ENVIRONMENTAL NOISE IMPACT ASSESSMENT FOR THE PROPOSED OLIPHANT ESTATE, PORTION 18 OF FARM ROODE PAN 70, KIMBERLEY, NORTHERN CAPE PROVINCE

PREPARED FOR

PREPARED BY

Head Office
Stand 616 Unit 4 Meintje Business Park
Plot 5 Sandpark, Corner Malibongwe Drive and Tennessee Drive
Kyasands Ext 97
Johannesburg 2169

Tel | +27 10 823 2292
Cell | +27 72 256 3230
Fax | 086 2703976
Website: www.uskconsulting.com

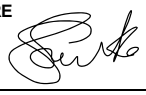
DOCUMENT CONTROL SHEET

Client:	Alleyroads Projects and Civils (Pty) Ltd
Report Title:	Environmental Noise Impact Assessment for The Proposed Oliphant Estate, Portion 18 Of Farm Roode Pan 70, Kimberley, Northern Cape Province.
Report No:	C22_08/01
Version:	**FINAL REPORT**
Date Issued:	Oct 2022

DOCUMENT DISTRIBUTION:

Copy	Type	Recipient	Organization
1	PDF/Email	Dean Gounden	Alleyroads
2	PDF/Email	Gesan Govender	Envirolution Consulting

Note: Electronic copies of this report are issued in portable document format and distributed via one of the following media; CD-ROM, Email or Internet Secure Server. Copies held by USK Consulting are stored on mass storage media archive. Further copies will be distributed on CD-ROM

	Prepared By	Reviewed By	Approved By
TECHNICAL	NAME Gladys NN Sonko	NAME Steve Kalule (PhD/ Pr.Sc.Nat)	NAME Grace Mbabazi
	SIGNATURE 	SIGNATURE 	SIGNATURE 
DATE **Oct 2022**	DESIGNATION **Electronics/Noise Engineer**	DESIGNATION **Environmental Engineer/**	DESIGNATION **Director**

ATTESTED TO BY

Gladys Sonko (MSc. Electronic Engineering, UCT)
Certificate of Environmental Noise Measurements,
Institute of Acoustics, University of Liverpool

USK Consulting Africa
P. O. Box 1018 Ruimsig, 1739
Email: jhboffice@uskconsulting.com
Web: www.uskconsulting.com

DECLARATION OF INTEREST

This report has been professionally independently prepared by USK Consulting a South African Professional Consulting firm, with a team of professionals specializing in several environmental science and environmental engineering fields.

Company Contact Details

Head Office
Physical Address: Unit 4 Meintjes Busines Park, Malibongwe Drive/ Tennesse Ave, Kya Sands 2169
Telephone Number: (011) 704 6433
Fax Number: (086) 2703679
E-mail: kkalule@uskconsulting.com

DECLARATION INTEREST. I hereby declare that to the best of my knowledge USK nor any of its members and consultants does not have any Interest in the project or associated projects. I undertake to inform the responsible representative of the client of any change in this information or any new information that needs to be reported, which occurs before or during the meeting or work itself and through the period up to the publication of the final report.

Date: 06 October 2022 Signature 

Name Email Telephone

DISCLAIMER

The findings within this report are relevant to the period during the commission and should not be relied on to represent conditions later. The opinions included herein are based on information obtained during this study and USK experience of similar facilities. If additional information becomes available which might alter our conclusions, we reserve the right to review such information, reassess the potential concerns, and modify our opinions, if warranted. If this assessment has referenced reports prepared by other third parties, it must be recognized that USK has no responsibility for the accuracy of information contained therein. Representative product outputs have been prepared within the timescales and agreed budget for the commission. Some site-specific information is based on statements provided by nominated site personnel (anecdotal) without further verification This assessment has been undertaken with the assumption that the site will remain in its current use and configuration.

ENVIRONMENTAL NOISE IMPACT ASSESSMENT FOR THE PROPOSED OLIPHANT ESTATE, PORTION 18 OF FARM ROODE PAN 70, KIMBERLEY, NORTHERN CAPE PROVINCE

Contents

Figures

Tables

GLOSSARY OF TERMS AND ABBREVIATIONS

The glossary of technical terminology below is useful for the correct interpretation of this report.

Ambient Noise: The all-encompassing sound at a point being composed of sounds from many sources both near and far. It includes noise from the noise source under investigation.

Annoyance: A negative response to a condition which creates dissatisfaction or interrupts specific activities.

Decibel (dB): The decibel is the basic unit of noise measurement. It relates to the cyclical changes in pressure created by the sound and operates on a logarithmic scale, ranging upwards from 0 dB. 0 dB is equivalent to the normal threshold of hearing at a frequency of 1000 Hz. Each increase of 3 dB on the scale represents a doubling of the sound pressure and is typically the minimum noticeable change in sound level under typical listening conditions. For example, whilst an increase in noise level from 32 dB to 35 dB represents a doubling of sound pressure, this change would only just be noticeable to the majority of listeners.

dB(A): Environmental noise levels are usually discussed in terms of dB(A). This is known as the A-weighted sound pressure level, and indicates that a correction factor has been applied, which corresponds to the human ear's response to sound across the range of audible frequencies. The ear is most sensitive in the middle range of frequencies (around 1000-3000 Hertz (Hz)), and less sensitive at lower and higher frequencies. The A-weighted noise level is derived by analyzing the level of a sound at a range of frequencies and applying a specific correction factor for each frequency before calculating the overall level. In practice this is carried out automatically within noise measuring equipment by the use of electronic filters, which adjust the frequency response of the instrument to mimic that of the ear.

Impulsive sound: sound characterized by brief sound pressure impulses that exceed the residual noise significantly.

LAeq, t: This term is known as the A-weighted equivalent continuous sound pressure level for a period, t. It is like an average and represents the sound pressure level of a steady sound that has, over a given period, the same energy as the fluctuating sound in question.

LAF90: Refers to those A-weighted noise levels in the lower 90 percentile of the sampling interval; it is the level which is exceeded for 90% of the measurement period. It will therefore exclude the intermittent features of traffic and is used to describe a background level. Measured using the "Fast" time weighting.

LAF10: Refers to those A-weighted noise levels in the top 10 percentile of the sampling interval; it is the level which is exceeded for 10% of the measurement period. It is used to determine the intermittent high noise level features of locally generated noise and usually gives an indicator of the level of trains. Measured using the "Fast" time weighting.

LAFmax: The maximum RMS A-weighted sound pressure level occurring within a specified time period. Measured using the "Fast" time weighting.

Lden: The Lden (Day Evening Night Sound Level) is the average sound level over a 24-hour period, with a penalty of 5 dB added for the evening hours or 19:00 to 22:00, and a penalty of 10 dB added for the night-time hours of 22:00 to 07:00

Lday: is the A-weighted long-term average sound level as defined in ISO 1996-2, determined over all day periods of a year.

Low frequency noise: Sounds containing a dominant proportion of total energy at frequencies below 100 Hz.

$L_{R, dn}$: This term is known as the equivalent continuous day/night rating level. This is the A-weighted equivalent continuous sound pressure level during a reference time interval of 24 hours. It also includes additional corrections for tonality and impulsivity.

$L_{Req, T}$: This term is known as the equivalent continuous rating level. This is the A- weighted equivalent continuous sound pressure level during a specified time interval. It also includes additional corrections for tonality and impulsivity.

Noise: Unwanted sound. May refer to both natural (e.g. wind, birdsong etc.) and artificial sounds (e.g. traffic, noise from wind turbines, etc.)

Noise contour plot: A diagram showing lines of equal sound levels (isobels) in a similar manner to height contours on an Ordnance Survey map or isobars (lines of equal pressure) on a weather map.

Noise sensitive receptors: Locations that may potentially be adversely affected by the addition of a new source of noise, such as residential properties.

Residual noise: Totally encompassing sound of situation, composed of many sources both near and far, excluding noise under investigation.

Sound power level (L_W): Sound power measured on the decibel scale, relative to a reference value (Wo) of 10-12 W.

Sound pressure (P): The fluctuations in pressure relative to atmospheric pressure, measured in Pascals (Pa).

Sound pressure level (L_p): Sound pressure measured on the decibel scale, relative to a sound pressure of 2 x 10-5 Pa.

Time Weighting: Fast, Slow and Impulse time weightings determine the speed at which a sound level meter responds to changing noise levels. All levels specified in this assessment relate to a Fast time weighting.

1. INTRODUCTION

USK Consulting Africa (Pty) Ltd was appointed by AlleyRoads Projects & Civils (Pty) Ltd to perform a specialist study, the Environmental Noise Impact Assessment for the proposed Oliphant Estate, located on portion 18 of Farm Roode Pan 70, Kimberley, Northern Cape Province.

1.1 Description of the Proposed Development

The proposed project involves the construction and development of a mixed-use housing estate consisting of development areas 1 to 4 with associated infrastructure and bulk services, including the following land uses:

Table 1 Development Area 1 (38.18 Hectares)

Land Use type	Number of sites (erven)
Residential 3	2
Residential 4	10
Tank Rank	1
Business	1

Table 2 Development Area 2 (23.57 Hectares)

Land Use type	Number of sites (erven)
Residential 1	176
Residential 3	1
Residential 4	6
Conservation	1

Table 3 Development Area 3 (49.97 Hectares)

Land Use type	Number of sites (erven)
Conservation	1

Table 4 Development Area 4 (42.75 Hectares)

Land Use type	Number of sites (erven)
Conservation	1
Open Spaces	2
Conservation	3

The proposed project will be developed on a parcel of land approximately 38.18 Ha (Area 1), 23.57 Ha (Area 2), 47.97 Ha (Area 3) and 42.75 Ha (Area 4). The development is located along Midlands Road to the west opposite the township, located on the northern edge of Kimberly town. The site is also bounded by a rail line to the east, as shown in the site layout plan Figure 1.

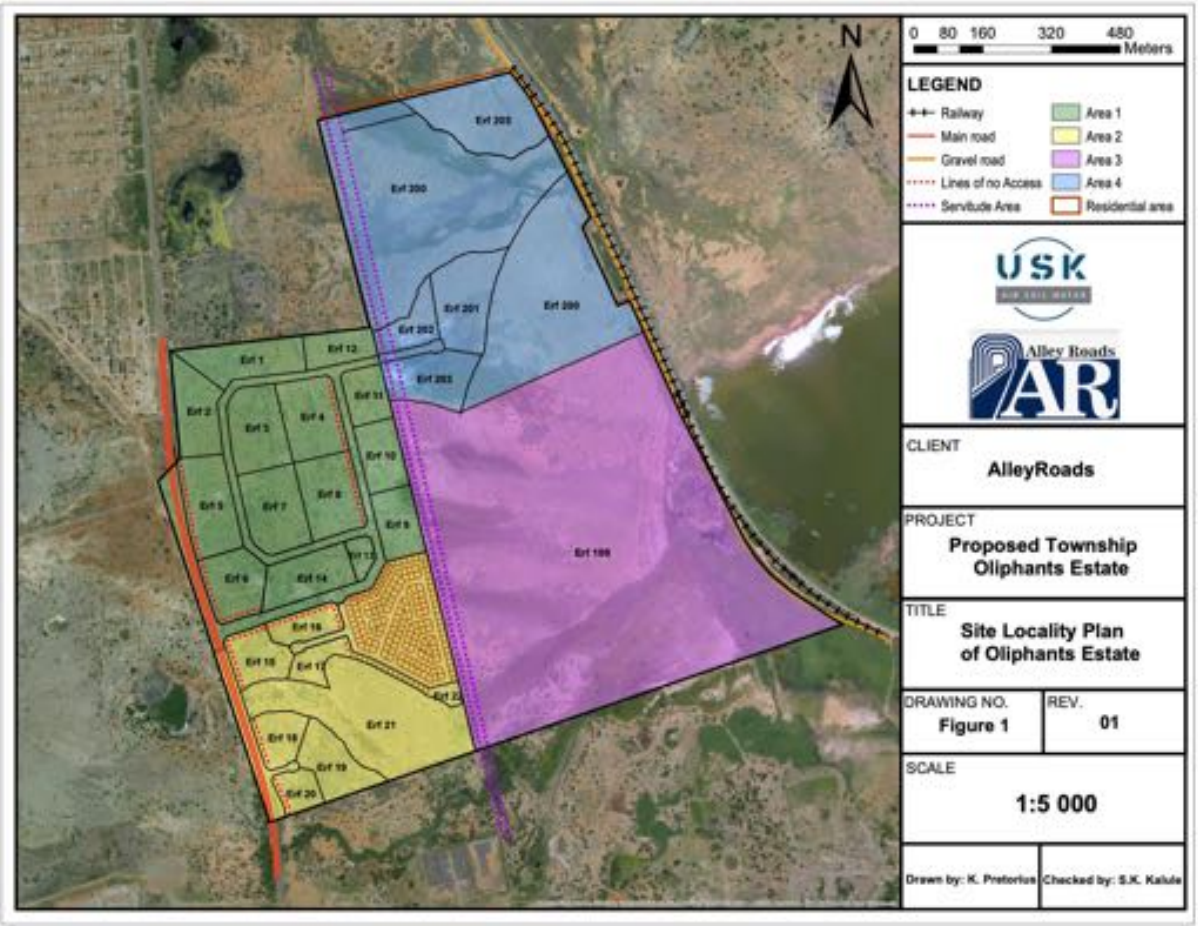


Figure 1 Development Site Locality Map and Development Plan

1.2 Purpose of this report

The purpose of this report is to use guidance from South African National Standards and assessment methodologies as well as other international best practice pertaining to environmental noise to assess potential noise impacts on the proposed developments. This report will include the following:

- Review of the relevant content of the standards that will be used for the inward noise impact assessment.
- Comment on the predicted noise levels across the site, and.
- Recommend mitigation measures during construction and operation to be put in place that will be considered in relation to the levels of noise at the site.

This report has been prepared as an independent specialist study report in terms of environmental impact assessment regulations, as part of the Basic Assessment Report for the application for Environmental Authorization (EA).

2. BACKGROUND AND LEGAL CRITERIA FOR ASSESSEMENT

2.1 Principles of Acoustics

This section provides a brief overview of the fundamentals of acoustics and the basis for the preparation of this noise assessment, to provide a broader understanding of some of the technical discussion in this report.

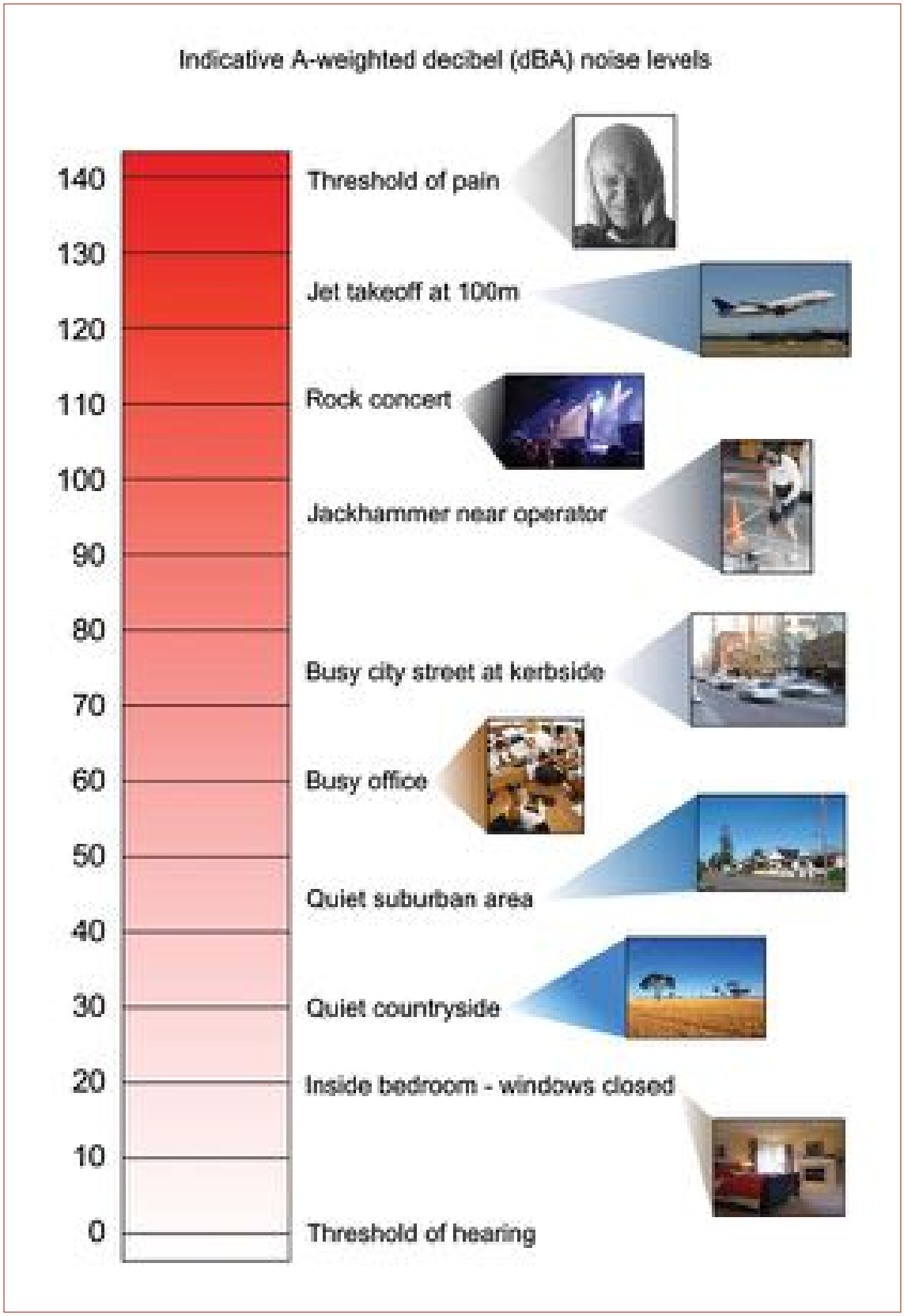
A sound wave travelling through the air is a regular disturbance of the atmospheric pressure. These pressure fluctuations are detected by the human ear, producing the sensation of hearing. To take account of the vast range of pressure levels that can be detected by the ear, it is convenient to measure sound in terms of a logarithmic ratio of sound pressures. These values are expressed as Sound Pressure Levels (SPL) in decibels (dB).

The audible range of sounds expressed in terms of Sound Pressure Levels is 0dB (for the threshold of hearing) to 120dB (for the threshold of pain). In general, a subjective impression of doubling of loudness corresponds to a tenfold increase in sound energy which conveniently equates to a 10dB increase in SPL. It should be noted that a doubling in sound energy (such as may be caused by a doubling of traffic flows) increases the SPL by 3dB.

The frequency of sound is the rate at which a sound wave oscillates and is expressed in Hertz (Hz). The sensitivity of the human ear to different frequencies in the audible range is not uniform. For example, hearing sensitivity decreases markedly as frequency falls below 250Hz. To rank the SPL of various noise sources, the measured level must be adjusted to give comparatively more weight to the frequencies that are readily detected by the human ear. Several weighting mechanisms have been proposed but the 'A-weighting' system has been found to provide one of the best correlations with perceived loudness. SPLs measured using 'A- weighting' are expressed in terms of dB(A). An indication of the level of some common sounds on the dB(A) scale is presented in Figure 1.

The 'A' subscript denotes that the sound levels have been A-weighted. The established prediction and measurement techniques for this parameter are well developed and widely applied. For a more detailed introduction to the basic principles of acoustics, reference should be made to an appropriate standard text.

Table 5 dB(A) Scale & Indicative Noise Levels – (Modified after EPA: Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4 – 2012)).



2.2 Environmental Noise Standards and Best Practice Guidance

The following South African and International guidance documents have therefore been taken into consideration:

- The National Noise Control Regulations: GN R154 of 1992 (NCR).
- SANS 10328:2003 Methods for environmental noise impact assessments.
- SANS 10103: 2006 The measurement and rating of environmental noise with respect to annoyance and speech communication[1].
- The UK IOA Good Practice Guide (IOA GPG)[2].
- The World Health Organization (WHO) Guidelines[3]; and
- BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites.
- BS 8233-2014 Guidance for the control of noise in and around buildings.

2.2.1 National Noise Control Regulations: GN154 OF 1992

The NCR defines "disturbing noise" as a noise level which exceeds the ambient sound level at the same measurement point by 7 dBA or more.

2.2.2 South African National Standards SANS 10328:2003

The SANS 10328:2003 defines procedures for environmental noise impact investigations and assessments at the various stages of an Environmental Impact Assessment (EIA), including: screening, scoping, impact assessment and review. This report addresses the requirements for an Impact Assessment. According to the standard, there could be acoustical implications where a wind generator farm is to be established within 2 km of a noise-sensitive development.

The following stages are defined for an Impact Assessment:

- Determination of the sound emission from the identified noise sources.
- Determination of the expected rating level.
- Determination of the desired rating level.
- Determination of the noise impact.
- Assessment of the noise impact; and
- Assessment of alternatives.

The environmental noise impact report should include the following:

- The purpose of the investigation.
- A brief description of the planned development.
- A brief description of the existing environment.
- An identification of noise sources, together with their respective sound power or sound pressure levels and acoustic characteristics.

- Noise sources that were not considered, and the reasons why.
- Identified noise-sensitive development and the noise impact on them.
- Any assumptions made regarding any calculations or determination of source and propagation characteristics.
- An explanation of all measuring and calculating procedures.
- The location of measurement or calculation points.
- Quantification of the environmental noise impact.
- 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.
- 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.
- Conclusions that were reached.
- Proposed recommendations, i.e., if there could be a significant impact or, if more information is needed, a recommendation that an environmental noise impact assessment should be conducted.
- 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; and
- 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 to ensure that the recommendations of this report will be maintained in the future.

2.2.3 South African National Standards SANS 10103:2006

SANS 10103 provides guidance on assessing working and living environments with respect to acoustic comfort, excellence and possible annoyance by noise. It provides information on typical indoor and outdoor noise levels in various districts, of which the outdoor levels in rural districts are of relevance to this report. These are:

Day/night: 45 dBA, LR, dn

Day: 45 dBA, LReq,d

Night: 35 dBA, LReq,d

The descriptor LReq denotes a rated level, i.e., that which has been adjusted to account for tonal character and impulsiveness.

In assessing annoyance, the rating level of the ambient noise (i.e., which includes the Development in operation) should be compared with the above typical rating levels. Table 5 of SANS 10103 details the

community or group response to the increase in noise due to a proposed development. It should be noted that the overlapping of ranges is because a spread in the individual reactions within a community might be expected:

0 to 10 dBA: Little response, sporadic complaints:

5 to 15 dBA: Medium response, widespread complaints;

10 to 20 dBA: Strong response, threats by community of group action; and

>15 dBA: Very strong response, vigorous community, or group action.

2.2.4 BS 5228-1:2009+A1:2014

BS 5228-1:2009+A1:2014 refers to the need for protection against noise and vibration of persons living and working in the vicinity of and those working on construction and open sites. Methods of calculating the levels of noise resulting from construction activities are provided, as are source levels for various types of plant, equipment, and construction activities, which have been utilized in this assessment where required.

2.2.5 BS 8233 - 2014

The standard, BS 8233 (2014) Guidelines for Sound Insulation and Noise Reduction for Buildings, sets out recommended internal noise levels for several different building types from external noise sources such as transport noise. The guidance is primarily for use by designers and hence BS 8233 may be used as the basis for an appropriate schedule of noise control measures. The recommended internal noise levels for residential developments are set out below.

Table 6 Internal noise levels (BS 8233-2014)

Activity	Location	Day 07:00 to 23:00hrs: dB, LAeq, 16hour	Night 23:00hrs to 07:00 hrs dB, LAeq, 8hour
Resting	Living room	35	
Dining	Dining room	40	
Sleeping (Day time resting)	Bedroom	35	30

The document also notes that where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved. In relation to noise levels in external amenity areas, BS 8233 provides the following guidance:

"For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB LAeq, T, with an upper guideline value of 55 dB LAeq, T which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a

compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces but should not be prohibited".

2.2.6 World Health Organization (WHO) Guidelines

The World Health Organization (WHO) document Guidelines for Community Noise (1999) provides the following design criteria and guidelines in relation to noise:

"The effects of noise in dwellings, typically, are sleep disturbance, annoyance and speech interference. For bedrooms, the critical effect is sleep disturbance. Indoor guideline values for bedrooms are 30dB LAeq for continuous noise and 45dB LAmax for single sound events. Lower noise levels may be disturbing depending on the nature of the noise source. To enable casual conversation indoors during daytime, the sound level of interfering noise should not exceed 35dB LAeq".

2.2.7 PROPG: Professional Practice Guidance on Planning and Noise for New Residential Development – 2017, IOA, UK

ProPG: Planning and Noise is new guidance with the overall aim of delivering sustainable development by promoting good health and well-being through the effective management of noise. The guidance aims to complement the national planning policy and encourages the use of good acoustic design at the earliest phase of the planning process.

"The ProPG guidance is relevant to assess the impact of noise on the proposed residential development rather than determining the assessment of the impact of noise from the development upon the existing area. The guidance is applicable to new residential development which would be exposed predominantly to noise from existing transport sources. "

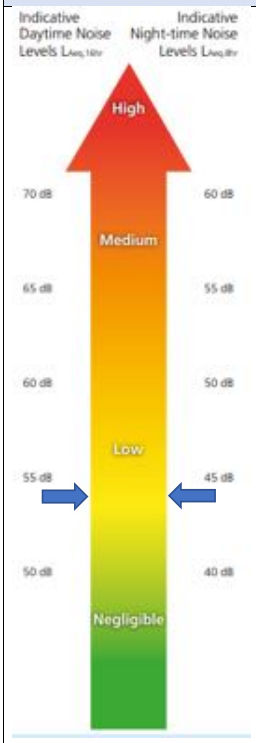
The ProPG advocates a risk-based approach to noise with a two-stage sequential approach, which is:

- *Stage 1 – an initial noise risk assessment of the proposed development site; and*
- *Stage 2 – a systematic consideration of four key elements –*

  Element 1 – demonstrating a 'Good Acoustic Design Process.
  Element 2 – observing internal 'Noise Level Guidelines'.
  Element 3 – undertaking an 'External Amenity Area Noise Assessment' and Element 4 – consideration of 'Other Relevant Issues'
- *The ProPG approach is underpinned by the preparation and delivery of an 'Acoustic Design Statement' (ADS), whereby the higher the risk the site, the more detailed the ADS. The ADS should address the following issues:*
- *Present the initial site noise risk assessment, including the pre-development acoustic conditions prior to development.*
- *Describe the external noise levels that occur across the site both before and after mitigation measures. The external post mitigation noise assessment should use an informed judgement of typical worst-case conditions.*

- *Demonstrate how good acoustic design is integrated into the overall design and how the proposed acoustic design responds to specific circumstances of the site.*
- *Confirm how the internal noise level guidelines will be achieved, including full details of the design measures, and building envelope specifications.*
- *A detailed assessment of the potential impact on occupants should be undertaken where individual noise events are expected to exceed 45 dB LAFmax more than 10 times a night inside bedrooms.*
- *Priority should be given to enable the use of openable windows where practical across the development. Where this is not practical to achieve the internal noise level guidelines with windows open, then full details of the proposed ventilation and thermal comfort arrangements must be provided.*
- *Present the findings of the external amenity area noise assessment.*
- *Present findings of the assessment of other relevant issues.*
- *Confirm for a low-risk site, however adverse impacts of noise will be mitigated and minimized.*
- *Confirm for a medium or high noise risk site how adverse impacts of noise will be mitigated and minimized and clearly demonstrate that a significant adverse noise impact has been avoided.*

Table 7 ProPG Noise Risk Assessment

NOISE RISK ASSESSMENT	POTENTIAL EFFECT WITHOUT NOISE MITIGATION	PRE-PLANNING APPLICATION ADVICE
	Increasing risk of adverse effect	High noise levels indicate that there is an increased risk that development may be refused on noise grounds. This risk may be reduced by following a good acoustic design process that is demonstrated in a detailed ADS. Applicants are strongly advised to seek expert advice. As noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development. At low noise levels, the site is likely to be acceptable from a noise perspective provided that a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development.
	No adverse effect	These noise levels indicate that the development site is likely to be acceptable from a noise perspective, and the application need not normally be delayed on noise grounds.
Typical Night-time LAmax (dB)	> 60 dB?	LAmax Level Comment
54-55	No	An indication that that there may be more than 10 noise events at night-time with L_{Amax} > 60 dB means the site should not be regarded as negligible risk.

2.2.8 Construction Noise Assessment Criteria

There is no published specific statutory South Africa guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. Building regulation /Site Operations set typical controls for construction activities by imposing limits on the hours of operation and consider noise limits at their discretion.

To set appropriate construction noise limits for the development site, reference has been made to:

- The South African National Building Regulations and Buildings Standards Act (Act 103 of 1977) mandates persons conducting construction activities to regulate emission of noise and time designates reasonable times for such activities to be from 06:00 to 18:00 on normal workdays (Monday to Friday), 06:00 to 17:00 on Saturdays and No work on public holidays and Sundays. Municipal bylaws: Sol Plaatje Municipality has derived its building controls and noise regulations for this act.

- *BS 5228 -1:2009 +A1 2014 Code of practice for noise and vibration control on construction and open sites- Noise*. Part 1 of this document Noise provides guidance on selecting appropriate noise criteria relating to construction works.
- BS 5228-1:2009+A 1:2014 gives several examples of acceptable limits of construction noise, the most simplistic being based upon the exceedance of fixed noise limits. For example, paragraph E.2 states: *'Noise from construction and demolition sites should not exceed the level at which conversation in the nearest building would be difficult with windows shut.'*

  Paragraph E.2 goes on to state:

  'Noise levels, between 07:00 and 19:00 hours; outside the nearest window of the occupied room closest to the site boundary should not exceed:

  - 70 decibels (dBA) in rural, suburban areas away from the main road traffic and industrial noise.

  - 75 decibels (dBA) in urban areas near main roads in heavy industrial areas.'

  Note that a typical planning condition in relation to construction noise issued by Local Authorities refer also to the compliance with BS 5228 part 1 as a means of controlling impacts to the surrounding environment. BS 5228 has therefore been used to inform the assessment approach for construction noise in line with Local Authorities requirements.

3. BASELINE CONDITIONS

3.1 Identification of Potential Noise Sources

The main source of ambient noise at the site were identified as follows:

3.1.1 Vehicular Traffic

There is a significant volume of vehicle traffic along Midlands Road, mainly comprising of heavy haul truck trucking mine related materials, big busses transporting commuters in and out of the townships to the CBD and mine areas, minibus taxis transporting commuters, and small personal and commercial vehicles. This traffic was observed to be moderate but constant and lasting up to about 10:00 pm.

3.1.2 Other Anthropogenic Noises

During both daytime and nighttime, other anthropogenic noises can be heard from a distance and these include mechanical noises from distant activities, human voices, radios sounds from nearby communities etc.

3.1.3 Biota Noises

During both daytime but more pronounced during nighttime are noises from insects, bugs, and other animals.

3.1.4 Aircraft Noise

While there is an airport in Kimberley, this airport is located 13.7 Km south of the site, and the site is not located along a major air traffic route for the airport. No single aircraft was recorded to have flown over the site during the period of the field work. Therefore, while aircraft noise is potential source of noise for developments in airport town, in this case it was not deemed a significant source concern for the impact assessment.

3.2 Identification of Potential Noise Sensitive Receptors

Several potential noise sensitive receptors were identified during the site visit. These are mainly residential housing, and community social amentias such schools, creches, clinics etc. surrounding proposed development site.

3.3 Baseline Noise

The baseline noise survey was undertaken in accordance with best practice methods as specified in SANS 10103 [1]. Measurements were taken at a standard height of 1.5 m and minimum of 3 m away from any reflecting surfaces. Both night and daytime measurements were recorded.

A Casella CEL-620B Type 1 sound level meter (SLM) was used for the short-term measurements. The selected sound level meters automatically log environmental noise measurement parameters including LAeq, LA10, LA90, and LAmax.

A survey was conducted on the 15th of August 2022, and on the 16th of August 2022. Details of the instruments used are presented below:

Table 8 Survey Instrument Details

Manufacturer	**Instrument Model**	**Instrument Model**	**Calibrated By**	**Calibration Certificate Number**
Casella	CEL-110/1 Field Calibrator	321597	Technology Solutions	L81897
Casella	CEL-62X /CEL 251 Type 1 Sound Level Meter and Microphone	3311886: 1607	Technology Solutions	L81896

Two rounds of short-term measurements were recorded at the five SR locations around the proposed development site. Measurements were recorded for 10-minute intervals at each location. Figures 2 and 3 show the location of these measurement points around the site. Tables 10 and 11 summarizes the baseline noise measurement results recorded at each of the five measurement locations.

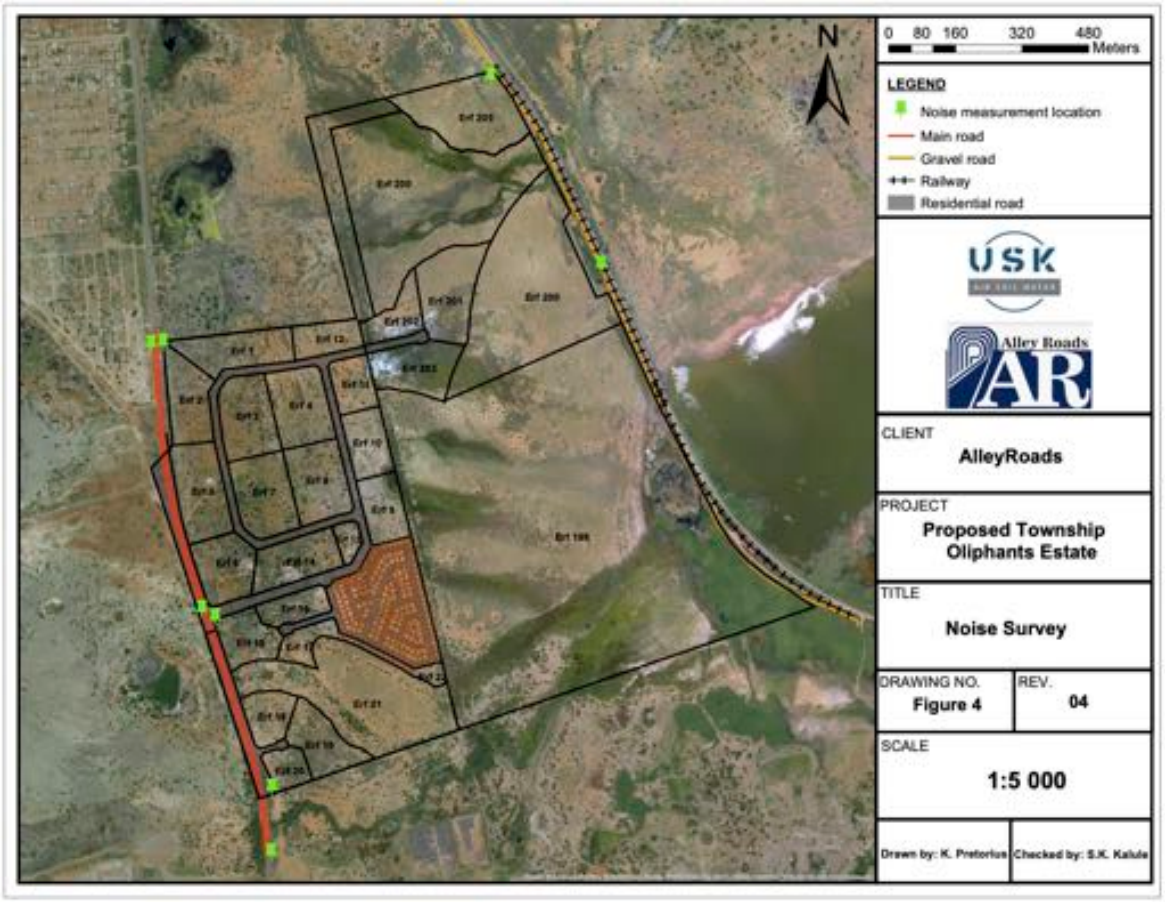


Figure 2 Location of the Baseline Noise Survey Points

Figure 3 Site Photo Locations for the Baseline Measurement Points

Table 9 Day Time Baseline Noise Measurements

Select Location	Latitude	Longitude	Laeq	LAF_{max}	SANS Limit (dB(A))	Max wind speed	Ave. wind speed	Temp °C	Comment
SR1	-28.6877716	24.7327731	57.6	70.1	50	2.3	0.7	23.5	Moderate to heavy vehicular traffic was noted as the main noise source
SR2	-28.6914795	24.734065	61.9	66.1	50	1.8	0.8	25.5	Moderate to heavy vehicular traffic was noted as the main noise source
SR3	-28.6818146	24.7316053	60.3	68.2	50	2.3	1	24.8	Moderate to heavy vehicular traffic was noted as the main noise source
SR4	-28.6761895	24.7397742	60.1	60.8	50	3.6	1.6	22.6	Birds and insects noted during the monitoring period. Distant dogs barking, hammering, grinding and vehicular traffic noted.
SR5	-28.680301	24.7423959	59.5	62	50	3.9	2.2	22.7	Birds and insects noted during the monitoring period. Distant dogs barking, hammering, grinding and vehicular traffic noted.

Table 10 Nighttime Baseline Noise Measurements

Select Location	Latitude	Longitude	Laeq	LAF_{max}	SANS Limit (dB(A))	Max wind speed	Ave. wind speed	Temp °C	Comment
SR1	-28.6875857	24.7324353	67.3	77.7	40	5.9	2.2	18.7	Moderate vehicular traffic was noted as the main noise source
SR2	-28.692888	24.7340225	59.7	72.5	40	4.9	2.3	18.6	Moderate vehicular traffic was noted as the main noise source
SR3	-28.6818417	24.7313265	62.5	72.7	40	6.1	2	18.4	Moderate vehicular traffic was noted as the main noise source
SR4	-28.6761895	24.7397742	36.1	50.8	40	7.1	4.6	18.7	Distant Road Traffic Noise and insects
SR5	-28.680301	24.7423959	35.5	50.1	40	8	4.8	18.9	Distant Road Traffic Noise and insects

Based on the above baseline data, the study area is generally noisy due to traffic along the Midlands Road. Midlands road is the main traffic carrier connecting the northern townships of Roodepan and Midlands to the Kimberley CBD, carries traffic till late hours of night with workers going in and out of the CBD and the mining hubs of Kimberley. This constant moderate traffic on the Midlands Road has significant influence on the soundscape in the area. The results also showed that eastern portions of the site which are further away from the anthropogenic activity (main road) generally experience lower noise level during both day and night. Sites closer to the main road have higher ambient sound levels than other areas. Both Daytime and Night-time noise levels were higher than recommended SANS limits. Figure 4 shows the main sources of ambient noise, which is basically the road traffic. While there is a rail line located on the eastern boundary of the proposed development site, this line is currently non-functional, however it could be a future source of noise, should the line be reactivated.

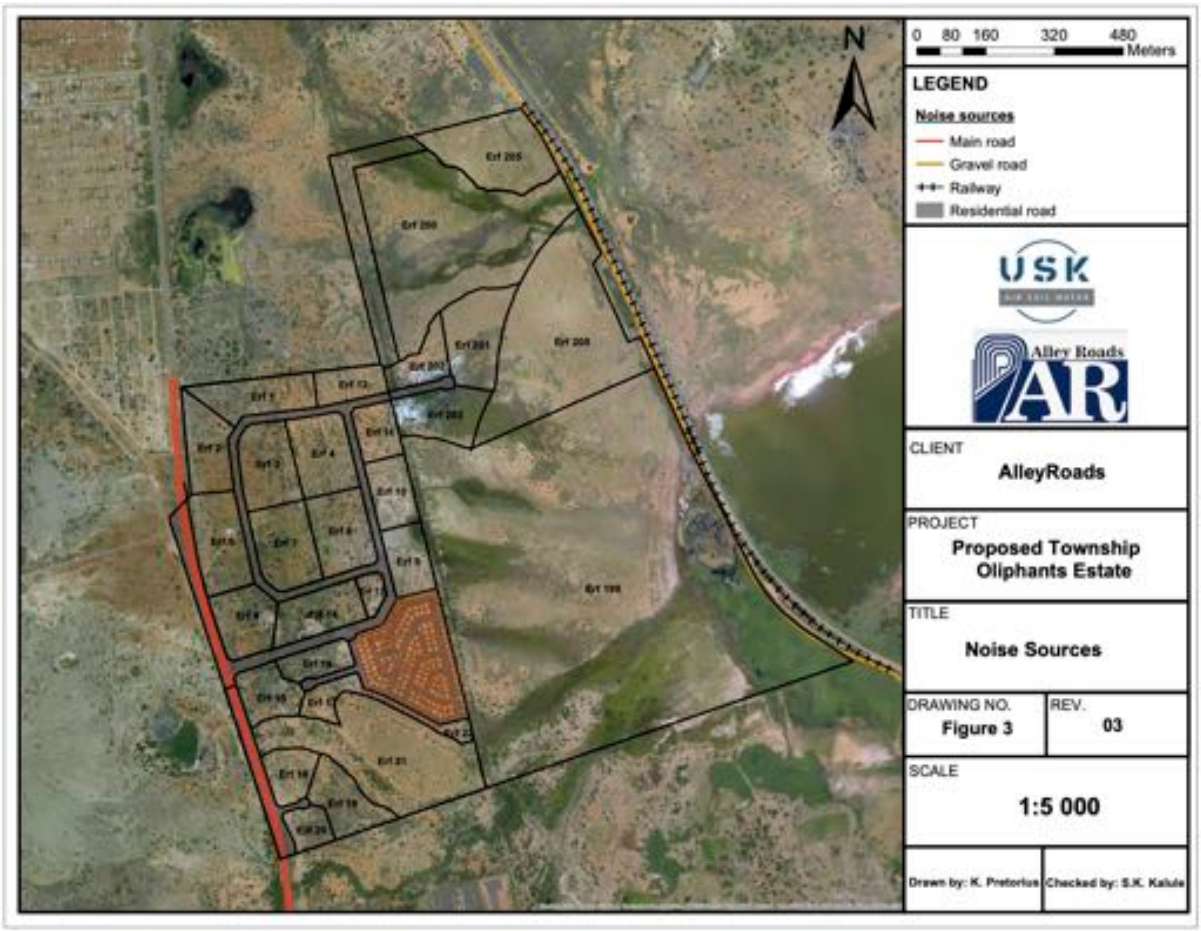


Figure 4 Noise Sources

4. DESCRIPTION AND MODELLING OF POTENTIAL NOISE IMPACTS

4.1 Construction Phase

The potential inward noise impacts associated with the construction of the proposed development are discussed in the following sections. Construction phase activities are only anticipated to take place during daytime only.

4.1.1 Noise Sensitive Locations

A review of the inward noise assessment and the threshold values indicates that the daytime noise guidance limit for construction noise ranges from 65-75dB LAeq Construction and some minor demolition works will be undertaken between 07:00-18:00 Monday to Friday, 07:00-17:00 on Saturdays, with no working on Sundays or public holiday in line with national building regulations. During the construction phase of the proposed development, a variety of items of plant will be in use, as shown in section 5.1.1.

Noise levels experienced by noise sensitive locations (NSLs) during such works depend upon several variables, the most significant of which are:

- The noise generated by plant/equipment used on site, generally expressed as Sound Power Levels (Lw) or the vibration generated by the plant.
- The periods of use of the plant on site, known as its on-time.
- The distance between the noise/ vibration source and the NSL.
- The noise attenuation due to ground absorption, air absorption and barrier effects.
- In some instances, the reflection of noise due to the presence of hard surfaces such as the sides of buildings; and
- The time of day or night the works are undertaken.

The closest NSLs have been identified as shown in Figure 5 and described below.

Figure 5 Noise Sensitive Receptors – Construction Phase

The area highlighted in the red band consists of township residential housing, social amenities including churches, creches and schools, which have been identified as sensitive noise receptors during construction. Ambient baseline noise levels in these areas are already high with LAeq in the 50 to 60 dB range.

4.1.2 Predicted Construction Noise Levels

Predicted noise levels for construction of the Proposed Development have been based upon construction methods used for other similar developments. As a conservative approach, it is assumed that all plant and activities will be taking place at the closest approach to each NSLs, whereas this will not always be the case and, in any event, activities are unlikely to occur for any significant duration. It is possible to predict typical noise levels using guidance set out in BS 5228-1:2009+A1:2014. Table 12 outlines typical plant items and associated noise levels that are anticipated for various phases of the construction. The calculations also assume that the equipment will operate for 66% of the 12-hour working day (i.e., 8 hours). Predictions assume that construction works will take place during normal working hours only.

Table 11 Estimated Noise Levels from key pieces of Construction Equipment

Activity	Item of Plant (BS5228 Ref)	Noise level at 10m Distance (dB $L_{Aeq\ (1hour)}$)
Site Preparation (Phase 1)	Wheeled Loader Lorry (D3 1)	75
	Track Excavator (C2 22)	72
	Dozer (C2.13)	78
	Dump Truck (C4.2)	78
	Cumulative Site Preparation	82
Demolition (Phase 2)	Pulveriser on Tracked Excavator (C1.5)	72
	Tracked Crusher (C1.14)	82
	Pulveriser on Tracked Excavator (C1.4)	76
	Dump Truck (C2.30)	79
	Diesel Generator (C4.76)	61
	Cumulative Demolition	85
General Construction (Phase 3)	Dump Truck (C2.30)	79
	Tracked excavator (02.21)	71
	Compressor (D7.08)	70
	Telescopic Handler (C4.54)	79
	Handheld Circular Saw (C4.72)	79
	Diesel Generator (C4.76)	61
	Internal Fit out	70
	Cumulative General Construction	84
Road Works/Landscaping (Phase 4)	Asphalt Paver & Tipping Lorry (C5.30)	75
	Electric Water Pump (C5.40)	68
	Vibratory Roller (C5.20)	75
	Cumulative General Landscaping and Road Work	78

Table 13 and Figure 6 below presents the predicted daytime noise levels from an indicative construction period at the NSLs.

Table 12 Predicted Construction at given distances from NSLs

Construction Phase	Item of Plant (BS5228-1 Ref)	L_{Aeq} distance (m) to NSL					
		24m	**16m**	**12m**	**10m**	**75m**	**121m**
Site Preparation (Phase 1)	Wheeled Loader Lorry (D3 1)	64	67	72	75	57	55
	Track Excavator (C2 22)	68	71	76	72	62	60
	Dozer (C2.13)	67	70	75	78	60	58
	Dump Truck (C4.2)	67	70	75	78	58	58
	Cumulative Site Preparation	**71**	**74**	**79**	**82**	**64**	**62**
Demolition (Phase 2)	Pulveriser on Tracked Excavator (C1.5)	68	71	76	72	61	59
	Tracked Crusher (C1.14)	69	72	77	82	62	60
	Pulveriser on Tracked Excavator (C1.4)	62	65	71	76	55	53
	Dump Truck (C2.30)	68	71	76	79	61	59
	Diesel Generator (C4.76)	50	53	58	61	43	41
	Cumulative Site Demolition	**74**	**77**	**82**	**85**	**67**	**65**
General Construction (Phase 3)	Dump Truck (C2.30)	68	71	76	79	61	59
	Tracked excavator (02.21)	60	63	68	71	53	51
	Compressor (D7.08)	59	62	67	70	52	50
	Telescopic Handler (C4.54)	68	71	76	79	61	59
	Handheld Circular Saw (C4.72)	68	71	76	79	61	59
	Diesel Generator (C4.76)	50	53	58	61	43	41
	Internal Fit out	59	62	67	70	52	50
	Cumulative General Construction	**73**	**76**	**81**	**84**	**66**	**64**
Road Works/Landscaping (Phase 4)	Asphalt Paver & Tipping Lorry (C5.30)	64	67	72	75	57	55
	Electric Water Pump (C5.40)	57	60	65	68	50	48
	Vibratory Roller (C5.20)	64	67	72	75	57	55
	Cumulative General Landscaping and Road Work	**67**	**70**	**75**	**78**	**60**	**58**

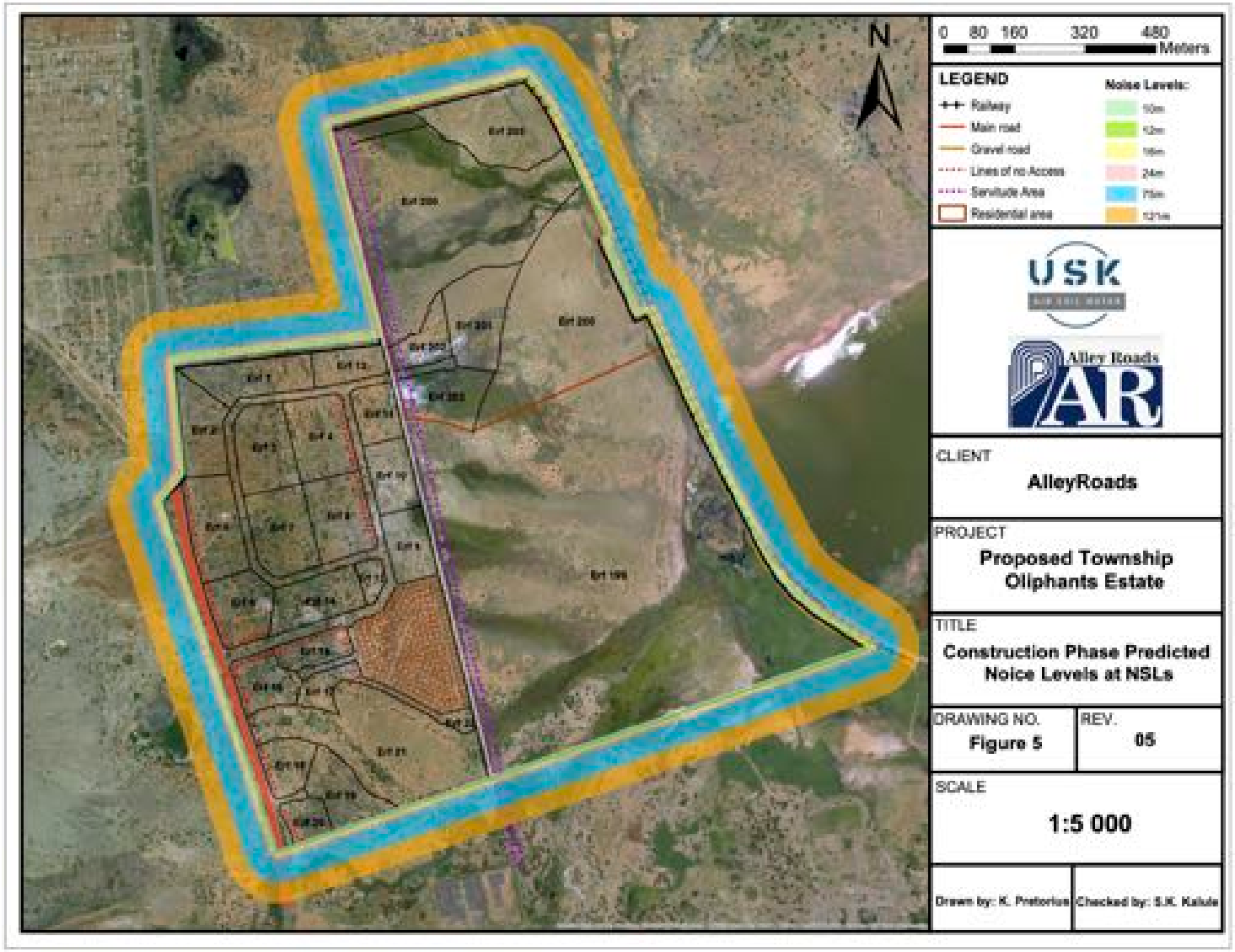


Figure 6 Construction Phase Predicted Noise Levels at NSLs

Distance to NSL	Limits	Construction Phases			
		Cumulative Site Preparation	Cumulative Site Demolition	Cumulative General Construction	Cumulative General Landscaping & Roadwork
24m	Construction Limit	71	74	73	67
	Level above limit	-4	-1	-2	-8
	Magnitude of Impact	Low	Low	Low	Low
16m	Construction Limit	74	77	76	70
	Level above limit	-1	+2	+1	-5
	Magnitude of Impact	Low	Medium	Low	Low
12m	Construction Limit	79	82	81	75
	Level above limit	+4	+7	+6	0
	Magnitude of Impact	Medium	Medium	Medium	Low
10m	Construction Limit	82	85	84	78
	Level above limit	+7	+10	+9	+3
	Magnitude of Impact	Medium	Medium	Medium	Medium
75m	Construction Limit	64	67	66	60
	Level above limit	-6	-3	-4	-10
	Magnitude of Impact	Low	Low	Low	Low
121m	Construction Limit	62	65	64	58
	Level above limit	-3	0	-1	-7
	Magnitude of Impact	Low	Low	Low	Low

4.2 Operational Phase

The potential inward noise impacts associated with the operational phase of the proposed development are discussed in the following sections.

4.2.1 Inward Noise

There are seven primary potential sources of noise associated with the development once operational. These are:

- Additional vehicular traffic on public roads
    - During the operational phase of the proposed development, there will be a

slight increase in vehicular traffic associated with the site on some surrounding roads.

- A Taxi rank is proposed to be part of the development, this will have significant increase in noise level.
- A traffic impact assessment relating to the proposed development should inform this issue.

- Residential
  - The noise impact of the residential aspect of the development on the receiving environment will be slight. It will be limited to internal vehicle movements entering and carparks and residents using the public open space.
- Business / Retail Units
  - The retail units of the development will also have a potential noise impact on the residential aspect of the development; however, this aspect of the development will not occur during the night-time period. The main noise associated with retail premises is from deliveries by lorries or van and from external speakers. External speakers shall not be used at any of the retail units. All deliveries will be permitted between 07:00hrs – 19:00hrs, to ensure that this activity does not impact the more sensitive night-time period. Retail units shall be posted appropriate signage to this effect.

5. MITIGATION MEASURES

The mitigation measures associated with the construction & operational phases of the proposed development are discussed in the following sections.

5.1 Operational Mitigation Measures

Noise mitigation at the receiver can be achieved by either installing a fence on the property or by upgrading the façade/glazing and ventilation of a building to provide a greater degree of noise reduction to internal areas. To determine internal noise levels within the proposed site a review of the external noise levels, internal noise levels and building elements have been undertaken as set out below.

5.1.1 Glazing

As is the case in most buildings, the glazed elements of the building envelope are typically the weakest element from a sound insulation perspective. Glazing Type 1 offers a minimum sound insulation performance of 33dB Rw. A standard thermal double-glazed system will typically achieve this level of performance. Type 2 provides an enhanced sound insulation performance of 37dB Rw or greater.

On review of the calculated noise levels across the development site over day and night-time periods, two glazing specifications have been determined for the residential properties to achieve the recommended internal noise levels for day and night-time periods within living rooms and bedrooms.

Site Layout Drawings in Appendix C show the recommended location of glazing types proposed. Type 2 glazing predominately relates to the living spaces of properties along the road to the south of the development and Midlands Road. For all other property facades, glazing Type 1 provides a sufficient level of sound insulation.

Table 13 Below sets out the required sound insulation performance per octave band for the glazing specification.

Glazing Specification	Octave Band Centre Frequency (Hz)							Overall Rw
	63	125	250	500	1k	2k	4k	
Type 1	15	17	21	30	38	36	35	**33**
Type 2	23	26	27	34	40	38	46	**37**

It is important to note that the acoustic performance specifications detailed herein are minimum requirements which apply to the overall glazing system. In the context of the acoustic performance specification the 'glazing system' is understood to include all the component parts that form part of the glazing element of the façade, i.e., glass, frames, seals, openable elements etc.

5.1.2 Wall Construction

In general, all wall constructions, i.e., block work or concrete, offer a high degree of sound insulation, much greater than that offered by the glazing systems. Therefore, noise intrusion via the wall construction will be minimal. The calculated internal noise levels across the building façade have assumed a minimum sound reduction index of 50dB Rw for this construction.

The predicted daytime noise levels at the open spaces of the development once built is currently modelled between 30– 53 dB L_{Aeq} and as such would achieve the Local Authority's daytime noise criteria in external amenity spaces.

Mitigating against noise from the neighboring roads particularly Midlands Road should be considered and form an integral part of the design process from the early master planning stages. This exercise established that the most appropriate and beneficial form of mitigation is the positioning of the buildings facing the Midland Road to act as a barrier. A perimeter wall along Midlands Road should be considered.

5.2 Construction Mitigation Measures

With regard to construction activities, best practice control measures for noise and vibration from construction sites are found within BS 5228 (2009 +A1 2014) Code of Practice for Noise and Vibration Control on Construction and Open Sites Parts 1 and 2. Whilst construction noise impacts are expected to vary during the construction phase depending on the distance between the activities and noise sensitive locations, the contractor will ensure that all best practice noise control methods will be used, to ensure impacts at off-site noise sensitive locations are minimized. The best practice measures set out in BS 5228 (2009) Parts 1 and 2 includes guidance on several aspects of construction site mitigation measures, including, but not limited to:

- Selection of quiet plant.
- Noise control at source.
- Screening.
- Liaison with the public
- Monitoring

A detailed comment is offered on these items in the following paragraphs. Noise control measures that will be considered include the selection of quiet plant, enclosures, and screens around noise sources, limiting the hours of work and noise and vibration monitoring, where required.

5.2.1 Use of Quite Plant

This practice is recommended in relation to static plant such as compressors and generators. It is recommended that these units be supplied with manufacturers' proprietary acoustic enclosures. The potential for any item of plant to generate noise will be assessed prior to the item being brought onto the site. The least noisy item should be selected wherever possible. Should a particular item of plant already on the site be found to generate high noise levels, the first action should be to identify whether said item can be replaced with a quieter alternative.

5.2.2 Noise Control at Source

If replacing a noisy item of plant is not a viable or practical option, consideration will be given to noise control "at source". This refers to the modification of an item of plant or the application of improved sound reduction methods in consultation with the supplier. For example, resonance effects in panel work or cover plates can be reduced through stiffening or application of damping compounds; rattling and grinding noises can often be controlled by fixing resilient materials in between the surfaces in contact. Referring to the potential noise generating sources for the works under consideration, the following best practice mitigation measures will be considered:

- Site compounds will be more than 30m from noise sensitive receptors within the site constraints. The use lifting bulky items, dropping, and loading of materials within these areas will be restricted to normal working hours.
- For mobile plant items such as dump trucks, excavators and loaders, the installation of an acoustic exhaust and/or maintaining enclosure panels closed during operation can reduce noise levels by up to 10dB. Mobile plant will be switched off when not in use and not left idling.
- For steady continuous noise, such as that generated by diesel engines, it may be possible to reduce the noise emitted by fitting a more effective exhaust silencer system or utilizing an acoustic canopy to re- place the normal engine cover. For concrete mixers, control measures will be employed during cleaning to ensure no impulsive hammering is undertaken at the mixer drum.
- For all materials handling ensure that materials are not dropped from excessive heights, lining drops chutes and dump trucks with resilient materials.
- For compressors, generators, and pumps, these can be surrounded by acoustic lagging or enclosed with in acoustic enclosures providing air ventilation.
- Demountable enclosures can also be used to screen operatives using hand tools and will be moved around site, as necessary.
- All items of plant will be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures.

5.2.3 Screening

Screening is an effective method of reducing the noise level at a receiver location and can be used successfully as an additional measure to all other forms of noise control. Construction site hoarding will be constructed around the site boundaries as standard. The hoarding will be constructed of a material to reduce noise by 20dB along the north and east barrier of the site and by 15db in the other areas. Appendix E shows locations and type of hoarding required. This will ensure guidance limit for construction noise at nearest noise sensitive location is followed and potential impacts relating to noise nuisance and disturbance and vibration impacts are effectively minimized and controlled.

5.2.4 Liaison with the Public

A designated liaison officer(s) will be appointed to site during construction works. Any noise complaints will be logged and followed up in a prompt fashion by the liaison officer. In addition, where a particularly noisy construction activity is planned or other works with the potential to generate high levels of noise, or where noisy works are expected to operate outside of normal working hours etc., the liaison officer will inform the nearest noise sensitive locations of the time and expected duration of the noisy works.

The Liaison officer(s) will also take notes of the following during complaint logging:

- Maintenance of a site complaints log detailing
- Name and address of complainant
- Time and date complaint was made.
- Date, time, and duration of noise
- Characteristics, such as rumble, clatters, intermittent, etc.
- Likely cause or source of noise
- Weather conditions, such as wind speed and direction
- Investigative and follow -up actions.
- Response to complainant

The Liaison officer(s) will also:

- Liaison with Local Community and Businesses
- Appointment of a Liaison Officer as a single point of contact to engage with the community and respond to concerns.
- Keeping residents informed of progress and timing of construction activities that may impact on them.

5.2.5 Monitoring

It is recommended that a complaint register for noise be kept on the site during the construction phase. Details of the complainant including names, whether individual, household, institution etc. proximity to the construction site, etc., should be kept and reviewed by the ECO monthly. Should the complaints persist and increase in number, then it is recommended that ambient environmental noise be undertake during operation of such activities to establish the noise impact, and mitigation measures be established to reduce the impact or completely stop the source of such noise. Such noise monitoring will be conducted in accordance with the International Standard ISO 1996: 2017: Acoustics - Description, measurement, and assessment of environmental noise

5.2.6 Phasing of works

The phasing programme will be arranged to control the amount of disturbance in noise and vibration

sensitive areas at times that are considered of greatest sensitivity. During excavation or when other high noise generating works are in progress on a site at the same time as other works of construction that themselves may generate significant noise and vibration, the working programme will be phased to prevent unacceptable disturbance at any time.

6. IMPACT STATEMENT AND CONCLUSION

Environmental Noise Impact from the proposed Oliphant Estate has been modeled and predicted in accordance with internationally recognized methodologies and software model. The predicted noise due to the construction and operational of the proposed development have been assessed at the surrounding identified Noise Sensitive Receptors both on the receiving environment and inward to the new development.

The predicted noise levels have been evaluated against several criteria incorporating South African and international guidance. The unmitigated worst-case level of impact for all three constructions, and operational were found to be of medium significance, while mitigated realistic scenario impacts have been determined to be of low significance.

It is our professional opinion that the proposed development should be authorized, with conditions that the recommended mitigation measures are implemented.

7. APPENDIX A

CERTIFICATES OF CALIBRATION OF INSTRUMENTS USED

Technology Solutions
Measurement Science Laboratory

Certificate of Calibration

ANSI National Accreditation Board (ANAB) is a member of the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Agreement (MRA). This arrangement allows for the mutual recognition of technical test and calibration data by the member accreditation bodies worldwide. For more information on the arrangement please consult www.ilac.org. The accuracies of all measurements were traceable to the SI (International System of Units) through NIST, NMISA, PTB or International Measuring Standards, unless otherwise noted. The uncertainties of measurement were estimated for a coverage factor of k=2 which approximates to a 95% confidence level.

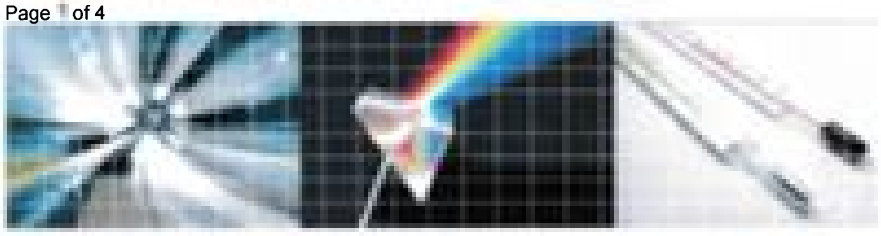
American Standard Calibration Laboratory
Measurement Science Laboratory

Certificate No	L81896	As Found/As Left	Rev 0
Manufacturer	Casella		
Description	Sound Level Meter; Microphone		
Model No	CEL-62X; CEL-251		
Serial No	3311886; 1607		
Plant No	None		
Calibrated for	JPG Programming cc		
Address	PO Box 15310, Lambton, 1414		
Temperature	22.5 °C ± 2 °C		
Relative humidity	47.8 % rh ± 5 % rh		
Barometric Pressure	855 mbar ± 5 mbar		
Date of calibration	25 August 2021		
Expiry date	25 August 2022	Issue Date	25 August 2021

Calibrated by *E Terblanche* Digitally signed by Enrico Terblanche Date: 2021.08.25 14:57:48 +02'00'

This certificate is issued without alteration, and in accordance with the conditions of accreditation granted by ANAB Copyright of this certificate is owned by Technology Solutions & American Standard Calibration Laboratory and may not be reproduced other than in full, except with the prior written approval. It is a correct record of the measurements performed at the time of calibration.Subsequently the accuracy will depend on factors such as care exercised in handling the instrument and frequency of use. Recalibration should be performed after a period which has been chosen to ensure that, under normal circumstances, the instruments accuracy remains within the desired limits.The results relate to the device under calibration.

Technical Signatory *E Terblanche* Digitally signed by Enrico Terblanche Date: 2021.08.25 14:58:04 +02'00'



Hards Laboratories cc
T/A Technology Solutions
C3 Prospect Close
43 Regency Drive
R21 Corporate Park, Irene
Tel: +27 (0) 12 345 5358
Fax +27 (0) 12 345 3263

Technology Solutions
Measurement Science Laboratory

Certificate of Calibration

ANSI National Accreditation Board (ANAB) is a member of the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Agreement (MRA). This arrangement allows for the mutual recognition of technical test and calibration data by the member accreditation bodies worldwide. For more information on the arrangement please consult www.ilac.org. The accuracies of all measurements were traceable to the SI (International System of Units) through NIST, NMISA, PTB or International Measuring Standards, unless otherwise noted. The uncertainties of measurement were estimated for a coverage factor of k=2 which approximates to a 95% confidence level.

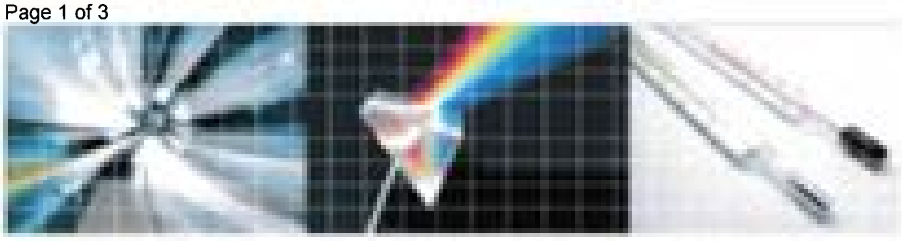
American Standard Calibration Laboratory
Measurement Science Laboratory

Certificate No	L81897	As Found/As Left	Rev 1
Manufacturer	Casella		
Description	Acoustic Calibrator		
Model No	CEL-110/1		
Serial No	321597		
Plant No	None		
Calibrated for	JPG Programming cc		
Address	PO Box 15310, Lambton, 1414		
Temperature	22.4 °C ± 2 °C		
Relative humidity	47.5 % rh ± 5 % rh		
Barometric Pressure	855 mbar ± 5 mbar		
Date of calibration	25 August 2021		
Expiry date	25 August 2022	Issue Date	26 August 2021

Calibrated by E Terblanche Digitally signed by Enrico Terblanche Date: 2021.08.26 14:09:01 +02'00'

This certificate is issued without alteration, and in accordance with the conditions of accreditation granted by ANAB Copyright of this certificate is owned by Technology Solutions & American Standard Calibration Laboratory and may not be reproduced other than in full, except with the prior written approval. It is a correct record of the measurements performed at the time of calibration.Subsequently the accuracy will depend on factors such as care exercised in handling the instrument and frequency of use. Recalibration should be performed after a period which has been chosen to ensure that, under normal circumstances, the instruments accuracy remains within the desired limits.The results relate to the device under calibration.

Technical Signatory E Terblanche Digitally signed by Enrico Terblanche Date: 2021.08.26 14:09:31 +02'00'



Hards Laboratories cc
T/A Technology Solutions
C3 Prospect Close
43 Regency Drive
R21 Corporate Park, Irene
Tel: +27 (0) 12 345 5358
Fax +27 (0) 12 345 3263

8. APPENDIX B

DECLARATION OF INTEREST BY SPECIALIST