NOISE ENVIRONMENTAL IMPACT ASSESSMENT REPORT FOR THE PROPOSED PAULPUTS WIND ENERGY FACILITY AND ASSOCIATED GRID CONNECTION, NORTHERN CAPE PROVINCE

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AUGUST 2019

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1 INTRODUCTION

Arcus Consultancy Services South Africa (Pty) Ltd (Arcus) were commissioned by Paulputs Wind Energy Facility (RF) (Pty) Ltd to carry out the EIA Noise Assessments for the proposed Paulputs Wind Energy Facility (WEF) and associated grid connection, located near Pofadder, Northern Cape Province (the Development).

The Development will consist of up to 75 wind turbines with a maximum hub height 140 m, blade length of maximum 90 m and a maximum rotor diameter of 180 m, along with associated infrastructure, including:

- Internal road (6 – 12 m wide, totalling approximately 80 km in length);
- Turbine bases including crane pads and hard-standings;
- Substation;
- Control Building;
- Laydown Area; and
- Grid Connection.

The proposed grid connection will connect to the existing Eskom Paulputs Substation. There are three grid connection route alternatives (OHPL Options A, B and C), all of which are being applied for, however only one will be utilised. Where applicable, this assessment considers the worst-case alternative, ensuring that the impacts would be acceptable for any of the potential grid connection options.

This report has been prepared by Alan Moore, Senior Acoustics Consultant at Arcus, who has nine years' experience of the assessment of environmental noise, particularly from wind turbines. He is a member of the UK Institute of Acoustics (UK IOA), holds an IOA Diploma in Acoustics and Noise Control. The assessor's CV and Declaration of Independence are provided in Appendix 1.

A glossary of technical terminology is included at the end of this report. For the avoidance of doubt, all noise measurements discussed in this assessment relate to a 'Fast' time weighting.

2 ASSESSMENT METHODOLOGY AND CRITERIA

2.1 Guidance

It is of note that no specific guidance or criteria for the assessment of wind turbine noise exists in South Africa. 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 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 Organisation (WHO) Guidelines[3]; and
- BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites.

[1] South African National Standard SANS 10103: 2006 The measurement and rating of environmental noise with respect to annoyance and speech communication, Edition 6

[2] A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of wind Turbine Noise, Institute of Acoustics (UK), May 2013

[3] World Health Organisation, Guidelines for Community Noise, 1999

2.1.1 The National Noise Control Regulations: GN R154 of 1992 (NCR)

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.

2.1.2 SANS 10328

SANS 10328 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 taken into account, and the reasons why;
- Identified noise-sensitive development and the noise impact on them;
- Any assumptions made with regard to 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 so as to ensure that the recommendations of this report will be maintained in the future.

2.1.3 SANS 10103

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, $L_{R,dn}$
- Day: 45 dBA, $L_{Req,d}$
- Night: 35 dBA, $L_{Req,n}$

The descriptor L_{Req} 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 due to the fact that 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 of community of group action; and
- >15 dBA: Very strong response, vigorous community or group action.

2.1.4 The IOA Good Practice Guide

The Good Practice Guide (GPG) was published by the UK Institute of Acoustics (IOA) in May 2013 and has been endorsed by the UK Government as current industry good practice. The guide presents current good practice in the assessment of wind turbine developments to the ETSU-R-97[4] methodology, at the various stages of the assessment process.

During the development of the GPG, a detailed study was undertaken of wind farm noise propagation and prediction methods used in a number of countries. The outcome of this research resulted in the GPG recommending a modified version of the ISO 9613-2[5] method in calculating the levels of wind turbine noise at receptor locations (immission levels).

The ISO 9613-2 method predicts noise levels at the receptor by taking the octave-band sound power level spectrum of the source, and applying a number of attenuation factors that determine the resulting sound pressure level. These factors are:

Geometric Divergence

Geometric divergence is the spherical-spreading of noise from a point source. The level of attenuation due to geometric divergence is based upon the distance from source to receptor.

Atmospheric Absorption

Sound is partly attenuated by the air through which it travels. The attenuation achieved is dependent on the frequency of the noise (with higher frequencies being absorbed more readily), along with the temperature and relative humidity of the air itself. The GPG recommends a temperature of 10°C and 70% relative humidity to represent a… *"reasonably low level of air absorption".* Air absorption increases with increasing temperature, and decreases with increasing humidity. As such, the typically hot, dry environment within

[4] ETSU-R-97 The Assessment and Rating of Noise from wind Turbines, Energy Technology Support Unit for UK Department of Trade and Industry, 1996.

[5] ISO 9613-2:1996 Acoustics -- Attenuation of sound during propagation outdoors - Part 2: General method of calculation.

which the Development is situated is likely to have a greater level of air absorption than recommended in the GPG, and is therefore a worst case assumption.

Directivity Factor

The directivity factor is used to account for a source which radiates sound in a non-uniform pattern (i.e. non-spherical). Wind turbine sound power levels are measured in a downwind direction, therefore providing worst-case predictions. As such, the directivity factor as described in ISO 9613-2 is not used in the prediction of wind turbine noise levels.

The GPG does state that account may need to be taken of the effect of wind direction upon wind turbine noise propagation, particularly in complex cumulative noise environments, however the implementation of this methodology is not necessary in this assessment as no cumulative noise effects are anticipated. As such, only worst case, downwind predictions are presented.

Ground Effect

The propagation of noise from a source is affected by the presence of the ground. The ground conditions are described in ISO 9613 through the variation of the Ground Type, G. This variable can be set between 0, which represents non porous, reflective surfaces such as water, ice, concrete etc. and 1, which represents 'soft' ground, such as that covered by trees or other vegetation.

The GPG recommends that use of G=0.5, along with a receptor height of 4 m results in realistic predictions of noise from wind turbines in most cases. The GPG states the use of G=0 can result in over-prediction of noise levels, but is recommended in situations where noise propagates over mainly large bodies of water or paved ground (which can occur in urban environments).

Barrier Attenuation

Any barrier between the source and receiver will reduce predicted noise immission levels. This may be either due to a structure (such a wall or building), or due to the local topography. With regard to wind turbine noise, the GPG states that barrier attenuation should be limited to no more than 2 dB, and is only applicable where there is no line of sight between the tip of the turbine and the receptor.

Propagation Through Foliage and Local Structures

ISO 9613 allows for adjustment of noise levels based upon the propagation path travelling through, or close to, vegetation or other nearby structures (such as other houses). Use of this factor is not recommended for use in the prediction of wind turbine noise, and has therefore not been considered, as per GPG guidance.

Additional Parameters

Whilst not part of the standard ISO 9613-2 model, the GPG states that an additional 3 dB should be added to noise immission levels at properties located across a valley or with heavily concave ground[6] between the property and the wind turbine(s).

The GPG states that the turbine sound power levels should be stated and these should include an appropriate allowance for measurement uncertainty. If the data provided contains no allowance for measurement uncertainty, or uncertainties are not provided, an additional 2 dB should be included. Declared Apparent Sound Power Levels (L_{wd}) as defined in IEC 61400-14[7], may be used as presented with no additional allowances.

[6] The presence of concave ground is determined using the equation presented is Section 4.3.9 of the GPG.

[7] IEC 61400-14 Wind turbines – Part 14: Declaration of apparent sound power level and tonality values.

Section 4.1.2 of this report details the turbine sound power levels used in the assessment.

ISO 9613-2 provides a prediction of noise levels likely to occur under worst-case conditions; those favourable to the propagation of sound, i.e. down-wind or under a moderate, ground-based temperature inversion as often occurs at night (often referred to as stable atmospheric conditions).

2.1.5 WHO Guidelines

The WHO Guidelines recommend that noise levels outside bedrooms at night do not exceed 45 dBA, $L_{eq,8hr}$ to prevent sleep disturbance indoors.

2.1.6 BS 5228-1:2009+A1:2014

BS 5228-1:2009+A1:2014 refers to the need for the 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 utilised in this assessment where required.

2.2 Methodology

2.2.1 Determination of Noise Levels

Construction Phase

The method for predicting levels of noise during construction is that described in BS 5228, as discussed in Section 2.1.6 of this Report. Noise emissions during the construction phase are described in Section 4.1.1.

Operational Phase

The method of predicting levels of wind turbine noise at receptors is discussed in Section 2.1.4. Noise emissions during the operational phase are described in Section 4.1.2.

2.2.2 Determination of the Desired Rating Level

Construction Phase

As effects during the construction phase are temporary in nature, the likelihood of complaint is reduced in comparison to longer-term effects such as operational noise. It is therefore considered appropriate to define the desired rating level for construction noise as 10 dB above the typical district rating levels defined in SANS 10103, i.e.:

- 55 dBA during the day; and
- 45 dBA at night.

Operational Phase

Given that wind turbines emit the greatest level of noise under high winds, the use of the long-term typical district rating levels specified in SANS 10103 are considered more appropriate for this assessment than short-term ambient measurements on site, which are undertaken during calm weather, making them incompatible with the assessment of worst-case wind turbine noise levels.

Based on the guidance provided in SANS 10103, and taking into account the definition of disturbing noise in the NCR, it is considered that appropriate rating levels from noise during operation of the Development are 7 dBA above the typical district rating levels during the day (i.e. 52 dBA).

At night, a rating level of 45 dBA L_{Feq} is recommended, based upon the most stringent night-time noise limit in ETSU-R-97 of 43 dB $L_{A90,10min}$ (equivalent to 45 dBA L_{Feq}), and WHO guidelines. Given that wind turbines can operate 24-hours a day, it is considered appropriate to set an overall noise limit for the development of 45 dBA L_{Feq}.

2.3 Assessment Significance Criteria

The rating noise levels associated with each phase of the Development have been compared with Desired Rating Levels (Section 2.2.2) derived from the guidance in SANS 10103 and the NCR in order to determine the likely community response, as detailed in Table 1.

Table 1: Assessment Significance Criteria

Category	Construction & Decommissioning Phase: dBA $L_{Feq,T}$	Operational Phase: dBA, L_{Feq}	Impact Intensity
No Impact	≤ 45 dBA $L_{Feq,T}$	≤ 40 dBA $L_{Feq,T}$	None
Little	> 45 dBA $L_{Feq,T}$, ≤ 55 dBA $L_{Feq,T}$	> 40 dBA $L_{Feq,T}$, ≤ 45 dBA $L_{Feq,T}$	Low
Medium	> 55 dBA $L_{Feq,T}$, ≤ 60 dBA $L_{Feq,T}$	> 45 dBA $L_{Feq,T}$, ≤ 52 dBA $L_{Feq,T}$	Medium
Strong	> 60 dBA $L_{Feq,T}$, ≤ 65 dBA $L_{Feq,T}$	> 52 dBA $L_{Feq,T}$, ≤ 60 dBA $L_{Feq,T}$	High
Very Strong	> 65 dBA $L_{Feq,T}$	> 60 dBA $L_{Feq,T}$	Very High

Impacts of None or Low intensity are considered to be Not Significant in terms of the EIA Regulations.

The following factors have also been considered:

- Extent;
- Duration;
- Intensity;
- Status (positive / negative);
- Significance (based on likely community response);
- Probability; and
- Confidence.

2.4 Consideration of Alternatives

A study of the proposed development site was conducted through the Scoping process. This study identified potential noise sensitive receptors, and predicted noise levels based upon the initial turbine layout. The proposed turbine layout was developed using the results of this study through an iterative process, and therefore represents the preferred alternative layout for assessment. This assessed layout was further refined using the results of the specialist's assessments, resulting in the Final Mitigated Layout assessed in this report.

2.5 Assessment Limitations

Noise sources occurring during construction and decommissioning have been assumed on the basis of typical construction methods for the type of development. Source levels have

been obtained from published data, i.e. BS 5228:2014, which is a well-recognised source of such information.

At the time of writing, a definite turbine model has not been selected for use at the proposed development; a candidate turbine model has therefore been assessed. Based upon Arcus's substantial experience of wind turbine noise, the candidate turbine type is considered to be a worst-case within the range of dimensions under consideration in terms of noise emissions.

2.6 Cumulative Impacts

A search has been carried out for other wind energy developments (WEDs) that may require to be included within a cumulative assessment. On the basis that SANS 10328 requires assessments to be carried out where a WED is located within 2 km of a noise-sensitive development, other WEDs within 4 km of the proposed development may require cumulative assessment. No such WEDs have been identified and therefore no cumulative assessment is considered to be necessary.

3 BASELINE CONDITIONS

3.1 Description of Existing Environment

The site falls entirely within the Buschmanland Arid Grassland vegetation type. The topography of the site is uniformly flat with small scattered rocky outcrops. The National Road N14 runs through the site from the southwest to the northeast. The predominant land use on the site is low intensity sheep grazing. A number of buildings are located sporadically around the Development, however the majority are not residential dwellings. Those properties which have been identified as residential dwellings are discussed in Section 3.2.

3.2 Developments Included in the Investigation

A desk-based search was carried out to identify potential noise-sensitive developments (principally houses) within 2 km of the Development, using National Geo-Spatial Information 1:50,000 scale digital mapping and Google Aerial imagery. All identified buildings were visited by the Arcus team to establish whether these were inhabited dwellings; a total of three occupied dwellings were identified within 2 km of the Development (marked as H1, H2 and H5 in Figure 1). One further dwelling was identified, but was unoccupied (marked as H3 of Figure 1). Notwithstanding this, it is understood that there remains the potential for this dwelling to become occupied at a later date, and has therefore been included as a noise-sensitive development as a conservative approach. The locations of the assessed noise-sensitive developments are presented in Figure 1.

3.3 Developments Excluded from Investigation

As discussed above, a number of other buildings were identified as part of the initial desk-based search, but the site visit confirmed these as not noise-sensitive, and have therefore been excluded from further consideration.

Noise-sensitive developments located more than 2 km of the proposed development have been excluded from investigation, on the basis that SANS 10328 requires assessment of those within 2 km.

3.4 Consultations

No specific comments have been received from Interested and Affected Parties at time of writing.

4 IDENTIFICATION AND DESCRIPTION OF POTENTIAL IMPACTS

4.1 Noise Sources Associated with the Proposed Development

4.1.1 Construction Phase

Noise sources during construction would consist of the equipment and vehicles used in the construction process. A list of such items typically employed in wind farm construction is provided in Section 4.1.1.

4.1.2 Operational Phase

Wind Turbines

Sources of noise during operation of a wind turbine are both mechanical (from machinery housed within the turbine nacelle) and aerodynamic (from the movement of the blades through the air). Modern turbines are designed to minimise mechanical noise emissions from the nacelle through isolation of mechanical components and acoustic insulation of the nacelle. Aerodynamic noise is controlled through the design of the blade tips and edges. In most modern wind turbines, aerodynamic noise is also restricted by control systems which actively regulate the pitch of the blades.

Wind Turbine Auxiliary Plant

There are a number of auxiliary plant items associated with wind turbines, such as transformers and switchgear. As stated in Section 4.3.4, noise emissions from such items are negligible in comparison to those from the wind turbines themselves.

Transmission Line

Under certain circumstances, power transmission lines can emit noise. This is discussed further at Section 4.3.5.

Substation

Electricity substations are quiet relative to wind turbines, but can emit noise in the form of a low-frequency (100 Hz), tonal hum. However, this noise is relatively easy to mitigate through the placement of the transformer equipment and / or use of acoustic shielding and will therefore not be considered further as discussed at Section 4.3.6.

4.1.3 Decommissioning Phase

Noise sources during decommissioning would be similar to, though fewer than, those during construction and the duration shorter. Effects during decommissioning would therefore be no greater than those during construction.

4.2 Determination of Sound Emission from Identified Noise Sources

4.2.1 Construction Phase

For each phase of construction, relevant items of plant have been determined from experience of similar developments and their noise emission levels taken from the source level tables contained within BS 5228.

The following construction activities and plant items are considered to be those with most potential to result in adverse noise effects. Plant source levels are presented as sound pressure levels at a distance of 10 m.

Construction of tracks and hardstanding:

- 2 no. Tracked Excavators (BS 5228 Ref C5/18) – 80 dB, L_{Aeq} each.
- 1 no. Articulated Dump Truck (Ref C6/16) – 88 dB, L_{Aeq};
- 1 no. Bulldozer (Ref C5/14) – 86 dB, L_{Aeq};
- 1 no. Vibratory Roller (Ref C5/18) – 84 dB, L_{Aeq}; and
- 6 no. Haulage Trucks per hour (Ref C2/34) – 88 dB, L_{Aeq}.

Excavation and concreting of turbine foundations:

- 1 no. Tracked Excavator (Ref C2/14) – 79 dB, L_{Aeq};
- 1 no. Concrete Mixer Truck with pump and boom arm (Ref C4/32) – 78 dB, L_{Aeq};
- 2 no. Poker Vibrators (Ref C4.33) – 78 dB, L_{Aeq} each;
- 1 no. Dump Truck (tipping fill) (Ref C2.30) – 79 dB, L_{Aeq};
- 1 no. Roller (rolling fill) (Ref C2.37) – 79 dB, L_{Aeq};
- 1 no. concrete Batching Plant (Ref D6/11) – 80 dB, L_{Aeq};
- 1 no. Lorry (Ref C11.18) – 80 dB, L_{Aeq}; and
- 6 no. Haulage Trucks per hour (Ref C2/34) – 88 dB, L_{Aeq}.

Turbine Erection:

- 1 no. Wheeled Mobile Crane (Ref C4/38) – 78 dB, $L_{Aeq;}$
- 1 no. Mobile Telescopic Crane (Ref C4/39) – 77 dB, L_{Aeq};
- 1 no. Diesel Generator (Ref C4.85) – 66 dB, L_{Aeq};
- 2 no. Torque guns – 82 dB, L_{Aeq} each; and
- 5 no. Haulage Trucks per hour (Turbine Delivery) (Ref C11.18) – 88 dB, L_{Aeq} each.

Electrical Transmission Tower Construction:

- 1 no. Wheeled Mobile Crane (Ref C4/38) – 78 dB, $L_{Aeq;}$
- 1 no. Mobile Telescopic Crane (Ref C4/39) – 77 dB, L_{Aeq};
- 2 no. Torque guns – 82 dB, L_{Aeq} each; and
- 2 no. Tracked Excavators (BS 5228 Ref C5/18) – 80 dB, L_{Aeq} each.
- 6 no. Haulage Trucks per hour (Ref C2/34) – 88 dB, L_{Aeq}.

Any noise from night-time activities is to be limited to a generator to maintain power to staff accommodation / welfare facilities (Diesel Generator Ref C4.85 – 66 dB, L_{Aeq}). The generator will be located sufficiently distant from all noise-sensitive developments that there will be no impact.

The following assumptions have also been made in the calculations of construction noise levels at noise-sensitive developments:

- A source height of 2.5m;
- A receiver height of 1.5 m;
- Hard ground conditions;
- No barriers;
- An on-time of 100%; and
- Free-field conditions.

4.2.2 Operational Phase

The majority of wind farms at planning stage will not have selected a preferred turbine; therefore a candidate turbine representative of a range of turbines has been selected to provide an appropriate estimate of noise levels. Once noise levels have been predicted at the potentially affected properties, compliance with noise limits can be assessed and design advice provided to ensure noise limits are met.

The candidate turbine for the purposes of the noise assessment is the Acciona AW132-3300, with an installed capacity of 3.3 MW, a rotor diameter of 132 m and a hub height of 120 m. Based upon Arcus' substantial experience of a wide range of large-scale

wind turbines, the turbine type selected for assessment is a worst-case of the turbines currently available within the Development's maximum envelope in terms of noise levels.

The turbine is available in a standard configuration or in a noise-mitigated version with blade serrations and nacelle insulation. The standard configuration has been assumed in this assessment as a worst-case approach.

In accordance with the GPG, an addition has been applied to the manufacturer's stated sound power level data to account for measurement uncertainties of 1.645 x uncertainty. The manufacturer's documentation states a typical uncertainty of up to 1 dB, therefore 1.6 dB has been added, as shown in Table 2 as 'Modelled Sound Power Level'.

Table 3 overleaf details the octave-band sound power spectrum provided by the manufacturer. This was scaled to the modelled sound power levels shown in Table 2. Whilst the data for the noise-mitigated variant is not required in this assessment, it has been presented in addition to the standard configuration in the interest of completeness.

Noise emissions from wind turbines are generally broadband in nature without significant tonality or impulsivity. The manufacturer's datasheet confirms an absence of significant tonality (tonal audibility ≤ 2 dB). No corrections for such characteristics are therefore considered to be necessary.

Table 2 - Manufacturers Noise Emission Data - Acciona AW132-3300

Wind Speed at 10m Height, ms^{-1}	**6**	**7**	**8**	**9**	**10**
Wind Speed at 84 m Height (Z_o = 0.05 m), ms^{-1}	8.4	9.8	11.2	12.6	14.0
Standard Configuration					
Manufacturer's Estimated Sound Power Level, dB L_{WA}	108.5	108.5	108.5	108.5	108.5
Modelled Sound Power Level, including 1.6 dB for uncertainty, dB, L_{WA}	110.1				
Noise Mitigated – with Blade Serrations and Nacelle Insulation					
Manufacturer's Estimated Sound Power Level, dB L_{WA}	106.0	106.0	106.0	106.0	106.0
Sound Power Level, including 1.6 dB for uncertainty, dB, L_{WA}	107.6				

Table 3 - Manufacturers Noise Emission Data - Acciona AW132-3300

Octave Band Centre Frequency, Hz	**32**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Sound Power Spectrum, dB, L_{WA}	73.6	84.7	98.1	103.8	103.0	99.5	97.9	95.9	89.3

Turbine technology is constantly evolving. The larger turbines coming to market tend to exhibit lower noise levels due to design improvements and the lower rotational speed of the larger diameter blades. For example, the maximum sound power level of the Vestas V136 4.2 MW turbine, excluding uncertainty, is 106.9 dB L_{WA}, compared to 108.5 dB, L_{WA} as presented in Table 2. As such, the selection of the Acciona AW132-3300 is considered a suitable worst-case for this assessment.

4.3 Sources not Taken into Account

4.3.1 Low Frequency Noise and Infrasound

A study[8], published in 2006 by acoustic consultants Hayes McKenzie on the behalf of the DTI, investigated low frequency noise from wind farms. This study concluded that there is no evidence of health effects arising from infrasound or low frequency noise generated by wind turbines, but that complaints attributed to low frequency noise were in fact, possibly due to a phenomenon known as Amplitude Modulation (AM).

In February 2013, the Environmental Protection Authority of South Australia published the results of a study into in infrasound levels near wind farms[9]. This study measured infrasound levels at urban locations, rural locations with wind turbines close by, and rural locations with no wind turbines in the vicinity. It found that infrasound levels near wind farms are comparable to levels away from wind farms in both urban and rural locations. Infrasound levels were also measured during organised shut-downs of the wind farms; the results showed that there was no noticeable difference in infrasound levels whether the turbines were active or inactive.

It is therefore not considered necessary to carry out specific assessments of low frequency noise or infrasound.

4.3.2 Amplitude Modulation

In its simplest form, Amplitude Modulation (AM), by definition, is the regular variation in noise level of a given noise source. This variation (the modulation) occurs at a specific frequency, which, in the case of wind turbines, is defined by the rotational speed of the blades, i.e. it occurs at the rate at which the blades pass a fixed point (e.g. the tower), known as Blade Passing Frequency.

A study[10] was carried out in 2007 on behalf of the UK Department for Business, Enterprise and Regulatory Reform (BERR) by the University of Salford, which investigated the incidence of noise complaints associated with windfarms and whether these were associated with AM. The study defined AM as aerodynamic noise from wind turbines with a greater degree of fluctuation than normal at blade passing frequency. Its aims were to ascertain the prevalence of AM on UK windfarm sites, to try to gain a better understanding of the likely causes, and to establish whether further research into AM is required.

The study concluded that AM had occurred at only a small number (4 of 133) of windfarms in the UK, and only for between 7% and 15% of the time. It also stated that, the causes of AM are not well understood and that prediction of the effect was not currently possible.

This research was updated in 2013 by an in-depth study undertaken by Renewable UK[11], which has identified that many of the previously suggested causes of AM have little or no association to the occurrence of AM in practice. The generation of AM is based upon the interaction of a number of factors, the combination and contributions of which are unique to each site. With the current knowledge, it is not possible to predict whether any particular site is more or less likely to give rise to AM, and the incidence of AM occurring at any particular site remains low, as identified in the University of Salford study.

[8] The measurement of low frequency noise at three UK wind farms, Hayes Mckenzie, The Department for Trade and Industry, URN 06/1412, 2006.

[9] Environment Protection authority (2013) Infrasound levels near wind farms and in other environments [Online] Available at: http://www.epa.sa.gov.au/xstd_files/Noise/Report/infrasound.pdf (Accessed 09/03/18)

[10] University of Salford (2007). 'Research into aerodynamic modulation of wind turbine noise'. Report by University of Salford, The Department for Business, Enterprise and Regulatory Reform, URN 07/1235, July 2007.

[11] Renewable UK (2013).'Wind Turbine Amplitude Modulation: Research to improve understanding as to its Cause and effects', Renewable UK, 2013.

Section 7.2.1 of the GPG states: *"The evidence in relation to 'Excess' or 'Other' Amplitude Modulation (AM) is still developing. At the time of writing, current practice is not to assign a planning condition to deal with AM".*

It is therefore not considered necessary to carry out specific assessments of AM.

4.3.3 Vibration

Research undertaken by Snow in 1996[12] found that levels of ground-borne vibration 100 m from a wind turbine were well below criteria for 'critical working areas' given by British Standard BS6472:1992 *Evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz)*, and were lower than limits specified for residential premises by an even greater margin.

4.3.4 Wind Turbine Auxiliary Plant

Additional auxiliary plant such as transformers and switchgear are anticipated to produce negligible levels of noise, and will not increase noise levels above those due to the operation of the wind turbines. Such sources have therefore not been considered further.

4.3.5 Transmission Line Noise (Corona noise)

Corona noise is caused by the partial breakdown of the insulation properties of air surrounding the conducting wires. It can generate an audible and radio-frequency noise, but generally only occurs in humid conditions as provided by fog or rain. A minimum line potential of 70 kV or higher is generally required to generate corona noise depending on the electrical design.

Corona noise has two major components: a low frequency tone associated with the frequency of the AC supply (100 Hz for 50 Hz source) and broadband noise. The tonal component of the noise is related to the point along the electric waveform at which the air begins to conduct. This varies with each cycle and consequently the frequency of the emitted tone is subject to great fluctuations. Corona noise can be characterised as broadband 'crackling' or 'buzzing', but it is generally only a feature during fog or rain.

Corona discharges results in:

- Power losses;
- Audible noises;
- Electromagnetic interference;
- A purple glow;
- Ozone production; and
- Insulation damage

As such, Electrical Service Providers go to great lengths to design power transmission equipment to minimise the formation of corona discharges. It is an infrequent occurrence requiring a specific and relatively uncommon set of weather conditions and is of a short duration compared to other operational noises. As such, any of the alternative grid connection routes are considered acceptable and will not be investigated further.

4.3.6 Substation

Substation noise is relatively easy to mitigate through the use of acoustic shielding and / or placement of the transformer equipment. Given this, along with the substantial separation distance to noise-sensitive developments, any of the alternative substation locations are considered acceptable, and will not be investigated further.

[12] ETSU (1997), Low Frequency Noise and Vibrations Measurement at a Modern Wind Farm, prepared by D J Snow.

4.3.7 Decommissioning Phase

Noise sources during decommissioning would be similar to, though fewer than, those during construction and the duration shorter. Effects during decommissioning would therefore be no greater than those during construction.

5 DETERMINATION OF THE NOISE IMPACT

5.1.1 Construction Phase

Construction phase impacts have been determined for the each of the identified noise-sensitive developments, and are shown in Tables 4 to 7. The predicted rating level of each activity has been compared with the criteria presented in Table 1 on order to determine the associated Impact.

As discussed in Section 4.2.1, any noise from night-time activities is to be limited to a generator to maintain power to staff accommodation / welfare facilities, which will be located sufficiently distant from all noise-sensitive developments that there will be no impact. For the purposes of this assessment, it has been assumed that the generator is located at the closest point of the Development infrastructure (including any of the proposed grid connection routs) to the respective noise-sensitive development; this ensures a worst-case approach.

Table 4 - H1 Predicted Construction Noise Levels, dBA, $L_{Feq,T}$

Activity	Predicted Rating Level dBA, $L_{Feq,T}$	Impact Intensity	
		Day	Night
Construction of Tracks and Hardstanding	39	None	-
Excavation and Concreting of Turbine foundations	38	None	-
Turbine Erection	36	None	-
Transmission Tower	52	Low	-
Generator	31	None	None

Table 5 – H2 Predicted Construction Noise Levels, dBA, $L_{Feq,T}$

Activity	Predicted Rating Level dBA, $L_{Feq,T}$	Impact Intensity	
		Day	Night
Construction of Tracks and Hardstanding	41	None	-
Excavation and Concreting of Turbine foundations	39	None	-
Turbine Erection	38	None	-
Transmission Tower	30	None	
Generator	13	None	None

Table 6 – H3 Predicted Construction Noise Levels, dBA, $L_{Feq,T}$

Activity	Predicted Rating Level dBA, $L_{Feq,T}$	Impact Intensity	
		Day	Night
Construction of Tracks and Hardstanding	47	Low	-
Excavation and Concreting of Turbine foundations	44	None	-
Turbine Erection	43	None	-
Transmission Tower	35	None	-
Generator	20	None	None

Table 7 – H5 Predicted Construction Noise Levels, dBA, $L_{Feq,T}$

Activity	Predicted Rating Level dBA, $L_{Feq,T}$	Impact Intensity	
		Day	Night
Construction of Tracks and Hardstanding	41	None	-
Excavation and Concreting of Turbine foundations	39	None	-
Turbine Erection	38	None	-
Transmission Tower	44	None	-
Generator	22	None	None

As can be seen from Tables 4 to 7, worst case potential impacts from construction are Low during the construction of tracks and hardstanding at H3, and during the construction of the transmission towers at H1 (assuming grid connection route OPHL Option A is adopted). No impacts are anticipated during any other activity at any time, or at any other noise-sensitive development.

5.1.2 Operational Phase

Figure 1 details predicted worst-case noise level contours for the operation of the development in 5 dBA intervals, based on the maximum noise emission levels of the candidate turbine as detailed in Section 4.2.2., i.e. 110.1 dB, L_{WA}.

The predicted maximum operational noise level from the Development at the identified potential noise-sensitive properties is presented in Table 8.

Table 8 – Predicted Operational Noise Levels, dBA, $L_{Feq,T}$

Noise-Sensitive Development	Grid Reference (X,Y)		Predicted Maximum Rating Level dBA, $L_{Req,T}$	Impact Intensity
H1	374774	6804193	33	None
H2	380283	6802542	36	None
H3	380038	6792392	44	Low
H5	369628	6795475	38	None

As can be seen from Tables 4 to 7, potential impacts from operation would be of no more than Low impact intensity, and then at only one location (H3), which is currently unoccupied.

5.1.3 Decommissioning Phase

Noise sources during decommissioning would be similar to, though fewer than, those during construction and the duration shorter. Effects during decommissioning would therefore be no greater than those during construction.

6 ASSESSMENT OF THE NOISE IMPACT

6.1.1 Construction Phase

As only four potential noise-sensitive developments have been identified (of which one is currently unoccupied), the extent of effects is considered to be Low.

The duration of effects would be limited to no more than 24 months, and therefore considered to be Low. Furthermore, in practice, any impacts which do occur will be restricted to periods when works are undertaken at the closest point to each noise-sensitive development.

As the desired rating levels would not be exceeded, effects are considered to be Neutral.

Based upon the significance criteria presented in Section 2.3, the impact intensity is Low.

Predicted noise levels have been calculated in accordance with a well-established methodology (BS 5228-1:2009+A1:2014); the level of confidence in the assessment is High.

The worst-case impacts of any of the three potential grid connection options have been considered; as such, any of the proposed options would be acceptable.

The impact of noise effects during construction is assessed as **Low**, and therefore **Not Significant.**

6.1.2 Operational Phase

Only four potential noise-sensitive developments have been identified in total, of which one is currently unoccupied. As such, the extent of effects is considered to be Low.

The duration of effects would be for the full operational life of the development, i.e., 25 years, which is considered to be High.

The predicted maximum operational noise level from the Development at the closest potential noise-sensitive development (H3) is 44 dB, L_{Aeq}. Based on the significance criteria presented in Section 2.3, the impact intensity is therefore Low.

As the desired rating levels would not be exceeded, the probability of an adverse effect is Low during both daytime and night-time periods, and effects are considered to be Neutral.

The level of confidence in the assessment is High.

The impact of noise effects during operation are assessed as **Low**, and therefore **Not Significant**.

6.1.3 Decommissioning

Impacts during decommissioning will be similar to those during construction, but are likely to be reduced in magnitude and duration.

The impact of noise effects during decommissioning is assessed as **Low**, and therefore **Not Significant**.

6.2 Investigation of Alternatives

The Development will consist of up to 75 wind turbines, each with an electricity generating capacity of between 3 and 6 MW. The turbine type selected for this assessment is considered to represent a worst case in terms of maximum sound power level, relative to the turbines currently available.

7 MITIGATION MEASURES AND RESIDUAL EFFECTS

7.1 Construction Phase

Whilst construction noise impacts are no more than Low significance, the noise management measures detailed below are recommended in the interest of best practice during construction operations:

- Construction activities should be limited to times agreed with the local municipalities;
- Deliveries of turbine components, plant and materials by HGV to site should only take place by designated routes and within times agreed with the relevant authorities;
- The site contractors should employ the best practicable means of reducing noise emissions from plant, machinery and construction activities, as described in BS 5228;
- Where practicable, the work programme should be phased, which would help to reduce the combined effects arising from construction operations;
- Where practicable, noise from fixed plant and equipment should be contained within suitable acoustic enclosures or behind acoustic screens;
- Where practicable, night time working should not be carried out. Local residents should be notified in advance of any potentially noisy night-time construction activities; and
- Any plant and equipment normally required for operation at night (19:00 - 07:00), e.g., generators, should be suitably screened or located such that noise levels from the plant do not exceed 45 dBA, L_{Feq} at the nearest noise-sensitive receptors.

7.2 Operational Phase

Operational noise mitigation was embedded in the Development during the design and Scoping stages, through maximising the distance from the wind turbines to the noise-sensitive developments. Section 6.1.2 identifies potential impacts of no more than Low intensity from the operation of the development; no further mitigation is therefore required.

7.3 Decommissioning Phase

As noted in Section 6.1.3, impacts during decommissioning are likely to be reduced in magnitude and duration relative to the construction phase. Notwithstanding this, the noise management measures detailed below are recommended in the interest of best practice during decommissioning:

- Decommissioning activities should be limited to times agreed with the local municipalities;
- Deliveries of plant and materials by HGV to site should only take place by designated routes and within times agreed with the relevant authorities;
- The site contractors should employ the best practicable means of reducing noise emissions from decommissioning activities, as described in BS 5228;
- Where practicable, the work programme should be phased, which would help to reduce the combined effects arising from decommissioning operations;
- Where practicable, noise from fixed plant and equipment should be contained within suitable acoustic enclosures or behind acoustic screens;
- Where practicable, night time working should not be carried out. Local residents should be notified in advance of any potentially noisy night-time activities; and

- Any plant and equipment normally required for operation at night (19:00 - 07:00), e.g., generators, should be suitably screened or located such that noise levels from the plant do not exceed 45 dBA, L_{Feq} at the nearest noise-sensitive receptors.

8 CUMULATIVE EFFECTS ASSESSMENT

As discussed in Section 2.6, SANS 10328 recommends assessment of the noise effects of an individual wind energy development where it is to be constructed within 2 km of a noise-sensitive development, it is therefore considered that a cumulative effects assessment is required where another wind energy development is to be constructed within 4 km of the Development. No permitted wind energy developments have been identified within 4 km of the Development; therefore, cumulative effects do not require further consideration.

9 SUMMARY OF POTENTIAL EFFECTS

Table 9 presents a summary of potential effects.

Table 9: Summary of Potential Effects

Impact Phase: Construction							
Potential impact description: Construction Noise Noise from equipment and vehicles used during construction of the Development.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	L	L	Neutral	L	L	H
With Mitigation	L	L	L	Neutral	L	L	H
Can the impact be reversed?			YES - construction period is temporary.				
Will impact cause irreplaceable loss of resources?			NO – construction period is temporary.				
Can impact be avoided, managed or mitigated?			YES – through application of good practice during construction.				
Mitigation measures to reduce residual risk or enhance opportunities (if required): Whilst not strictly necessary, the following measures are recommended in the interest of good site management: - Construction activities should be limited to agreed times; - Deliveries of turbine components, plant and materials by HGV to site should only take place by designated routes and within agreed times; - The site contractors should be required to employ the best practicable means of reducing noise emissions from plant, machinery and construction activities; - Where practicable, the work programme should be phased; - Where practicable, noise from fixed plant and equipment should be contained within suitable acoustic enclosures or behind acoustic screens; - Where practicable, night time working should not be carried out. - Local residents shall be notified in advance of any night-time activities likely to generate significant noise levels; and - Any plant and equipment normally required for operation at night (23:00 - 07:00), e.g., generators, should be suitably screened or located such that noise levels from the plant do not exceed 45 dBA, L_{Feq} at the nearest noise-sensitive receptors.							
Impact to be addressed/ further investigated and assessed in Impact Assessment Phase?			NO – impacts are not significant (including any of the three grid connection options) and can be satisfactorily mitigated.				

Impact Phase: Operation

Potential impact description: Operational Noise - **Day**

The maximum operational noise level from the Development has been estimated to be 44 dBA, L_{Feq} at the closest identified potential noise-sensitive development (H3). This property is currently uninhabited, but has been assessed in the interest of presenting a worst-case assessment.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	H	L	Neutral	L	L	H
With Mitigation	L	H	L	Neutral	L	L	H

Can the impact be reversed?	YES – operational noise will cease when the Development is decommissioned.
Will impact cause irreplaceable loss of resources?	NO – operational noise will cease when the Development is decommissioned.
Can impact be avoided, managed or mitigated?	YES – noise emission from the wind turbines could be reduced, however this is not necessary in respect of this impact.

Mitigation measures to reduce residual risk or enhance opportunities:

Noise due to the operation of the proposed Development is not to exceed 45 dBA, LFeq,8hr at any residential dwelling present at the time of this consent.

In addition to the above, it is also recommended that a condition is attached requiring operational noise monitoring to be undertaken at the closest residential dwelling (H3), within 6 months of the Development being fully commissioned. In the event that the Development is found to exceed the noise limit specified above, the operator should implement a noise abatement programme in consultation with a suitably qualified Acoustics Consultant, and a further measurement undertaken to determine compliance. This cycle should continue until it can be demonstrated that the Development is operating within its specified noise limit.

-

Impact to be addressed/ further investigated?	NO – impacts are not significant

Potential impact description: Operational Noise - **Night**

The maximum operational noise level from the Development has been estimated to be 44 dBA, L_{Feq} at the closest identified potential noise-sensitive development.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	H	L	Negative	L	L	H
With Mitigation	L	H	L	Neutral	L	L	H

Can the impact be reversed?	YES – operational noise will cease when the development is decommissioned.
Will impact cause irreplaceable loss of resources?	NO – operational noise will cease when the development is decommissioned.
Can impact be avoided, managed or mitigated?	YES – noise emission from the wind turbines could be reduced, however this is not necessary in respect of this impact.

Mitigation measures to reduce residual risk or enhance opportunities: - Not required	
Impact to be addressed/ further investigated?	NO – impacts are not significant

Impact Phase: Decommissioning

Potential impact description: Decommissioning Noise
As described above

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	L	L	Neutral	L	L	H
With Mitigation	L	L	L	Neutral	L	L	H

Can the impact be reversed?	YES - construction period is temporary.
Will impact cause irreplaceable loss of resources?	NO – construction period is temporary.
Can impact be avoided, managed or mitigated?	YES – through application of good practice during construction.

Mitigation measures to reduce residual risk or enhance opportunities (if required):

Whilst not strictly necessary, the following measures are recommended in the interest of good site management:

- Decommissioning activities should be limited to agreed times;
- Deliveries of plant and materials by HGV to site should only take place by designated routes and within agreed times;
- The site contractors should be required to employ the best practicable means of reducing noise emissions from plant, machinery and decommissioning activities;
- Where practicable, the work programme should be phased;
- Where practicable, noise from fixed plant and equipment should be contained within suitable acoustic enclosures or behind acoustic screens;
- Where practicable, night time working should not be carried out.
- Local residents shall be notified in advance of any night-time activities likely to generate significant noise levels; and
- Any plant and equipment normally required for operation at night (23:00 - 07:00), e.g., generators, should be suitably screened or located such that noise levels from the plant do not exceed 45 dBA, L_{Feq} at the nearest noise-sensitive receptors.

Impact to be addressed/ further investigated?	NO – impacts are not significant and can be satisfactorily mitigated.

10 STATEMENT OF SIGNIFICANCE AND CONCLUSION

Noise due to the construction and operation of the proposed Development has been determined at the closest, and therefore most noise-sensitive developments, in accordance with internationally recognised methodologies.

The predicted noise levels have then been assessed against a number of criteria incorporating South African and international guidance. The worst-case level of impact was found to be Low at the closest noise-sensitive development, with no impacts anticipated for more distant noise-sensitive developments.

No significant impacts are therefore anticipated due to the proposed Development, and as such, it is the opinion of the author that the proposed Development may be authorised.

11 CONDITIONS TO BE INCLUDED IN ENVIRONMENTAL AUTHORISATION

It is recommended that a condition is attached to the permission for the proposed Development, requiring that noise due to the operation of the proposed Development is not to exceed 45 dBA, $L_{Feq,8hr}$ at any residential dwelling present at the time of this consent.

In addition to the above, it is also recommended that a condition is attached requiring operational noise monitoring to be undertaken at the closest residential dwelling (H3), within 6 months of the Development being fully commissioned. In the event that the Development is found to exceed the noise limit specified above, the operator should implement a noise abatement programme in consultation with a suitably qualified Acoustics Consultant, and a further measurement undertaken to determine compliance. This cycle should continue until it can be demonstrated that the Development is operating within its specified noise limit.

12 GLOSSARY

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.

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 analysing 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. Table 18 details typical dB(A) noise levels for a range of noise sources.

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

$L_{Aeq,t}$: This term is known as the A-weighted equivalent continuous sound pressure level for a period of time, t. It is similar to 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.

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.

13 EIA REGULATION CHECKLIST

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	**Section of Report**
(a) details of the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a curriculum vitae;	Section 1, Appendix 1
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix 1
(c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1
(cA) an indication of the quality and age of base data used for the specialist report;	Section 3
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 5
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	n/a
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 2
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 2
(g) an identification of any areas to be avoided, including buffers;	n/a
(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figure 1
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment, or activities;	Section 5
(k) any mitigation measures for inclusion in the EMPr;	Section 7
(l) any conditions for inclusion in the environmental authorisation;	Section 11
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	n/a
(n) a reasoned opinion— i. as to whether the proposed activity, activities or portions thereof should be authorised; iA. Regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr or Environmental Authorization, and where applicable, the closure plan;	The proposed development has been found to be acceptable in terms of noise; it is therefore requested that the proposal be accepted. Recommended mitigation measures are presented in Section 7
(o) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	No noise-specific comments received to date.
(p) any other information requested by the competent authority	n/a
Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	n/a

Basemapping from Chief Directorate: National Geo-Spatial Information of South Africa

ARCUS

⊕ Turbine Location

● Assessed Receptor

Predicted Noise Level, dB LAeq

- 35 dB
- 40 dB
- 45 dB
- 50 dB

1:65,000 Scale @ A3

0 1 2 km

NORTH

Produced By: SW	Ref: 3073-REP-002
Checked By: AM	Date: 18/06/2019

Noise Contour Plot

Figure 1

Paulputs WEF
EIA Report

P:\Projects\South Africa\SouthAfrica Noise\SouthAfrica_Noise.aprx\3073-REP-002

APPENDIX 1 - EXTERNAL REVIEW AND CV

Name: Morné de Jager
Cell: 082 565 4059
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Date: 14 July 2019
Ref: AC/2019/PaulPuts

Arcus Consulting
Office 220 Cube Workspace
Cnr Long Street and Hans Strijdom Road
Cape Town
8001

Attention: Mr Ryan David-Andersen

Dear Sir

REVIEW OF SPECIALIST STUDY: NOISE ENVIRONMENTAL IMPACT ASSESSMENT REPORT FOR THE PROPOSED PAULPUTS WIND ENERGY FACILITY AND ASSOCIATED GRID CONNECTION, NORTHERN CAPE PROVINCE

The above-mentioned report, dated June 2019, has relevance.

Terms of reference for the Review

A review report is normally done to ensure that a comprehensive noise investigation was completed. An Environmental Noise Impact Assessment (ENIA) is normally done as per the guideline set by SANS 10328 (2008). This specialist report however must feed into an Environmental Impact Assessment report, completed in terms of the latest relevant legislative requirements. As such, the specialist report should address both these requirements and this review will consider both aspects.

SANS 10328 proposed a number of review questions in section 9 which will be followed in this review. Any deviations to the guideline will be highlighted and a reason provided. It is critical to understand that the review investigation should not repeat the original investigation. Any shortcomings will be referred back to the original consultant that conducted the investigation.

In addition, it is critical that the review can confirm that the report complies with the requirements of Regulation GNR 326 of 4 December 2014, as amended in 2017 (known as Appendix 6).

As such this review will be divided into two distinct sections; one reviewing the SANS 10328 requirements and the second considering the DEA Requirements.

Qualification and Experience of Reviewer

I studied Chemical Engineering and graduated at the University of Pretoria in 1998 – B. Ing (Chem). I have been involved in Environmental Impact Assessments and Management since 1999 on various projects for Mining, Industry and Urban Development, but started to focus on Environmental Acoustics during 2006. Since 2007 I have done the Environmental Noise Impact Assessments for numerous projects covering Renewable Energy, Power Stations, Road and Railway construction, Industrial and Urban Development as well as numerous noise monitoring and noise audit reports. I have been involved in the Environmental Impact Assessment process for more than 100 different Wind Energy (WE) projects, review reports for more than 40 WE projects, measurements at existing wind energy facilities as well as ambient sound level measurements, scoping and screening level assessments for a number other WE facilities. This includes the measurement of ambient sound and noise levels at numerous locations over a total period of more than 200 nights.

Review in terms of section 9.3.3.1 of SANS 10328:2008

Environmental Legislation constantly changes and this review will only consider the checklist highlighted in section 9.3.3.1 and not the requirements of section 9.3 (Screening, Scoping and EIA Noise Reports). This is because the SANS 10328 edition 3 was compiled considering the relevant environmental legislation up to 2008 and does not consider the latest legislative requirements.

Table 1: Checklist used when reviewing Environmental Noise Impact Assessment report

Check list – Section 9.3.3.1 of SANS 10328	Comment / Remark
Is a detailed plan of study included?	No. Not required as per latest legislation.
Is a list and description of all the noise sources and noise-sensitive developments given?	Yes.
Are the feasible alternatives listed in the scoping report given?	**Scoping report not required.**
Is a description of the noise sources and noise-sensitive developments, as well as the alternatives listed in the scoping report, which need to be further investigated, given?	**Scoping report not required.**
Is a description of the noise sources and noise-sensitive developments, as well as the alternatives listed in the scoping report which need not be further investigated, and reasons for their omission given?	**Scoping report not required.**
Is the sound disturbance from the identified noise sources given together with the sources of origin, procedures used, as well as the measurement results?	Yes.
Is the estimated expected rating level given?	Yes.
Is the desired rating level and its details of determination given?	Yes. Specialist used multiple criteria to define an acceptable rating level.
Is a conclusion reached on a significant impact?	Yes.
Are full details of the results of measurements or calculation at the different identified points given, preferably by means of equal rating level contours?	Yes.
Are any alternative measures proposed?	Alternatives for wind turbine power generation potential briefly discussed, with the report considering a worst-case scenario. Since wind farms can only be developed at certain locations, this is considered sufficient.
Are full details of the proposed alternative measures given?	
Is there a complete study done on the effectiveness of the alternative measures?	
Is information as to possible follow-up investigations given after the project is completed?	Not discussed.
Is some follow up investigation indicated to ensure the reliability of any alternative measures?	No. Because of the predicted noise level of 44 dBA, it is the opinion of the reviewer that follow-up noise measurements be recommended to ensure that noise levels are less than 45 dBA.
Is a list of all interested or affected parties who partook in the investigation given with their individual comments?	Yes, statement that there was no comments.
Are all items to be covered by the report as given in 8.7 available?	See Table 2 below.
Is a record of all measurement and calculation results available?	Noise levels calculated in Tables 4 - 8.
Can the proposed recommendation be agreed to?	Partly, considering the approach and findings of report. The reviewer would recommend that the developer consider the implementation of a noise abatement programme if noise measurements indicate noise levels higher than 45 dBA at receptor H3.

Table 2: SANS 10328:2008 – Environmental Noise Impact Report requirements

Check list – Section 8.7 of SANS 10328	Comment / Remark
The environmental noise impact report shall contain at least the following information:	

a) the purpose of the investigation.	Yes, discussed.
b) a brief description of the planned development or the changes that are being considered.	Yes, discussed.
c) a brief description of the existing environment.	Yes, discussed.
d) 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.	Potential noise sources well defined with worst-case investigated for operational phase.
e) the identified noise sources that were not taken into account and the reasons as to why they were not investigated.	Not discussed but not required.
f) the identified noise-sensitive developments and the noise impact on them.	Yes. Potential noise-sensitive developments identified and noise intensity level calculated (Table 5 - 8).
g) where applicable, any assumptions, with references, made with regard to any calculations or determination of source and propagation characteristics.	Yes. Basic assumptions presented.
h) 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.	Yes. Calculation procedures were discussed.
i) 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.	**Ambient sound levels were not measured onsite with no reasons where measurements were not collected. Area were classified as typical rural noise district as per SANS 10103.**
j) the location of measuring or calculating points in a sketch or on a map.	No map although the report refers to Figure 1.
k) quantification of the noise impact with, where relevant, reference to the literature consulted and the assumptions made.	Yes.
l) alternatives that were considered and the results of those that were investigated.	Alternative wind turbines considered, though author used worst-case scenario for operational phase.
m) a list of all the interested or affected parties that offered any comments with respect to the environmental noise impact investigation.	Statement that no comments were received.
n) 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.	No comments received.
o) conclusions that were reached.	No.
p) proposed recommendations.	There are recommendations contained in the report; it recommends a condition to be attached to the Environmental Authorization.
q) if remedial measures will provide an acceptable solution which would prevent a significant impact, these remedial measures should be outlined in detail.	Yes. Impact significance is low and remedial measures are not required.
r) 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.	No follow-up investigation recommended, although it is the opinion of the reviewer that noise measurements be recommended during the operational phase due to the projected noise level of 44 dBA at H3.

Review in terms of GNR 326 requirements

The review considered all the requirements of Appendix 6 as included in the report. The references were followed to confirm whether the requirements were addressed. This review only highlights the potential issues as found in the DEA Requirements Checklist.

Table 3: Regulation GNR 326 Checklist

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	Section of Report
(a) details of the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a curriculum vitae;	Section 1. Referred to in Appendix 1 though not attached in the report as reviewed.
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Referred to in Appendix 1 though not attached in the report as reviewed.
(cA) an indication of the quality and age of base data used for the specialist report;	No site measurements.
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	No sound level measurements with no reason why this was not done.
(g) an identification of any areas to be avoided, including buffers;	Reportedly noise contours were developed. Figure 1 not attached.
(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figure 1 not attached
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	No and considered required.

Summary Conclusions

As an ENIA it is the opinion of the reviewer that the report is objective and scientific. The modeling procedure is precautious and technically accurate. The mitigation measures proposed is appropriate, though not required due to the low significance. The reviewer:

- may not agree with the criteria used to assess the significance of the noise impact;
- would recommend that future noise measurements be recommended, to be conducted during the operational phase (because of the relative high noise level calculated at H3);
- that a section be added with clear concluding remarks.

However, considering the approach of the author, the reviewer would likely come to similar findings.

Should you require any further details, or have any additional questions, please do not hesitate to call me on the above numbers.

Yours Faithfully,

Morné de Jager
Enviro-Acoustic Research cc

Name	:	Mr Morné de Jager
Profession	:	Acoustician / Noise Specialist
Date of Birth	:	1971/12/21
Parent Firm	:	Enviro Acoustic Research cc
Position in Firm	:	Noise Specialist
Years with firm	:	5 years
Nationality	:	South African
BI & Male/Female Status	:	White Male
Professional Qualification	:	B. Ing (Chemical) University of Pretoria 1998
Professional Membership	:	International Associate: American Society of Acoustics

LANGUAGE	SPEAK	READ	WRITE
English	Y	Y	Y
Afrikaans	Y	Y	Y

Countries of Work Experience	:	South Africa, Lesotho, Namibia, Ghana, Zambia, Mozambique
Proposed Position on Team	:	Noise Specialist

SUMMARY

Morné has been in private consulting for the last 20 years, managing various projects for the mining and industrial sector, private developers, business, other environmental consulting firms as well as the Department of Water Affairs. During that period he has been involved in various projects, either as specialist, consultant, trainer or project manager. During that period he gradually moved towards environmental acoustics, focusing on this field exclusively since 2007. He focused on Environmental Noise Measurement, Prediction and Control. He has been doing work in this field for the past 11 years and was involved with more than 300 noise studies in the last few years for a plethora of different projects, including studies for numerous existing and proposed mines, power stations, wind farms, road and transportation networks, residential development and pipeline development amongst others.

RELEVANT EXPERIENCE

Wind Energy Facilities	*Full Environmental Noise Impact Assessments for - Bannf (Vidigenix), iNCa Gouda (Aurecon SA), Isivunguvungu (Aurecon), De Aar (Aurecon), Kokerboom 1 (Aurecon), Kokerboom 2 (Aurecon), Kokerboom 3 (Aurecon), Kangnas (Aurecon), Plateau East and West (Aurecon), Wolf (Aurecon), Outeniqwa (Aurecon), Umsinde Emoyeni (ARCUS) , Komsberg (ARCUS), Karee (ARCUS), Kolkies (ARCUS), San Kraal (ARCUS), Phezukomoya (ARCUS), Canyon Springs (Canyon Springs), Perdekraal (ERM), Scarlet Ibis (CESNET), Albany (CESNET), Sutherland (CSIR), Kap Vley (CSIR), Kuruman (CSIR), Rietrug (CSIR), Sutherland 2 (CSIR), Perdekraal (ERM), Teekloof (Mainstream), Eskom Aberdene (SE), Dorper (SE), Spreeukloof (SE), Loperberg (SE), Penhoek Pass (SE), Amakhala Emoyeni (SE), Zen (Savannah Environmental – SE), Goereesoe (SE), Springfontein (SE), Garob (SE), Project Blue (SE), ESKOM Kleinzee (SE), Namas (SE), Zonnequa (SE), Walker Bay (SE), Oyster Bay (SE), Hidden Valley (SE), Deep River (SE), Tsitsikamma (SE), AB (SE), West Coast One (SE), Hopefield II (SE), Namakwa Sands (SE), VentuSA Gouda (SE), Dorper (SE), Klipheuwel (SE), INCA Swellendam (SE), Cookhouse (SE), Iziduli (SE), Msenge (SE), Cookhouse II (SE), Rheboksfontein (SE), Suurplaat (SE), Karoo Renewables (SE), Koningaas (SE), Spitskop (SE), Castle (SE), Khai Ma (SE), Poortjies (SE), Korana (SE), IE Moorreesburg (SE), Gunstfontein (SE), Boulders (SE), Vredenburg (Terramanzi), Loeriesfontein (SiVEST), Rhenosterberg (SiVEST), Noupoort (SiVEST), Prieska (SiVEST), Dwarsrug (SiVEST), Graskoppies (SiVEST), Philco (SiVEST), Hartebeest Leegte (SiVEST), Ithemba (SiVEST), !Xha Boom (SiVEST), Spitskop West (Terramanzi), Haga Haga (Terramanzi), Vredenburg (Terramanzi), Msenge Emoyeni (Windlab)*
Mining and Industry	*Full Environmental Noise Impact Assessments for – Delft Sand (AGES), BECSA – Middelburg (Golder Associates), Kromkrans Colliery (Geovicon Environmental), SASOL Borrow Pits Project (JMA*

	Consulting), Lesego Platinum (AGES), Tweefontein Colliery (Cleanstream Environmental), Evraz Vametco Mine and Plant (JMA), Goedehoop Colliery (Geovicon), Hacra Project (Prescali Environmental), Der Brochen Platinum Project (J9 Environment), Brandbach Sand (AGES), Verkeerdepan Extension (CleanStream Environmental), Dwaalboom Limestone (AGES), Jagdlust Chrome (MENCO), WPB Coal (MENCO), Landau Expansion (CleanStream Environmental), Otjikoto Gold (AurexGold), Klipfontein Colliery (MENCO), Imbabala Coal (MENCO), ATCOM East Expansion (Jones and Wagner), IPP Waterberg Power Station (SE), Kangra Coal (ERM), Schoongesicht (CleanStream Environmental), EastPlats (CleanStream Environmental), Chapudi Coal (Jacana Environmental), Generaal Coal (JE), Mopane Coal (JE), Glencore Boshoek Chrome (JMA), Langpan Chrome (PE), Vlakpoort Chrome (PE), Sekoko Coal (SE), Frankford Power (REMIG), Strahrae Coal (Ferret Mining), Transalloys Power Station (Savannah), Pan Palladum Smelter, Iron and PGM Complex (Prescali Environmental), Fumani Gold (AGES), Leiden Coal (EIMS), Colenso Coal and Power Station (SiVEST/EcoPartners), Klippoortjie Coal (Gudani), Rietspruit Crushers (MENCO), Assen Iron (Tshikovha), Transalloys (SE), ESKOM Ankerlig (SE), Nooitgedacht Titano Project (EcoPartners), Algoa Oil Well (EIMS), Spitskop Chrome (EMAssistance), Vlakfontein South (Gudani), Leandra Coal (Jacana), Grazvalley and Zoetveld (Prescali), Tjate Chrome (Prescali), Langpan Chromite (Prescali), Vereeniging Recycling (Pro Roof), Meyerton Recycling (Pro Roof), Hammanskraal Billeting Plant 1 and 2 (Unica), Development of Altona Furnace, Limpopo Province (Prescali Environmental), Haakdoorndrift Opencast at Amandelbult Platinum (Aurecon), Landau Dragline relocation (Aurecon), Stuart Coal Opencast (CleanStream Environmental), Tetra4 Gas Field Development (EIMS), Kao Diamonds – Tiping Village Relocation (EIMS), Kao Diamonds – West Valley Tailings Deposit (EIMS), Upington Special Economic Zone (EOH), Arcellor Mittal CCGT Project near Saldanha (ERM), Malawi Sugar Mill Project (ERM), Proposed Mooifontein Colliery (Geovicon Environmental), Goedehoop North Residue Deposit Expansion (Geovicon Environmental), Mutsho 600MW Coal-Fired Power Plant (Jacana Environmentals), Tshivhaso Coal-Fired Power Plant (Savannah Environmental), Doornhoek Fluorspar Project (Exigo)
Road and Railway	*K220 Road Extension (Urbansmart), Boskop Road (MTO), Sekoko Mining (AGES), Davel-Swaziland-Richards Bay Rail Link (Aurecon), Moloto Transport Corridor Status Quo Report and Pre-Feasibility (SiVEST), Postmasburg Housing Development (SE), Tshwane Rapid Transport Project, Phase 1 and 2 (NRM Consulting/City of Tshwane), Transnet Apies-river Bridge Upgrade (Transnet), Gautrain Due-diligence (SiVest), N2 Piet Retief (SANRAL), Atterbury Extension, CoT (Bokomoso Environmental), Riverfarm Development (Terramanzi)*
Airport	*Oudtshoorn Noise Monitoring (AGES), Sandton Heliport (Alpine Aviation), Tete Airport Scoping (Aurecon)*
Noise monitoring and Audit Reports	*SASOL Exploration (Lefatshe), Charlie Rig, Twisdraai Colliery (Lefatshe), Peerboom Colliery (EcoPartners), Thabametsi (Digby Wells), Doxa Deo (Doxa Deo), Harties Dredging (Rand Water), Xstrata Coal – Witbank Regional (Xstrata), Sephaku Delmas (AGES), Amakhala Emoyeni WEF (Windlab Developments), Oyster Bay WEF (Renewable Energy Systems), Tsitsikamma WEF Ambient Sound Level study (Cennergi and SE), Hopefield WEF (Umoya), Wesley WEF (Innowind), Ncora WEF (Innowind), Boschmanspoort (Jones and Wagner), Nqamakwe WEF (Innowind), Hopefield WEF Noise Analysis (Umoya), Dassiesfontein WEF Noise Analysis (BioTherm), Transnet Noise Analysis (Aurecon), Jeffries Bay Wind Farm (Globeleq), Sephaku Aganang (Exigo), Sephaku Delmas (Exigo), Beira Audit (BP/GPT), Nacala Audit (BP/GPT), NATREF (Nemai), Rappa Resources (Rayten), Measurement Report for Sephaku Delmas (Ages), Measurement Report for Sephaku Aganang (Ages), Development noise measurement protocol for Mamba Cement (Exigo), Measurement Report for Mamba Cement (Exigo), Measurement Report for Nokeng Fluorspar (Exigo), Tsitsikamma Community Wind Farm Pre-operation sound measurements (Cennergi), Waainek WEF Operational Noise Measurements (Innowind), Sedibeng Brewery Noise Measurements (MENCO), Tsitsikamma Community Wind Farm Operational noise measurements (Cennergi), Noupoort Wind Farm Operational noise measurements (Mainstream),*
Small Noise Impact	*TCTA AMD Project Baseline (AECOM), NATREF (Nemai Consulting), Christian Life Church (UrbanSmart), Kosmosdale (UrbanSmart), Louwlardia K220 (UrbanSmart), Richards Bay Port*

Assessments	*Expansion (AECOM), Babalegi Steel Recycling (AGES), Safika Slag Milling Plant (AGES), Arcelor Mittal WEF (Aurecon), RVM Hydroplant (Aurecon), Grootvlei PS Oil Storage (SiVEST), Rhenosterberg WEF, (SiVEST), Concerto Estate (BPTrust), Ekuseni Youth Centre (MENCO), Kranskop Industrial Park (Cape South Developments), Pretoria Central Mosque (Noman Shaikh), Soshanguve Development (Maluleke Investments), Seshego-D Waste Disposal (Enviroxcellence), Zambesi Safari Equipment (Owner), Noise Annoyance Assessment due to the Operation of the Gautrain (Thornhill and Lakeside Residential Estate), Upington Solar (SE), Ilangalethu Solar (SE), Pofadder Solar (SE), Flagging Trees WEF (SE), Uyekraal WEF (SE), Ruuki Power Station (SE), Richards Bay Port Expansion 2 (AECOM), Babalegi Steel Recycling (AGES), Safika Ladium (AGES), Safika Cement Isando (AGES), RareCo (SE), Struisbaai WEF (SE), Perdekraal WEF (ERM), Kotula Tsatsi Energy (SE), Olievenhoutbosch Township (Nali), , HDMS Project (AECOM), Quarry extensions near Ermelo (Rietspruit Crushers), Proposed uMzimkhulu Landfill in KZN (nZingwe Consultancy), Linksfield Residential Development (Bokomoso Environmental), Rooihuiskraal Ext. Residential Development, CoT (Plandev Town Planners), Floating Power Plant and LNG Import Facility, Richards Bay (ERM), Floating Power Plant project, Saldanha (ERM), Vopak Growth 4 project (ERM), Elandspoort Ext 3 Residential Development (Gibb Engineering)*
Project reviews and amendment reports	*Loperberg (Savannah), Dorper (Savannah), Penhoek Pass (Savannah), Oyster Bay (RES), Tsitsikamma Community Wind Farm Noise Simulation project (Cennergi), Amakhala Emoyeni (Windlab), Spreeukloof (Savannah), Spinning Head (SE), Kangra Coal (ERM), West Coast One (Moyeng Energy), Rheboksfontein (Moyeng Energy), De Aar WEF (Holland), Quarterly Measurement Reports – Dangote Delmas (Exigo), Quarterly Measurement Reports – Dangote Lichtenburg (Exigo), Quarterly Measurement Reports – Mamba Cement (Exigo), Quarterly Measurement Reports – Dangote Delmas (Exigo) Quarterly Measurement Reports – Nokeng Fluorspar (Exigo), Proton Energy Limited Nigeria (ERM), Hartebeest WEF Update (Moorreesburg) (Savannah Environmental), Modderfontein WEF Opinion (Terramanzi), IPD Vredenburg WEF (IPD Power Vredenburg), etc.*

SUMMARY OF OTHER EXPERIENCE

2013 to Date	Enviro Acoustic Research cc
2000 to 2013	M2 Environmental Connections
1998 to 2000	Department of Water and Sanitation, Assistant Director

DECLARATION

I confirm that the above information contained in the CV is an accurate description of my experience and qualifications and that, at the time of signature, I am available and willing to serve in the position indicated by me in the Proposal Ref: MDTE/2019/09.

Signature of Staff Member

24 January 2019

Date

APPENDIX 2 - CV AND DECLARATION OF INDEPENDENCE

CURRICULUM VITAE

Alan Moore

Senior Acoustic Consultant

Email:alanm@arcusconsulting.co.uk Tel: 01904 715470

Specialisms

- Acoustics
- EIA
- Renewable Energy
- Noise Modelling
- GIS

Summary of Experience

Alan is a Senior Acoustic Consultant, working in all aspects of environmental noise assessment, from scoping and consultation, through background noise surveys and modelling, to reporting, condition discharge and review of third-party assessments. In addition to numerous large-scale wind farm EIA projects at the planning stage (both onshore and offshore), Alan has significant experience of post-consent noise compliance monitoring work and noise complaint resolution.

As a corporate member of the Institute of Acoustics (MIOA), Alan undertakes noise survey work across the UK, and regularly attends meetings with Local Authorities, residents and public exhibitions. In addition to wind turbine noise, Alan has invaluable experience of industrial noise, transport noise and noise impact assessment of residential developments, designing noise mitigation schemes where necessary.

Professional History

2013-on – Senior Acoustic Consultant, Arcus Consultancy Services Ltd

2011-13 – Acoustic Consultant, Arcus Consultancy Services Ltd

2010-11 – Junior Acoustic Consultant, Arcus Consultancy Services Ltd

2004-08 – Graphic Designer, WAE Group Ltd

Qualifications and Professional Interests

- Postgraduate Diploma in Acoustics and Noise Control, Merit with Special Commendation; Institute of Acoustics
- BA(hons) Music Technology, 2:1 Honours; University of Huddersfield.

Project Experience

- Lead acoustic consultant for numerous wind energy developments across the UK including Fife Energy Park Offshore Demonstration Wind Turbine (Fife), Beinneun Extension Wind Farm (Scottish Highlands) and High Wood Wind Farm (East Riding of Yorkshire).

- Review of noise conditions and noise surveys to ensure compliance at sites including Wester Hassockrigg (North Lanarkshire) and Wheatrigg Farm (Ayrshire) and Glenconway (Northern Ireland).

- Blyth Offshore Wind Turbine Demonstration site, NAREC: Conducting background noise survey in accordance with BS4142 assessment methodology with regard to proposed electrical substation.

- EIA noise assessment for 11.5 MW wind farm in West Yorkshire. Feasibility studies, layout design, turbine selection, extensive cumulative noise modelling, background noise survey, reporting. Data analysis included the use of historic noise data from nearby consented sites, and accounting for the effect of wind direction on cumulative noise levels at nearby dwellings. Local Authority and local resident consultation both pre and post-submission.

- Becklands Park Industrial Estate, Market Weighton: Review of third-party noise assessment and industrial noise mitigation scheme for a proposed housing development on adjoining land. Client and Local Authority consultation, noise survey, and production of residential amenity report to determine suitability and likely efficacy of the proposed mitigation measures.

- Beatrice Offshore Wind Farm: Modelling and assessment of the onshore elements of the Development including construction noise (Horizontal Directional Drilling (HDD), cable trenching, substation construction etc.) and operational noise (primarily assessment of the impact upon residential amenity due to operational noise of the substation).

- Due Diligence noise assessment review of EIA wind farm development in Aberdeenshire.

- Research and manufacture of dual-layer microphone windshields, seeking to minimise the effect of wind-induced noise during environmental noise monitoring in exposed locations.

- Wind turbine noise emission testing in accordance with ISO 61400-11 on behalf of medium-scale wind turbine manufacturer.

- Consultation, modelling, data analysis and reporting for Section 36 wind farm Applications in Perth & Kinross and The Scottish Borders.

- Hawton Wind Farm, Nottinghamshire: Noise modelling, background noise survey, and post-submission consultation with Local Authority regarding suggested conditions.

- Ryder Point Wind Farm – Longcliffe Quarries Ltd: All aspects of EIA noise assessment process for a 4.6 MW development in Derbyshire. Cumulative noise modelling to determine feasibility and inform design process, consultation with client, Local Authority and residents, public exhibition attendance, survey, analysis and reporting. Data analysis included the use of historic noise data from nearby consented sites, and correcting this data to account for the effect of wind shear as per current best practice guidance.

- Investigation of the potential for an extension to a large-scale operational wind farm in Northern Ireland. Assessment included the re-analysis of existing background noise data, and evaluation of complex cumulative scenario in line with current best practice guidance.

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Paulputs Wind Energy Facility

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	Arcus Consultancy Services Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100%
Specialist name:	Alan Moore			
Specialist Qualifications:	BA(hons), MIOA			
Professional affiliation/registration:	Institute of Acoustics (UK). Member number 44639			
Physical address:	Suite 1C, Swinegate Court East, Swinegate, York, North Yorkshire, UK.			
Postal address:	Suite 1C, Swinegate Court East, Swinegate, York, North Yorkshire, UK.			
Postal code:	YO1 8AJ	Cell:	+44 7388 388910	
Telephone:	+44 1904 715470	Fax:		
E-mail:	alanm@arcusconsulting.co.uk			

2. DECLARATION BY THE SPECIALIST

I, Alan Moore, declare that –

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

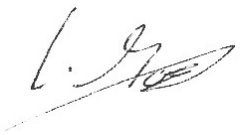
Signature of the Specialist

Name of Company: Arcus Consultancy Services Ltd

Date: 15/07/2019

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Alan Moore, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.



Signature of the Specialist

Name of Company: Arcus Consultancy Services Ltd

Date: 15/07/2019

Signature of the Commissioner of Oaths

Date