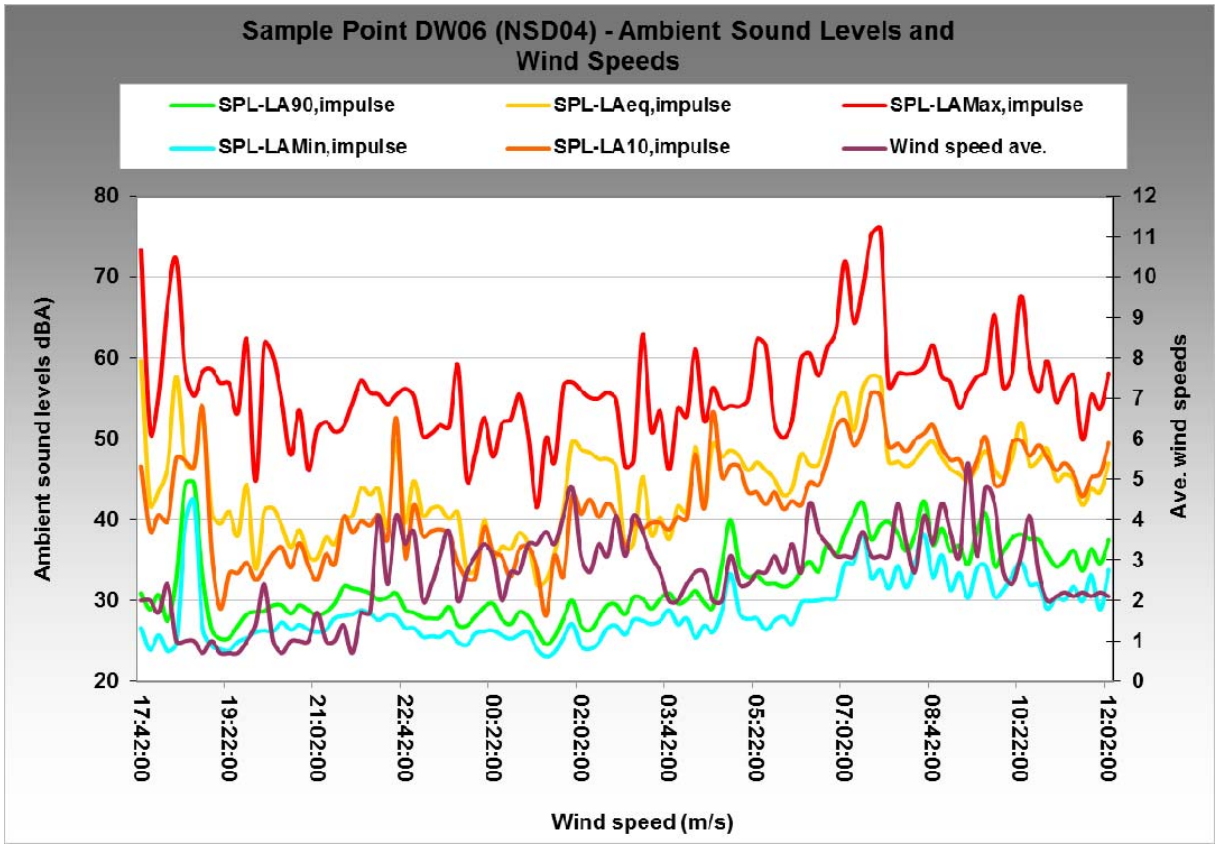

Figure 3-8: Ambient Sound Levels at DW06

3.8 POTENTIAL NOISE SOURCES IN AREA

See **section 1.4.5**. All these noise sources are further than 5,000 meters from the proposed development it is unlikely to influence the ambient sound levels at the development site. Ambient sound measurements should be collected to confirm whether these existing noise sources impact on the identified NSDs.

It is however unlikely that the existing noise sources and proposed development cumulatively impact on each other (with regards to noise) or the identified NSDs.

4 POTENTIAL NOISE SOURCES AND NOISE IMPACTS

4.1 ACTIVITIES MODELLED

Increased noise levels are directly linked with the various activities associated with the establishment of the facility and related infrastructure (construction phase), the operational as well as the closure phase.

For the purpose of the scoping noise assessment a minimal scenario is evaluated, with the some of the activities modelled over distance. The model uses is simplistic and only consider distance from the activity. It does not include factors such as air attenuation, wind direction, height differences, barriers or even ground conditions. These calculations are preliminary and only to identify whether a risk exist of a noise impact occurring on surrounding NSDs and environment.

Once further information is available, this potential noise impact will be reviewed in more detail (EIA phase).

4.2 POTENTIAL NOISE SOURCES: CONSTRUCTION PHASE

4.2.1 Construction Activities

The following are possible to be the main construction related sources of noise for a coal mine and its infrastructure:

i. Vegetation removal and the stripping of topsoil;
ii. Construction camp establishment;
iii. Development of the internal and access roads;
iv. Activities related to the deployment and implementation of services;
v. Excavation of building foundations and service trenches. Blasting may be required but in general pneumatic breakers will be used where rock is encountered;
vi. Development of initial boxcut (excavation of soft overburden, drilling and blasting of hard overburden, loading of blasted hard overburden as well as material transport);
vii. Piling operations for large buildings and structures;
viii. Construction of offices and other structures;
ix. Installation of crushing and screening plant;
x. Laying of railway lines and the installation of the siding ancillary equipment;
xi. General movement of heavy vehicles around the site; and,
xii. Construction material and equipment delivery vehicles.

The level and character of the construction noise will be highly variable as different activities with different equipment take place at different times, for different periods of time (operating cycles), in different combinations, in different sequences and on different parts of the construction site.

Potential maximum noise levels generated by various construction equipment are presented in **Table 4.1**.

4.2.2 Blasting

Blasting may be required as part of the civil works to clear obstacles or to prepare foundations. However, blasting will not be considered during the Scoping or EIA phase for the following reasons:

- Blasting is highly regulated, and control of blasting to protect human health, equipment and infrastructure will ensure that any blasts will use minimum explosives and will occur in a controlled manner.
- Blasting is a highly specialised field, and various management options are available to the blasting specialist. Options available to minimise the risk to equipment, people and infrastructure includes:
    - The use of different explosives that have a lower detonation speed, which reduces vibration, sound pressure levels as well as air blasts.
    - Blasting techniques such as blast direction and/or blast timings (both blasting intervals and sequence).
    - Reducing the total size of the blast.
    - Damping materials used to cover the explosives.
- People are generally more concerned over ground vibration and air blast levels that might cause building damage than the impact of the noise from the blast. This is normally associated with close proximity mining/quarrying.
- Blasts will be an infrequent occurrence, with a loud but a relative instantaneous character. Potentially affected parties normally receive sufficient notice (siren), and the knowledge that the duration of the siren noise as well as the blast will be over relative fast result in a higher acceptance of the noise.

Table 4.1: Potential maximum noise levels generated by construction equipment

Equipment Description[5]	Impact Device?	Maximum Sound Power Levels (dBA)	Operational Noise Level at given distance considering potential **maximum** noise levels (Cumulative as well as the mitigatory effect of potential barriers or other mitigation not included – simple noise propagation modelling only considering distance) (dBA)											
			5 m	10 m	20 m	50 m	100 m	150 m	200 m	300 m	500 m	750 m	1000 m	2000 m
Auger Drill Rig	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Backhoe	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Chain Saw	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Compactor (ground)	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Compressor (air)	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Concrete Batch Plant	No	117.7	92.7	86.7	80.6	72.7	66.7	63.1	60.6	57.1	52.7	49.2	46.7	40.6
Concrete Mixer Truck	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Concrete Pump Truck	No	116.7	91.7	85.7	79.6	71.7	65.7	62.1	59.6	56.1	51.7	48.2	45.7	39.6
Concrete Saw	No	124.7	99.7	93.7	87.6	79.7	73.7	70.1	67.6	64.1	59.7	56.2	53.7	47.6
Crane	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Dozer	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Drill Rig Truck	No	118.7	93.7	87.7	81.6	73.7	67.7	64.1	61.6	58.1	53.7	50.2	47.7	41.6
Drum Mixer	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Dump Truck	No	118.7	93.7	87.7	81.6	73.7	67.7	64.1	61.6	58.1	53.7	50.2	47.7	41.6
Excavator	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Flat Bed Truck	No	118.7	93.7	87.7	81.6	73.7	67.7	64.1	61.6	58.1	53.7	50.2	47.7	41.6
Front End Loader	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Generator	No	116.7	91.7	85.7	79.6	71.7	65.7	62.1	59.6	56.1	51.7	48.2	45.7	39.6
Generator (<25KVA, VMS Signs)	No	104.7	79.7	73.7	67.6	59.7	53.7	50.1	47.6	44.1	39.7	36.2	33.7	27.6
Grader	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Impact Pile Driver	Yes	129.7	104.7	98.7	92.6	84.7	78.7	75.1	72.6	69.1	64.7	61.2	58.7	52.6
Jackhammer	Yes	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Man Lift	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Mounted Impact Hammer	Yes	124.7	99.7	93.7	87.6	79.7	73.7	70.1	67.6	64.1	59.7	56.2	53.7	47.6

[5] Equipment list and Sound Power Level source: http://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/handbook09.cfm

Paver	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Pickup Truck	No	89.7	64.7	58.7	52.6	44.7	38.7	35.1	32.6	29.1	24.7	21.2	18.7	12.6
Pumps	No	111.7	86.7	80.7	74.6	66.7	60.7	57.1	54.6	51.1	46.7	43.2	40.7	34.6
Rivit Buster/Chipping Gun	Yes	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Rock Drill	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Roller	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Sand Blasting (single nozzle)	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Scraper	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Sheers (on backhoe)	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Slurry Plant	No	112.7	87.7	81.7	75.6	67.7	61.7	58.1	55.6	52.1	47.7	44.2	41.7	35.6
Slurry Trenching Machine	No	116.7	91.7	85.7	79.6	71.7	65.7	62.1	59.6	56.1	51.7	48.2	45.7	39.6
Soil Mix Drill Rig	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Tractor	No	118.7	93.7	87.7	81.6	73.7	67.7	64.1	61.6	58.1	53.7	50.2	47.7	41.6
Vacuum Excavator (Vac-Truck)	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Vacuum Street Sweeper	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Ventilation Fan	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Vibrating Hopper	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Vibratory Concrete Mixer	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Vibratory Pile Driver	No	129.7	104.7	98.7	92.6	84.7	78.7	75.1	72.6	69.1	64.7	61.2	58.7	52.6
Warning Horn	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Welder/Torch	No	107.7	82.7	76.7	70.6	62.7	56.7	53.1	50.6	47.1	42.7	39.2	36.7	30.6

4.2.3 Traffic

A significant source of noise during the construction phase is additional traffic to and from the site, as well as traffic on the site. This will include trucks transporting equipment and machinery, as well as contractors.

Construction traffic is expected to be generated throughout the entire construction period, however, the volume and type of traffic generated will be dependent upon the construction activities being conducted, which will vary during the construction period. Traffic however will not be considered in the scoping phase, but only in the EIA phase.

4.3 POTENTIAL NOISE SOURCES: OPERATIONAL PHASE

4.3.1 Operational activities

While the process is not yet defined, the following typical noise-generation activities are associated with coal mining activities:

- Surface preparation activities in front of the opencast pit(s) (vegetation removal and stripping of topsoil);
- Opencast activities;
    - Excavation of soft overburden,
    - Drilling and blasting of hard overburden,
    - Coal excavation and loading,
    - Hauling of overburden and coal,
    - Plant activities (crushing, screening, stockpiling and material movement).
- Plant activities near the ROM stockpile;
- Coal product management (stockpiling, siding activities); and,
- Railway activities.

Of these listed activities significant noise are associated with the most opencast and plant activities. Typical sound power levels associated with various activities that may be found at a opencast coal mine is presented in **Table 4.2**.

Table 4.2: Potential equivalent noise levels generated by various equipment

Equipment Description	Equivalent (average) Sound Levels (dBA)	Operational Noise Level at given distance considering equivalent (average) sound power emission levels (Cumulative as well as the mitigatory effect of potential barriers or other mitigation not included – simple noise propagation modelling only considering distance) (dBA)											
		5 m	10 m	20 m	50 m	100 m	150 m	200 m	300 m	500 m	750 m	1000 m	2000 m
Bulldozer CAT D10	111.9	86.9	80.9	74.9	66.9	60.9	57.4	54.9	51.3	46.9	43.4	40.9	34.9
Bulldozer CAT D11	113.3	88.4	82.3	76.3	68.4	62.3	58.8	56.3	52.8	48.4	44.8	42.3	36.3
Bulldozer CAT D9	111.9	86.9	80.9	74.9	66.9	60.9	57.4	54.9	51.3	46.9	43.4	40.9	34.9
Bulldozer CAT D6	108.2	83.3	77.3	71.2	63.3	57.3	53.7	51.2	47.7	43.3	39.8	37.3	31.2
Bulldozer CAT D5	107.4	82.4	76.4	70.4	62.4	56.4	52.9	50.4	46.9	42.4	38.9	36.4	30.4
Bulldozer Komatsu 375	114.0	89.0	83.0	77.0	69.0	63.0	59.5	57.0	53.4	49.0	45.5	43.0	37.0
Bulldozer Komatsu 65	109.5	84.5	78.5	72.4	64.5	58.5	54.9	52.4	48.9	44.5	41.0	38.5	32.4
Crusher/Screen (MTC Mobile)	109.6	84.6	78.6	72.6	64.6	58.6	55.1	52.6	49.0	44.6	41.1	38.6	32.6
Coal crushing plant (50 k tons)	114.5	89.5	83.5	77.5	69.5	63.5	60.0	57.5	54.0	49.5	46.0	43.5	37.5
Coal beneficiation plant	107.5	82.5	76.5	70.5	62.5	56.5	53.0	50.5	46.9	42.5	39.0	36.5	30.5
Coal silo (Material Transfer)	103.2	78.3	72.2	66.2	58.3	52.2	48.7	46.2	42.7	38.3	34.7	32.2	26.2
Coal Yard Equipment	106.8	81.8	75.8	69.8	61.8	55.8	52.3	49.8	46.3	41.8	38.3	35.8	29.8
Coal Screen	105.1	80.1	74.1	68.1	60.1	54.1	50.6	48.1	44.6	40.1	36.6	34.1	28.1
Diesel loco moving	108.7	83.7	77.7	71.7	63.7	57.7	54.2	51.7	48.2	43.7	40.2	37.7	31.7
Diesel loco idling	100.7	75.7	69.7	63.7	55.7	49.7	46.2	43.7	40.1	35.7	32.2	29.7	23.7
Diesel Generator (Large - mobile)	106.1	81.2	75.1	69.1	61.2	55.1	51.6	49.1	45.6	41.2	37.6	35.1	29.1
Drilling Machine	109.6	84.6	78.6	72.6	64.6	58.6	55.1	52.6	49.1	44.6	41.1	38.6	32.6
Diamond drilling rig	107.2	82.2	76.2	70.2	62.2	56.2	52.7	50.2	46.7	42.2	38.7	36.2	30.2
Dumper/Haul truck - CAT 700	115.9	91.0	85.0	78.9	71.0	65.0	61.4	58.9	55.4	51.0	47.5	45.0	38.9
Dumper/Haul truck - Terex 30 ton	112.2	87.2	81.2	75.2	67.2	61.2	57.7	55.2	51.7	47.2	43.7	41.2	35.2
Dumper/Haul truck - Bell 25 ton (B25D)	108.4	83.5	77.5	71.4	63.5	57.5	53.9	51.4	47.9	43.5	40.0	37.5	31.4
Excavator - Cat 416D	103.9	78.9	72.9	66.8	58.9	52.9	49.3	46.8	43.3	38.9	35.4	32.9	26.8
Excavator - Hitachi EX1200	113.1	88.1	82.1	76.1	68.1	62.1	58.6	56.1	52.6	48.1	44.6	42.1	36.1
Excavator - Hitachi 870 (80 t)	108.1	83.1	77.1	71.1	63.1	57.1	53.6	51.1	47.5	43.1	39.6	37.1	31.1
Excavator - Hitachi 270 (30 t)	104.5	79.6	73.5	67.5	59.6	53.5	50.0	47.5	44.0	39.6	36.0	33.5	27.5
FEL - Bell L1806C	102.7	77.7	71.7	65.7	57.7	51.7	48.2	45.7	42.1	37.7	34.2	31.7	25.7
FEL - CAT 950G	102.1	77.2	71.2	65.1	57.2	51.2	47.6	45.1	41.6	37.2	33.7	31.2	25.1

FEL - Komatsu WA380	100.7	75.7	69.7	63.7	55.7	49.7	46.2	43.7	40.1	35.7	32.2	29.7	23.7
General noise	108.8	83.8	77.8	71.8	63.8	57.8	54.2	51.8	48.2	43.8	40.3	37.8	31.8
General Noise - Construction (commercial)	96.5	71.6	65.6	59.5	51.6	45.6	42.0	39.5	36.0	31.6	28.1	25.6	19.5
Grader - Operational Hitachi	108.9	83.9	77.9	71.9	63.9	57.9	54.4	51.9	48.4	43.9	40.4	37.9	31.9
Grader	110.9	85.9	79.9	73.9	65.9	59.9	56.4	53.9	50.3	45.9	42.4	39.9	33.9
JBL TLB	108.8	83.8	77.8	71.8	63.8	57.8	54.3	51.8	48.3	43.8	40.3	37.8	31.8
Road Transport Reversing/Idling	108.2	83.3	77.2	71.2	63.3	57.2	53.7	51.2	47.7	43.3	39.7	37.2	31.2
Road Truck average	109.6	84.7	78.7	72.6	64.7	58.7	55.1	52.6	49.1	44.7	41.1	38.7	32.6
Screening plant (approx 50k tons)	105.5	80.6	74.6	68.5	60.6	54.6	51.0	48.5	45.0	40.6	37.0	34.6	28.5
Vibrating roller	106.3	81.3	75.3	69.3	61.3	55.3	51.8	49.3	45.8	41.3	37.8	35.3	29.3
Water Dozer, CAT	113.8	88.8	82.8	76.8	68.8	62.8	59.3	56.8	53.3	48.8	45.3	42.8	36.8

4.3.2 Traffic

A significant source of noise during the operational phase will be traffic to and from the site, traffic around the facility, coal transport (railway) and activities associated with waste management.

Traffic will not be considered in the scoping phase and only in the EIA phase once more details are available.

4.4 POTENTIAL NOISE SOURCES: CLOSURE PHASE

The closure of the facility would take place in some undetermined time in the future and could include:

- Demolishing of infrastructure;
- Loading, hauling, placing and shaping of waste and discard dumps;
- Shaping of any walls and berms;
- Loading, hauling, placing and shaping of topsoil (all disturbed areas, including stockpile sites and demolished infrastructure);
- Seeding of topsoil;
- Ripping and seeding of unnecessary roads; and
- Maintenance activities.

Closure will however not be considered during the Scoping phase, and only discussed in general during the EIA phase. This is because the noise impacts associated with the closure phase are normally less than both the construction and operational phases. The mine in addition will have to compile a closure Environmental Management Plan to be approved by the regulatory authorities before the start of closure activities. If necessary noise will be addressed in this report.

5 METHODOLOGY: CALCULATION OF NOISE LEVELS DURING THE ENVIRONMENTAL NOISE IMPACT ASSESSMENT PHASE

5.1 NOISE EMISSIONS INTO THE SURROUNDING ENVIRONMENT: MODEL USED

The noise model used for these calculations is defined in SANS 10357:2004. Known as the Concawe model it can considers the following:

- Noise emission characteristics in octaves of the noise sources;
- The number of noise sources;
- The distance between the receiver and the various noise sources;
- The impact of atmospheric absorption;
- The meteorological conditions in terms Pasquill stability;
- The operational details of the proposed project, such as projected areas where activities will be taking place;
- Acoustical characteristics of the ground;
- Potential reflections; and
- Height of receptor(s) and noise sources.

The noise emission into the environment due to additional traffic will be calculated using the sound propagation model described in SANS 10210. Corrections such as the following will be considered:

- Distance of receptor from the road;
- Road construction material;
- Average speeds of travel;
- Types of vehicles used;
- Ground acoustical conditions.

Unfortunately there is no standard or guideline in South Africa stipulating the requirements to calculate or model the potential noise impacts from a railway operation. For this purpose it was selected to make use of the United Kingdom Department of Transport document, "*Calculation of Railway Noise, 1995*". The methodology proposed in this document is illustrated in **Figure 5.1**. Railway data will be sourced from the report "Noise impact study for Environmental Impact Assessment: Establishment of the Sekoko Coal Loading Siding on various farms near Lephalale, Limpopo" and updated using the proposed railway alignment.

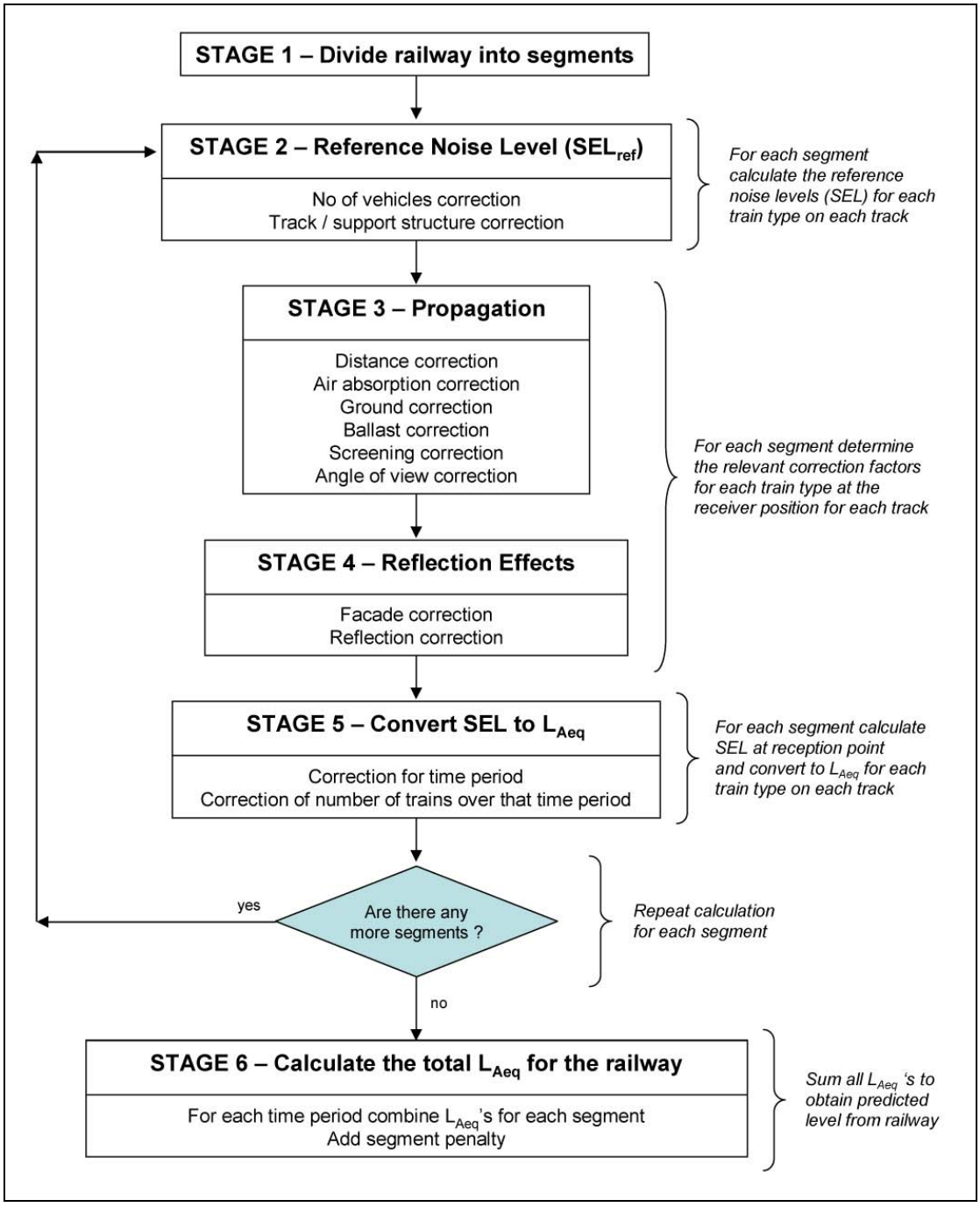

Figure 5.1: Flow diagram illustrating the methodology to calculate the noise from railways

6 METHODOLOGY TO BE FOLLOWED DURING THE ENVIRONMENTAL NOISE IMPACT ASSESSMENT: DETERMINING NOISE IMPACT ASSESSMENT AND SIGNIFICANCE

6.1 NOISE IMPACTS ON ANIMALS

Unfortunately there exist far less studies on the effects of noise on animals than on humans. However, a great deal of research was conducted in the 1960's and 1970's on the effects of aircraft noise on animals. Most of the studies however are highly relevant to other noise sources, including those associated with mining and industrial operations.

Overall, the research suggests that species differ in their response to:

- Various types of noise,
- Durations of noise,
- Sources of noise.

A general animal behavioural reaction to aircraft noise is the startle response. However, the strength and length of the startle response appears to be dependent on:

- which species is exposed,
- whether there is one animal or a group,
- whether there have been some previous exposures.

Unfortunately there are numerous other factors in the environment of animals that also influence the effects of noise. This includes predators, weather, changing prey/food base and ground-based disturbance, especially anthropogenic. This hinders the ability to define the real impact of noise on animals.

From this and other studies the following can be concluded:

- Animals respond to impulsive (sudden) noises (higher than 90 dBA) by running away. If the noises continue animals would try to relocate.
- Animals of all species exhibit adaptation with noise, including aircraft noise and sonic booms.
- More sensitive species would relocate to a more quiet area, especially species that depend on hearing to hunt or evade prey, or species that makes use of sound/hearing to locate a suitable mate.

- Noises associated with helicopters, motor- and quad bikes significantly impacts on animals.

6.1.1 Domestic Animals

It has been observed that most domestic animals are generally not bothered by noise, excluding most impulsive noises.

6.1.2 Wildlife

Noise impacts are also very highly species dependent. Studies showed that most animals adapt to noises, and would even return to a site after an initial disturbance, even if the noise continuous. The more sensitive animals that might be impacted by noise would most likely relocate to a more quiet area.

6.2 WHY NOISE CONCERNS COMMUNITIES

Noise can be defined as "unwanted sound", an audible acoustic energy that adversely affects the physiological and/or psychological well-being of people, or which disturbs or impairs the convenience or peace of any person. One can generalise by saying that sound becomes unwanted when it:

- Hinders speech communication,
- Impedes the thinking process,
- Interferes with concentration,
- Obstructs activities (work, leisure and sleeping),
- Presents a health risk due to hearing damage.

However, it is important to remember that whether a given sound is "noise" depends on the listener or hearer. The driver playing loud rock music on their car radio hears only music, but the person in the traffic behind them hears nothing but noise.

Response to noise is unfortunately not an empirical absolute, as it is seen as a multi-faceted psychological concept, including behavioural and evaluative aspects. For instance, in some cases annoyance is seen as an outcome of disturbances, in other cases it is seen as an indication of the degree of helplessness with respect to the noise source.

Noise does not need to be loud to be considered “disturbing”. One can refer to a dripping tap in the quiet of the night, or the irritating “thump-thump” of the music from a neighbouring house at night when one would like to sleep.

Severity of the annoyance depends on factors such as:

- Background sound levels, and the background sound levels the receptor is used to,
- The manner in which the receptor can control the noise (helplessness),
- The time, unpredictability, frequency distribution, duration, and intensity of the noise,
- The physiological state of the receptor,
- The attitude of the receptor about the emitter (noise source).

6.3 NOISE AND SLEEP DISTURBANCES

Research has concluded that humans need anywhere from six to eight hours of restful sleep per night to be able to maintain optimal health[6]. A few people can operate unaffected with five hours sleep.

However, electrophysiological and behavioral methods have demonstrated that both continuous and intermittent noises can lead to sleep disturbance. The more intense the noise (higher level), the more disturbing is its effect on sleep. Measurable effects on sleep start at background noise levels of about 30 dB L_{Aeq}.

Physiological effects include changes in the pattern of sleep stages, especially a reduction in the proportion of REM sleep. Subjective effects have also been identified, such as difficulty in falling asleep, perceived sleep quality, and adverse after-effects such as headache and tiredness. Sensitive groups mainly include elderly persons, babies and young children, shift workers and persons with physical or mental disorders.

Where noise is continuous, the equivalent sound pressure level should not exceed 30 dBA (10 dBA lower than SANS indoors maximum rating level) if negative effects on sleep are to be avoided. When the noise is composed of a large proportion of low-frequency sounds a still lower guideline value is recommended, because low-frequency noise (e.g. from ventilation systems) can disturb rest and sleep even at low sound pressure levels. It should be noted that the adverse effect of noise partly depends on the nature of the source. A special situation is for newborns in incubators, for which the noise can cause sleep disturbance and other health effects.

[6] WHO: 2009 (Night noise guidelines for Europe)

Even if the total equivalent noise level is fairly low, a small number of noise events with a high maximum sound pressure level will affect sleep. Studies indicate that sleep disturbances is directly related to the number of $L_{A,max}$ events that receptors are exposed, as well as the size of the event.

If the noise is not continuous, $L_{A,max}$ could be used to indicate the probability of noise-induced awakenings. Effects have been observed at individual $L_{A,max}$ exposures of 45 dB (indoors) or less. Consequently, it is important to limit the number of noise events with a $L_{A,max}$ exceeding 45 dB. Therefore, potential impacts should be evaluated on a combination of L_{Aeq} and $L_{A,max}$.

6.4 IMPACT ASSESSMENT CRITERIA

6.4.1 Overview: The common characteristics

The word "noise" is generally used to convey a negative response or attitude to the sound received by a listener. There are four common characteristics of sound, any or all of which determine listener response and the subsequent definition of the sound as "noise". These characteristics are:

- Intensity,
- Loudness,
- Annoyance, and
- Offensiveness

Of the four common characteristics of sound, intensity is the only one which is not subjective and can be quantified. Loudness is a subjective measure of the effect sound has on the human ear. As a quantity it is therefore complicated but has been defined by experimentation on subjects known to have normal hearing.

The annoyance and offensive characteristics of noise are also subjective. Whether or not a noise causes annoyance mostly depends upon its reception by an individual, the environment in which it is heard, the type of activity and mood of the person and how acclimatised or familiar that person is to the sound.

6.4.2 Annoyance associated with industrial activities

Annoyance is the most widely acknowledged effect of environmental noise exposure, and is considered to the most widespread. It is estimated that less than a third of the individual noise annoyance is accounted for by acoustic parameters, and that non-acoustic factors plays a major role. Non-acoustic factors that have been identified

include age, economic dependence on the noise source, attitude towards the noise source and self-reported noise sensitivity.

On the basis of a number of studies into noise annoyance, exposure-response relationships were derived for high annoyance from different noise sources. These relationships, illustrated in **Figure 6.1**, are recommended in an European Union position paper published in 2002, stipulating policy regarding the quantification of annoyance

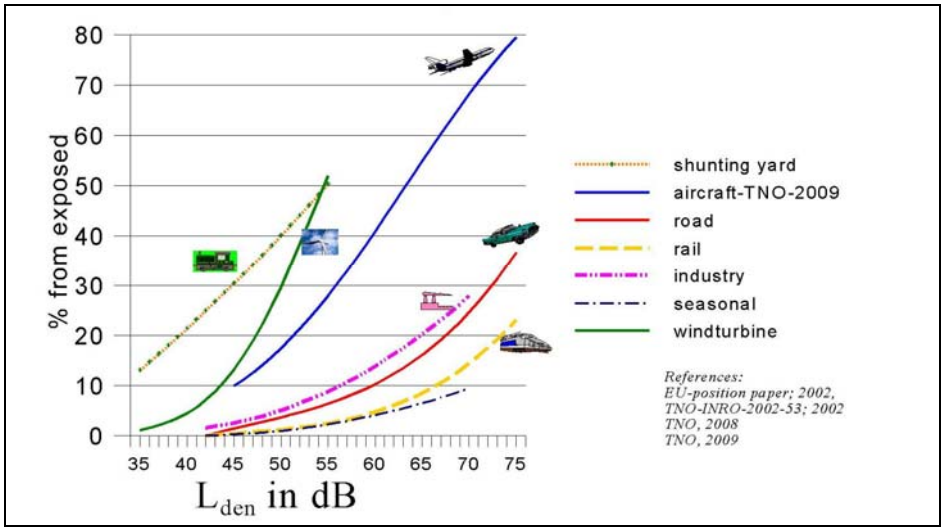

Figure 6.1: Percentage of annoyed persons as a function of the day-evening-night noise exposure at the façade of a dwelling

This can be used in Environmental Health Impact Assessment and cost-benefit analysis to translate noise maps into overviews of the numbers of persons that may be annoyed, thereby giving insight into the situation expected in the long term. It is not applicable to local complaint-type situations or to an assessment of the short-term effects of a change in noise climate.

6.4.3 Noise criteria of concern

The criteria that will be used to determine the significance of the noise impact during the EIA phase were drawn from the criteria for the description and assessment of environmental impacts from the EIA Regulations, published by the Department of Environmental Affairs (April 1998) in terms of the NEMA, SANS 10103 as well as guidelines from the World Health Organization.

There are number of criteria that are of concern for the assessment of noise impacts. These can be summarised in the following manner:

- *Increase in noise levels:* People or communities often react to an increase in the ambient noise level they are used to, which is caused by a new source of noise.

With regards to the Noise Control Regulations (promulgated in terms of the ECA), an increase of more than 7 dBA is considered a disturbing noise. This is also the criteria promoted to define the potential on potentially sensitive receptors. See also **Figure 6-2**.

- *Zone Sound Levels:* Also referred as the acceptable rating levels, it sets acceptable noise levels for various areas. See also **Table 6.1**.
- *Absolute or total noise levels:* Depending on their activities, people generally are tolerant to noise up to a certain absolute level, e.g. 65 dBA. Anything above this level will be considered unacceptable.

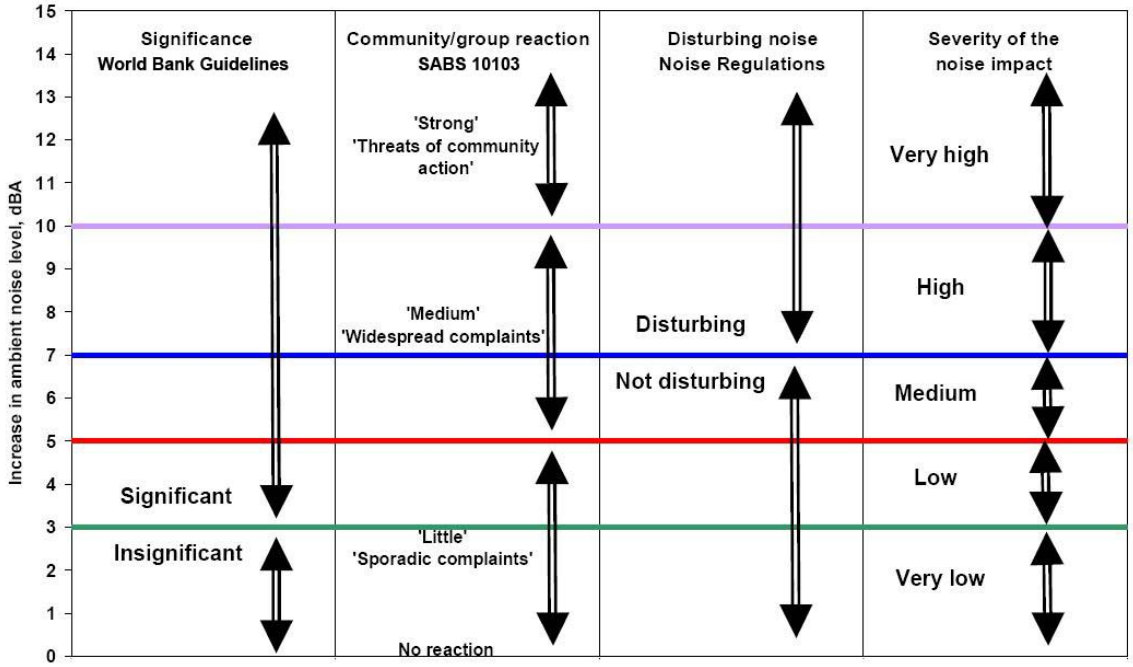

Figure 6-2: Criteria to assess the significance of impacts stemming from noise

In South Africa the document that addresses the issues concerning environmental noise is SANS 10103 (see **Table 6.1**). It provides the maximum average background ambient sound levels, $L_{Req,d}$ and $L_{Req,n}$, during the day and night respectively to which different types of developments may be exposed. Based on onsite measurements, considering both the $L_{Aeq,10min}$ and L_{A90} measurements, the ambient sound levels on and around the proposed activity correspond to the rating levels for an rural area. Zone Sound Levels therefore used would be:

- Day (06:00 to 22:00) - $L_{Req,d}$ = 45 dBA, and
- Night (22:00 to 06:00) - $L_{Req,n}$ = 35 dBA.

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

- **Δ ≤ 3 dBA:** An increase of 3 dBA or less will not cause any response from a community. It should be noted that for a person with average hearing acuity, an increase of less than 3 dBA in the general ambient noise level would not be noticeable.
- **3 < Δ ≤ 5 dBA:** An increase of between 3 dBA and 5 dBA will elicit 'little' community response with 'sporadic complaints'. People will just be able to notice a change in the sound character in the area.
- **5 < Δ ≤ 15 dBA:** An increase of between 5 dBA and 15 dBA will elicit a 'medium' community response with 'widespread complaints'. In addition, an increase of 10 dBA is subjectively perceived as a doubling in the loudness of a noise. For an increase of more than 15 dBA the community reaction will be 'strong' with 'threats of community action'.

Table 6.1: Acceptable Zone Sound Levels for noise in districts (SANS 10103)

1	2	3	4	5	6	7
Type of district	**Equivalent continuous rating level ($L_{Req.T}$) for noise,** dBA					
	Outdoors			**Indoors, with open windows**		
	Day-night $L_{R,dn}$[a]	**Day-time $L_{Req,d}$[b]**	**Night-time $L_{Req,n}$[b]**	**Day-night $L_{R,dn}$[a]**	**Day-time $L_{Req,d}$[b]**	**Night-time $L_{Req,n}$[b]**
RESIDENTIAL DISTRICTS						
a) Rural districts	45	45	35	35	35	25
b) Suburban districts with little road traffic	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
NON RESIDENTIAL DISTRICTS						
d) Urban districts with some workshops, with business premises, and with main roads	60	60	50	50	50	40
e) Central business districts	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50

In addition, the number of $L_{A,max}$ events above 60 dBA (60 dBA outside, 45 dBA inside a dwelling assuming 15 dBA attenuation) should be identified and where possible defined, to confirm whether there exist a risk of loud noises that could result in sleep disturbances. Where identified, management measures should be considered to minimize the significance of this impact.

6.4.4 Determining the Significance of the Noise Impact

The level of detail as depicted in the EIA regulations was fine-tuned by assigning specific values to each impact. In order to establish a coherent framework within which all impacts could be objectively assessed, it was necessary to establish a rating system, which was applied consistently to all the criteria. For such purposes each aspect was assigned a value as defined in the third column in the tables below.

The impact consequence is determined by the summing the scores of Magnitude (**Table 6.2**), Duration (**Table 6.3**) and Spatial Extent (**Table 6.4**). The impact significance (see **sections 6.4.5** and **6.4.6**) is determined by multiplying the Consequence result with the Probability score (**Table 6.5**).

An explanation of the impact assessment criteria is defined in the following tables.

Table 6.2: Impact Assessment Criteria - Magnitude

This defines the impact as experienced by any receptor. In this report the receptor is defined as any resident in the area, but excludes faunal species.		
Rating	**Description**	**Score**
Low	No change in ambient sound levels discernable (less than 3 dBA) Total projected noise level is less than the Zone Sound Level in wind-still conditions.	2
Low Medium	Increase in average sound pressure levels between 3 and 5 dB from the ambient sound level. The change is barely discernable, but the noise source might become audible.	4
Medium	Increase in average sound pressure levels between 5 and 7 dB from the ambient sound level. Sporadic complaints expected. Any point where the zone sound levels are exceeded.	6
High	Increase in average sound pressure levels between 7 and 10 dB from the ambient sound level. Medium to widespread complaints expected.	8
Very High	Increase in average sound pressure levels higher than 7 dBA from the ambient sound level. Change of 10 dBA is perceived as 'twice as loud', leading to widespread complaints and even threats of community or group action. Any point where noise levels exceed 65 dBA at any receptor.	10

Table 6.3: Impact Assessment Criteria - Duration

The lifetime of the impact that is measured in relation to the lifetime of the proposed development (construction, operational and closure phases). Will the receptors be subjected to increased noise levels for the lifetime duration of the project, or only infrequently.		
Rating	**Description**	**Score**
Temporary	Impacts are predicted to be of short duration (portion of construction period) and intermittent/occasional.	1
Short term	Impacts that are predicted to last only for the duration of the construction period.	2
Long term	Impacts that will continue for the life of the Project, but ceases when the Project stops operating.	4
Permanent	Impacts that cause a permanent change in the affected receptor or resource (e.g. removal or destruction of ecological habitat) that endures substantially beyond the Project lifetime.	5

Table 6.4: Impact Assessment Criteria – Spatial extent

Classification of the physical and spatial scale of the impact		
Rating	**Description**	**Score**
Site	The impacted area extends only as far as the activity, such as footprint occurring within the total site area.	1
Local	The impact could affect the local area (within 1,000 m from site).	2
Regional	The impact could affect the area including the neighbouring farms, the transport routes and the adjoining towns.	3
National	The impact could have an effect that expands throughout the country (South Africa).	4
International	Where the impact has international ramifications that extend beyond the boundaries of South Africa.	5

Table 6.5: Impact Assessment Criteria - Probability

This describes the likelihood of the impacts actually occurring, and whether it will impact on an identified receptor. The impact may occur for any length of time during the life cycle of the activity, and not at any given time. The classes are rated as follows:		
Rating	**Description**	**Score**
Improbable	The possibility of the impact occurring is none, due either to the circumstances, design or experience. The chance of this impact occurring is zero (0 %).	1
Possible	The possibility of the impact occurring is very low, due either to the circumstances, design or experience. The chances of this impact occurring is defined to be up to 25 %.	2
Likely	There is a possibility that the impact will occur to the extent that provisions must therefore be made. The chances of this impact occurring is defined to be between 25% and 50 %.	3
Highly Likely	It is most likely that the impacts will occur at some stage of the development. Plans must be drawn up before carrying out the activity. The chances of this impact occurring is defined to be between 50 % to 75 %.	4
Definite	The impact will take place regardless of any prevention plans, and only mitigation actions or contingency plans to contain the effect can be relied on. The chance of this impact occurring is defined to be between 75% and 100 %.	5

6.4.5 Identifying the Potential Impacts without Mitigation Measures (WOM)

Following the assignment of the necessary weights to the respective aspects, criteria are summed and multiplied by their assigned probabilities, resulting in a value for each impact (prior to the implementation of mitigation measures).

Significance without mitigation is rated on the following scale:

SR < 30	Low (L)	Impacts with little real effect and which should not have an influence on or require modification of the project design or alternative mitigation. No mitigation is required.
30 < SR < 60	Medium (M)	Where it could have an influence on the decision unless it is mitigated. An impact or benefit which is sufficiently important to require management. Of moderate significance - could influence the decisions about the project if left unmanaged.
SR > 60	High (H)	Impact is significant, mitigation is critical to reduce impact or risk. Resulting impact could influence the decision depending on the possible mitigation. An impact which could influence the

		decision about whether or not to proceed with the project.

6.4.6 Identifying the Potential Impacts with Mitigation Measures (WM)

In order to gain a comprehensive understanding of the overall significance of the impact, after implementation of the mitigation measures, it will be necessary to re-evaluate the impact. Significance with mitigation is rated on the following scale:

SR < 30	Low (L)	The impact is mitigated to the point where it is of limited importance.
30 < SR < 60	Medium (M)	Notwithstanding the successful implementation of the mitigation measures, to reduce the negative impacts to acceptable levels, the negative impact will remain of significance. However, taken within the overall context of the project, the persistent impact does not constitute a fatal flaw.
SR > 60	High (H)	The impact is of major importance. Mitigation of the impact is not possible on a cost-effective basis. The impact is regarded as high importance and taken within the overall context of the project, is regarded as a fatal flaw. An impact regarded as high significance, after mitigation could render the entire development option or entire project proposal unacceptable.

6.4.7 Management and Mitigation Measures

Once the mitigation prediction has been conducted the management and mitigation measures can be developed. The criteria used for prescribing and designing management measures for mitigation has been adopted from the Council on Environmental Quality Regulations (1998) and includes the measures defined in **Table 6.6**.

Table 6.6: Management Measures criteria

Management Measures	
Avoidance	Mitigation by not carrying out the proposed activity, or the unacceptable parts of the proposed activity.
Minimisation	Mitigation by scaling down the magnitude of a project, reorienting the layout of the project or employing technology or management measures that reduces the factors generating the undesirable environmental impact.
Compensation	Mitigation through they relocation of potential affected parties. This step should only be considered after all steps above have been completed.

7 CONCLUSIONS AND RECOMMENDATIONS

This report is a Scoping Noise Assessment of the predicted noise environment due to the development of a proposed coal mine west of the town of Lephalale in Limpopo Province, making use of a sound propagation model to identify potential noise issues of concern that would need further investigation.

With the preliminary input data as used, this assessment indicated that:

- Considering maximum noise emission levels, that the construction activities could be audible over a distance of more than 2,000 meters (refer **Table 4.1**). These levels were higher than the equivalent ambient sound levels recorded on the site;
- Considering equivalent (average) noise emission levels, activities could influence the ambient sound levels over a distance greater than 2,000 meters (refer **Table 4.2**).

A potential risk exist that a noise impact could occur and it is recommended that the noise impact be investigated in more detail during the Environmental Impact Assessment phase.

Additional information required would be:

- Exact location of the various activities (i.e. opencast areas, plant areas, haul roads, siding alignment, etc.). In the case of equipment installed on buildings/structures the height of these equipment will be required.
- Project design (which equipment will be in buildings, what materials will be used to build these buildings).
- A more accurate description of equipment to be used in and around the proposed facility. This would include data such as the type of equipment, but also the number of that equipment to be used, focusing specifically on noisy activities such as crushers and screens;
- Alignment of various roads and projected routes that equipment and material/coal will use
- Quantity of coal hauled and transported to markets; and
- Locations of any significant (higher than 5 meters) berms, stockpiles and dumps.

Information not provided or available will be estimated using internet sources.

8 TERMS OF REFERENCE FOR THE ENVIRONMENTAL NOISE IMPACT PHASE

Work that will take place during the Environmental Noise Impact Assessment phase is defined in section 8 of SANS 10328:2008.

8.1 PURPOSE OF THE ENVIRONMENTAL NOISE IMPACT ASSESSMENT

The purpose of an environmental noise impact investigation and assessment is to determine and quantify the acoustical impact of, or on a proposed development.

8.2 PLAN OF STUDY FOR ENVIRONMENTAL NOISE IMPACT INVESTIGATION AND ASSESSMENT

In this regard the following will be included to assist the EAP in the compilation of the Plan of Study (PoS) for the EIA:

- Data (location of equipment/activities, type of equipment/noise-generation activities, number of equipment or activities that simultaneously could generate noise) as received from the developer will be used to model the potential noise impact.
- The potential impact will be evaluated (where possible) in terms of the nature (description of what causes the effect, what/who might be affected and how it/they might be affected) as well as the extent of the impact.
- The potential significance of the identified issues will be calculated based on the evaluation of the issues/impacts.
- The development of an Environmental Management Plan and a proposal of potential mitigation measures (if required).
- Recommendations.

8.3 ENVIRONMENTAL NOISE IMPACT INVESTIGATION

8.3.1 Sound emission from the identified noise sources

Sound emission data of equipment as provided by the developer would be used to calculate the potential noise emissions. In the instance that this data is unavailable, worst-case sound emission data as measured or available from databases will be used.

The operating cycle and nature of the sound emission (impulsiveness, tonal character or potential low frequencies) would, where relevant, be considered when the expected rating level in the target area is calculated.

8.3.2 Determination of Rating levels

The Concawe noise- propagation model defined in SANS 10357:2004 will be used to model the noise levels for both the construction and operational phases.

Other input parameters used would be as defined in **section 4.1**.

8.3.3 Assessment of the noise impact: No mitigation

The significance will be determined considering the defined magnitude of the noise level, the extent as well as the duration of the projected noise impact, as well as the probability that this impact may take place.

The magnitude of the noise impact will be assessed by considering:

- The total projected cumulative noise level compared to the appropriate acceptable rating levels as defined in table 2 of SANS 10103:2008.
- The potential community response from table 5 of SANS 10103:2008. In addition, other relevant and suitable literature may be consulted as defined in the scoping report. In particular the likely ambient sound levels due to wind induced noises will be estimated at the wind speed under investigation and considered.
- Projected noise levels considering the likely and projected ambient sound levels.

8.3.4 Assessment of the noise impact: Implementation of mitigation measures

Should the significance of the impact be high, the potential significance will be recalculated considering that the developer would be implementing reasonable mitigation measures.

8.4 ENVIRONMENTAL NOISE IMPACT REPORT

The Environmental Noise Impact Report will cover the following points:

- the purpose of the investigation;
- a brief description of the planned development or the changes that are being considered;

- a brief description of the existing environment including, where relevant, the topography, surface conditions and meteorological conditions during measurements;
- the identified noise sources together with their respective sound pressure levels or sound power levels (or both) and, where applicable, the operating cycles, the nature of sound emission, the spectral composition and the directional characteristics;
- the identified noise sources that were not taken into account and the reasons as to why they were not investigated;
- the identified Potentially Sensitive Receptors and the noise impact on them;
- where applicable, any assumptions, with references, made with regard to any calculations or determination of source and propagation characteristics;
- an explanation, either by a brief description or by reference, of all measuring and calculation procedures that were followed, as well as any possible adjustments to existing measuring methods that had to be made, together with the results of calculations;
- an explanation, either by description or by reference, of all measuring or calculation methods (or both) that were used to determine existing and predicted rating levels, as well as other relevant information, including a statement of how the data were obtained and applied to determine the rating level for the area in question;
- the location of measuring or calculating points in a sketch or on a map;
- quantification of the noise impact with, where relevant, reference to the literature consulted and the assumptions made;
- alternatives that were considered and the results of those that were investigated;
- a list of all the interested or affected parties that offered any comments with respect to the environmental noise impact investigation (if comments are received);
- a detailed summary of all the comments received from interested or affected parties as well as the procedures and discussions followed to deal with them (if comments are received);
- conclusions that were reached;
- proposed recommendations including potential mitigation measures;
- any follow-up investigation which should be conducted at completion of the project as well as at regular intervals after the commissioning of the project so as to ensure that the recommendations of this report will be maintained in the future.

9 THE AUTHOR

The author of this report, M. de Jager (B. Ing (Chem), UP) graduated in 1998 from the University of Pretoria. He has been interested in acoustics as from school days, doing projects mainly related to loudspeaker enclosure design. Interest in the matter brought him into the field of Environmental Noise Measurement, Prediction and Control. As from 2007 he has been involved with the following projects:

- Full Noise Impact Studies for a number of Wind Energy Facilities, including: Cookhouse I and II, Amakhala Emoyeni, Dassiesfontein/Klipheuwel, Rheboksfontein, AB, Dorper, Suurplaat, Gouda, Riverbank, Oyster Bay, Walker Bay, De Aar, Loeriesfontein, Noupoort, Prieska, Deep River, West Coast, Happy Valley, Canyon Springs, Tsitsikamma WEF, West Coast One, Kleinzee, Karoo and Project Blue.
- Full Noise Impact Studies for a number of mining projects, including: Skychrome (Pty) Ltd (A Ferro-chrome mine), Mooinooi Chrome Mine (WCM), Buffelsfontein East and West (WCM), Elandsdrift (Sylvania), Jagdlust Chrome Mine (ECM), Der Brochen, Apollo Brick (Pty) Ltd (Clay mine and brick manufacturer), Arthur Taylor Expansion project (X-Strata Coal SA), Klipfontein Colliery (Coal mine), Imbabala Coal, AurexGold, Sephaku Limestone Mine, Sekoko Railway Siding, Verkeerdepan Expansion, Schoongezicht Coal, WPB Colliery, Landau Expansion project (Coal mine).
- A number of Scoping Reports, smaller Noise Impact Assessments, Noise Monitoring Projects, Screening Investigations as well as project reviews.

The author is an independent consultant to the project, the developer as well as Savannah Environmental (Pty) Ltd. He,

- does not and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations
- have and will not have no vested interest in the proposed activity proceeding
- have no and will not engage in conflicting interests in the undertaking of the activity
- undertake to disclose all material information collected, calculated and/or findings, whether favourable to the developer or not
- will ensure that all information containing all relevant facts be included in this report.

10 REFERENCES

In this report reference was made to the following documentation:

1. Radle, Autumn Lyn (2001). *The Effect of Noise on Wildlife: A Literature Review.* World Forum for Acoustic Ecology, University of Oregon.
2. Noise Quest, *How does noise affect domestic animals and wildlife?*, http://www.noisequest.psu.edu/pmwiki.php?n=NoiseAffect.Animals
3. Norton, M.P. and Karczub, D.G. (2003): *Fundamentals of Noise and Vibration Analysis for Engineers, Second Edition*
4. SANS 0103:2004. '*The measurement and rating of environmental noise with respect to annoyance and to speech communication*'.
5. SANS 0210:2004. '*Calculating and predicting road traffic noise*'.
6. SANS 10357:2004. '*The calculation of sound propagation by the Concave method*'.
7. SANS 10328:2003. '*Methods for environmental noise impact assessments*'.
8. WHO, 1999: Guidelines for Community Noise, Geneva

End of report.