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ENVIRONMENTAL NOISE IMPACT ASSESSMENT INTO THE ESTABLISHMENT OF A WIND ENERGY FACILITY ALONG THE WEST COAST NORTH OF THE OLIFANTS RIVER MOUTH

Prepared by

A.W.D. Jongens

for

Savannah Environmental (Pty) Ltd

January 2008

EXECUTIVE SUMMARY

A specialist study was conducted into the potential impact of noise emanating from the proposed establishment of a Wind Energy Facility (WEF) along the west coast north of the Olifants River mouth and east of Koekenaap.

The land surrounding the proposed facility is primarily undeveloped, undisturbed farmland that is very sparsely populated. The closest farm homesteads or residences identified that might potentially be impacted upon by noise emanating from the wind turbines are at Skaapvlei, Skilpadvlei and Nooitgedag.

The results of the study indicated that there would be no impact of outdoor noise emanating from the wind turbines at the nearest noise sensitive area, Skaapvlei, and at all other noise sensitive land.

It was identified that low-frequency noise emanating from the turbines might have a low negative impact of low significance within dwellings at Skaapvlei.

The results indicated that on-site construction noise would not impact on any noise sensitive land other than in the vicinity of Skaapvlei.

Traffic flow, particularly of heavy-duty vehicles, during construction would probably result in a noise impact on the residents of the agricultural small holdings adjacent to the Skaapvlei Road who are situated close to the road. In order to minimise the noise during vehicular movement during the construction and operation of the facility it is recommended that the portion of the Skaapvlei road to the facility that passes through these smallholdings consist of a low-noise road surface.

It was anticipated that transportation of heavy equipment, such as the turbine nacelles, by slow moving, ultra-heavy-duty vehicles would result in a noise impact on communities along the entire route taken by the vehicles.

This report of the specialist study is submitted by the author independent of any third party influence.

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1 INTRODUCTION

1.1 Background and brief

Jongens Keet Associates was commissioned to undertake a specialist study into the potential impact of noise from the proposed establishment of a Wind Energy Facility (WEF) along the west coast north of the Olifants River mouth and west of Koekenaap. This report describes the Noise Impact Investigation into the establishment of the Facility.

2 STUDY AREA

The study area is shown on the map of Figure 1. The area is located west of the nearest town, Koekenaap, extending along the west coast north of the Olifants River mouth to south of Brand-se-baai (not shown in the Figure). It is proposed that between 50 and 100 wind turbines, each with an electrical capacity of up to 2 MW, will be located within an area of 37,6 km^2 shown within the green line. The proposed land area straddles an existing gravel road linking Skaapvlei with the R363 at a cluster of smallholdings situated close to Koekenaap. The distance between the eastern boundary of the proposed WEF and the R363 is approximately 14 km and to the outskirts of the cluster of smallholdings approximately 10 km. The orange and yellow lines indicate the alternative routes of the overhead electrical distribution lines.

The surrounding land is primarily undeveloped, undisturbed farmland that is very sparsely populated and covered in natural scrub similar to that shown in Figure 5.

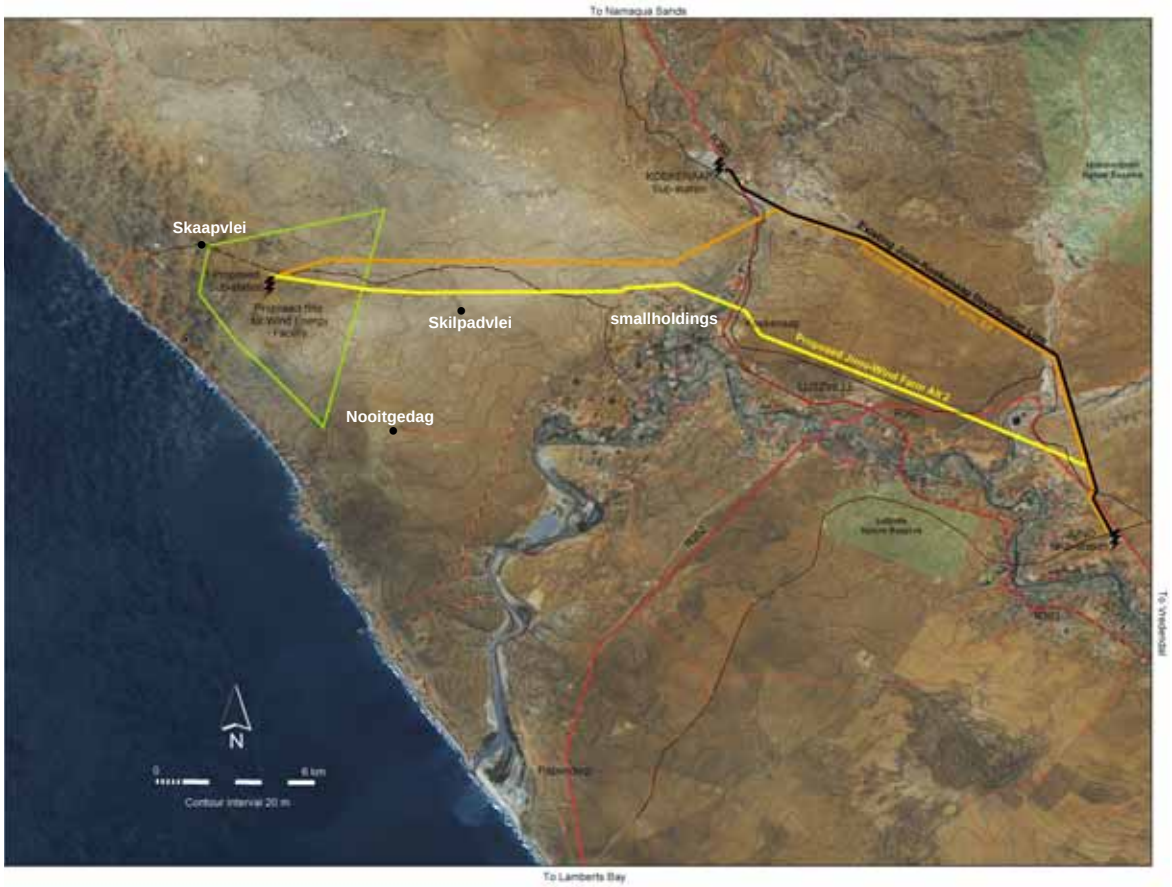

FIGURE 1 Study area showing demarcated area of the proposed Wind Energy Facility and alternative routes of power lines

3 METHODOLOGY

The study was conducted in accordance with procedures contained in South African National Standard (SANS) 10328, *Methods for environmental noise impact assessments* in terms of the National Environmental Management Act Nr 107 of 1998. A summary of the procedure is outlined hereunder.

1. Determine the land use zoning and identify all potential noise sensitive sites that could be impacted upon by activities relating to operation of the proposed WEF.
2. Determine the existing ambient levels of noise within the study area by conducting representative sound measurements.
3. Determine the acceptable rating level for noise at identified noise sensitive sites.
4. Identify all noise sources relating to the activities of the WEF during construction phase and operation phase that could potentially result in a noise impact at the identified noise sensitive sites.
5. Determine the sound emission and nature of the sound emission from each of the identified noise sources.

6. Calculate the expected rating level of sound at the identified noise sensitive sites from the combined sound power level emanating from identified noise sources.
7. Calculate the noise impact at identified noise sensitive sites.
8. Assess the noise impact at identified noise sensitive sites in terms of SANS 10328; the Noise Control Regulations; the World Health Organsation; the World Bank.
9. Investigate alternative noise mitigation procedures, if required.
10. Prepare and submit an environmental noise impact assessment report containing the procedures and findings of the investigation.

4 ASSESSMENT OF NOISE

A glossary of the terminology used in South African National Standards for the measurement and assessment of noise is contained in Appendix 1.

4.1 South African National Standards

In accordance with SANS 10328, the predicted impact that noise emanating from a proposed development would have on occupants of surrounding land is assessed by determining whether the rating level, $L_{Req,T}$, of the predicted ambient noise would exceed the residual noise or exceed the acceptable rating level of noise on that land as indicated in Table 2 of SANS 10103 and relating this excess to the probable response of a community to the noise as indicated in Table 5 of SANS 10103. Tables 2 and 5 of SANS 10103 are reproduced hereunder. Refer to Appendix 1 for definitions of terminology.

SANS 10103, Table 2 — Acceptable rating levels for noise in districts

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

NOTE 1 If the measurement or calculation time interval is considerably shorter than the reference time intervals, significant deviations from the values given in the table may result.

NOTE 2 If the spectrum of the sound contains significant low frequency components, or when an unbalanced spectrum towards the low frequencies is suspected, special precautions should be taken, and specialist attention is required. In this case the indoor sound levels may significantly differ from the values given in columns 5 to 7. See also annex B.

NOTE 3 Residential buildings, e.g. dormitories, hotel accommodation, residences etc. may only be allowed in non- residential districts on condition that the calculated or anticipated indoor $L_{Req,T}$ values given in column 3 of table 1 are not exceeded.

a The values given in columns 2 and 5 are equivalent continuous rating levels and include corrections for tonal character, impulsiveness of the noise and the time of day.

b The values given in columns 3, 4, 6 and 7 are equivalent continuous rating levels and include corrections for tonal character and impulsiveness of the noise.

SANS 10103, Table 5 — Categories of community/group response

1	2	3
Excess $\Delta L_{Req,T}$ [1)] dBA	**Estimated community/group response**	
	Category	**Description**
0 – 10	Little	Sporadic complaints
5 – 15	Medium	Widespread complaints
10 – 20	Strong	Threats of community/group action
>15	Very strong	Vigorous community/group action

a Calculate $\Delta L_{Req,T}$ from the appropriate of the following:

1) $\Delta L_{Req,T}$ = $L_{Req,T}$ of ambient noise under investigation MINUS $L_{Req,T}$ of the residual noise (determined in the absence of the specific noise under investigation).

2) $\Delta L_{Req,T}$ = $L_{Req,T}$ of ambient noise under investigation MINUS the maximum rating level for the ambient noise given in table 1.

3) $\Delta L_{Req,T}$ = $L_{Req,T}$ of ambient noise under investigation MINUS the acceptable rating level for the applicable district as determined from table 2.

4) $\Delta L_{Req,T}$ = Expected increase in $L_{Req,T}$ of ambient noise in an area because of a proposed development under investigation.

NOTE Overlapping ranges for the excess values are given because a spread in the community reaction may be anticipated

4.2 World Health Organisation

SANS 10103 contains the statement that the acceptable rating levels for ambient noise are essentially in line with the recommendations of the World Health Organisation (WHO) for community exposure [3].

4.3 World Bank

The World Bank has adopted the WHO recommendations on maximum L_{Aeq} in residential areas and schools. These recommendations apply to all World Bank Group funded projects. The assessments of noise impact in this study therefore embody WHO and World Bank assessments.

4.4 Impact qualifiers

The **magnitude** of a predicted noise impact was determined in relation to the categories of community response contained in Table 5 of SANS 10103 and are qualified as follows:

Negligible	Predicted $L_{Req,T}$ does not exceed the residual or acceptable $L_{Req,T}$
Low	Predicted $L_{Req,T}$ exceeds the residual or acceptable $L_{Req,T}$ by between 0 & 5 dB
Moderate	Predicted $L_{Req,T}$ exceeds the residual or acceptable $L_{Req,T}$ by between 5 & 10 dB
High	Predicted $L_{Req,T}$ exceeds the residual or acceptable $L_{Req,T}$ by between 10 & 15 dB
Very high	Predicted $L_{Req,T}$ exceeds the residual or acceptable $L_{Req,T}$ by more than 15 dB

For a 16-hour daytime assessment $L_{Req,d}$ replaces $L_{Aeq,T}$.
For an 8-hour night-time assessment $L_{Req,n}$ replaces $L_{Aeq,T}$.

4.5 Noise Control Regulations

The control of noise in the Western Cape is legislated in the form of the Noise Control Regulations of the Environment Conservation Act No. 73 of 1989 applicable to the Province of the Western Cape, Provincial Gazette Number 5309 of 20 November 1998.

In terms of Clause 2 (d) of the Noise Control Regulations:

"*A local authority may, before changes are made to existing facilities or existing use of land or buildings, or before new buildings are erected, in writing require that noise impact assessments or tests be conducted to the satisfaction of the local authority by the owner, developer, tenant or occupant of the facilities, land or buildings and that reports or certificates relating to the noise impact be submitted to the local authority, to the satisfaction of the local authority, by the owner, developer, tenant or occupant.*"

In terms of Schedule 3 (c) of the Noise Control Regulations:

"No person shall make changes to existing facilities or existing use of land or buildings or erect new buildings, if these will house or cause activities that will, after such changes or erection, cause a disturbing noise, unless precautionary measures to prevent the disturbing noise have been taken to the satisfaction of the local authority."

In terms of Clause 4 of the Noise Control Regulations:

"No person shall make, produce or cause a disturbing noise, or allow it to be made, produced or caused by any person, animal, machine, device or apparatus or any combination thereof."

Disturbing noise means a noise level that exceeds the ambient sound level measured continuously at the same measuring point by 7 dB or more.

Ambient sound level means the reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such meter was put into operation.
Certain terminologies used in the Noise Control Regulations and in the SANS 10103 have similar sounding, but not equal, meanings. Thus,

Noise Control Regulations:		SANS 10103:
Ambient sound level	is similar to	Residual noise
Noise level	is similar to	Rating level of ambient noise

Cognisance needs to be taken of the fact that the Provincial Noise Control Regulations have undergone major revision to bring them in line with recommendations of the World Health Organisation, WHO. South Africa is a signatory of WHO and is thereby bound by its recommendations. Although the existing Noise Control Regulations remain in force until promulgation of the revised Noise Control Regulations, the draft revision could be promulgated within the near future. Noise limits in the draft revision of the Noise Control Regulations are based on the acceptable rating levels of ambient noise contained in SANS 10103. Thus,

disturbing noise, in terms of the revised Regulations, would mean a specific noise level that exceeds either the outdoor equivalent continuous day/night rating level (L_{Rdn}), the outdoor equivalent continuous day rating level (L_{Rd}) and/or the outdoor equivalent continuous night rating level (L_{Rn}) for the particular neighbourhood indicated in SANS 10103 as the outdoor ambient noise in various districts.

5 NOISE SENSITIVE SITES

The closest farm homesteads or residences that might potentially be impacted upon by noise emanating from the wind turbines are at Skaapvlei, Skilpadvlei and Nooitgedag indicated in Figures 1 and 2

6 EXISTING AMBIENT SOUND LEVELS

Ambient sound levels were recorded at four locations on Thursday 5th and Friday 6th April 2007. The weather on both days was fine. The usually strong wind that blows in the area did not materialise. On both days there was little to no air movement.

The equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$, simultaneously with the 1/3rd octave band equivalent sound pressure levels were measured using a Larson Davis Type 824 precision integrating sound level meter mounted on a tripod with the

microphone positioned 1,4 metres above the ground and at least 1,5 metres from any large sound-reflecting surface. The microphone was fitted with a windshield. Prior to and after the measurements the calibration of the meter was checked using a Brüel & Kjaer type 4230 Calibrator.

The locations were established by means of a Magellan Meridian GPS unit and are indicated as L1 and L2 on the map of Figure 2. A description of each measurement location is recorded in Table 1 together with the geographical position, elevation and the measured $L_{Aeq,T}$ in the absence of noise from an occasional passing vehicle. The duration, T, of each measurement was approximately 10 minutes. Repeat measurements were within 0,6 dB. The stability of the sound levels indicated that the duration was long enough to be representative of that occurring during a daytime period for the same weather conditions. The $L_{Aeq,T}$ was therefore considered to represent the daytime rating level, $L_{Req,d}$, during wind still conditions and hence the lowest daytime residual level.

TABLE 1 Ambient sound level at measurement locations

Location		Latitude	Longitude	Elevation, m.	$L_{Aeq,T}$, dBA
L1	Road overlooking Olifants river & Zoutpansklipheuwel	31° 37.19S	018° 11.05E	65	36
L2	Road to Skaapvlei beyond turnoff to Skilpadvlei	31° 30.06S	018° 10.03E	80	34

A photograph of measurement location L1 is recorded in Figure 3. No photograph was taken at location L2. The equivalent continuous A-weighted sound level in each 1/3rd octave frequency band from 31,5 Hz to 8000 Hz measured at Locations L1 and L2 are recorded in Figures 4 and 5 respectively.

The ambient sound levels measured at locations L1 and L2 were considered to be representative of land in the vicinity of the identified noise sensitive sites at Skaapvlei, Nooitgedag and Skildapvlei. Within 1 dB they were equal to the acceptable outdoor night-time rating level, $L_{Req,n}$, for a rural residential district.

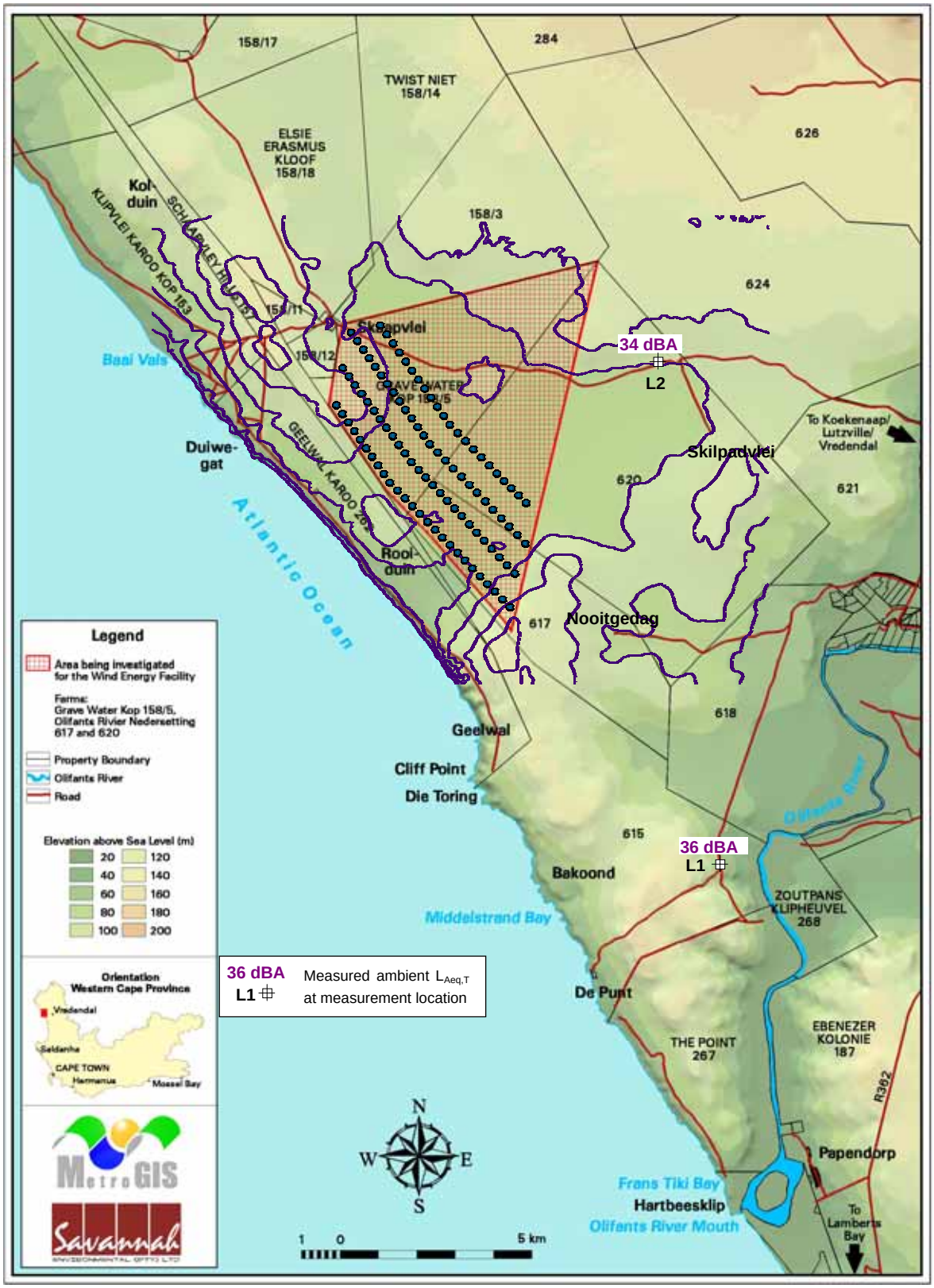

FIGURE 2 Map of study area including ambient sound measurement locations with measured $L_{Aeq,T}$.

FIGURE 3 Measurement location L1 looking east towards Olifants River and Zoutpansklipheuwel

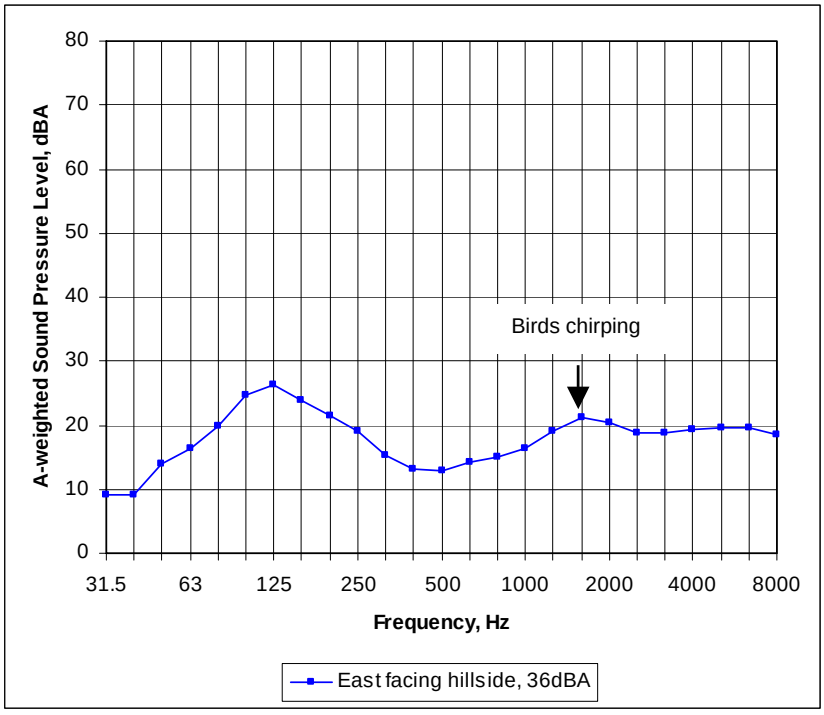

FIGURE 4 Sound level spectrum measured at location L1

Date & time:	Friday 6 April 2007; 11:15hrs
Weather:	Clear; no wind
Audible sounds:	Sea surf and/or distant vehicle noise just audible; chirping birds
$L_{Aeq,T}$:	36 dBA

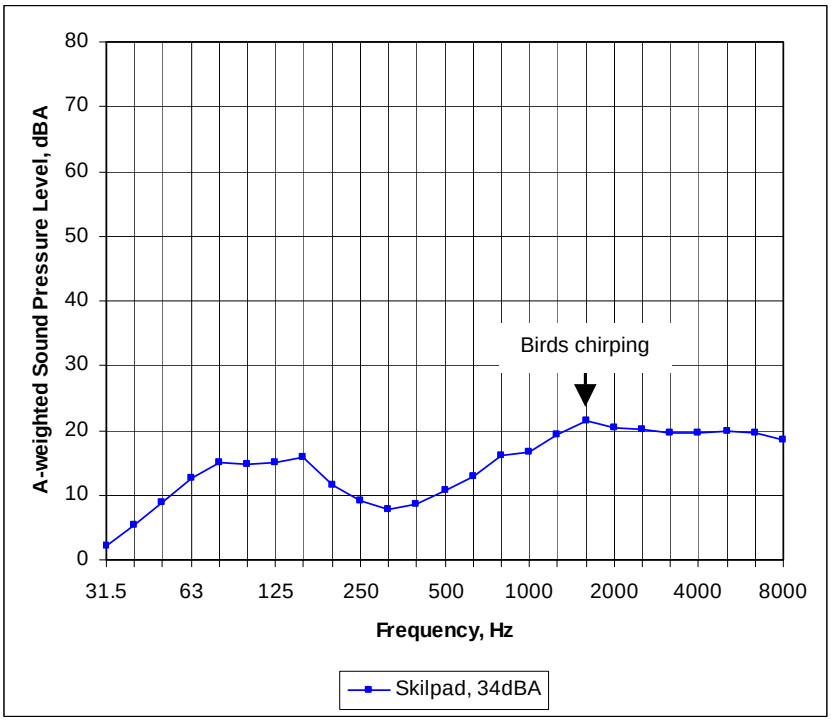

FIGURE 5 Sound level spectrum measured at location L2 on gravel road to Skaapvlei just beyond turnoff to Skilpadvlei (no photograph)

Date & time:	Friday 6 April 2007; 12:20hrs
Weather:	Clear; no wind
Audible sounds:	Chirping birds
$L_{Aeq,T}$:	34 dBA

7 NOISE SOURCES

It is proposed that between 50 and 100 wind turbines will be located within an area of 25 km^2 shown hatched within an orange line in Figure 2. The proposed location of the 100 turbines is included. At the time of preparation of this report no decision had been made on the type or electrical capacity of the turbines.

8 IMPACT OF NOISE AT RECEIVER LOCATIONS DURING OPERATION PHASE

8.1 Outdoor rating level $L_{Req,T}$

At the time of compiling this report precise details of the turbines were not available.

A report entitled Klipheuwel Audible Noise, dated 2005 was received from Mr I. Smit of Eskom. The report contains results of sound measurements conducted at the Klipheuwel Wind Energy Demonstration Facility (KWEDF) at Klipheuwel including graphs of the minimum, average and maximum sound power levels emitted in each 1/3rd octave frequency band by three wind turbines extending from 25 Hz to 10 kHz.
A Vestas V66, 1,7 MW wind turbine is the largest of these and was chosen as a yardstick for this study.

The sound power emission data of the Vestas V66 was used to calculate the approximate $L_{Req,T}$ in the vicinity of the proposed WEF. A copy of the sound power emission graph contained in the Klipheuwel report is displayed in Figure 6. No pure tones are evident. Therefore the $L_{Aeq,T}$ equals the rating level, $L_{Req,T}$, for constant operation of and hence constant noise emission from the WEF.

FIGURE 6 Sound power level emission of a Vestas, V66 wind turbine

The octave band sound power levels from 31,5 Hz to 4000 Hz for the maximum sound emission were derived from the 1/3rd octave values read off the graph. It was interpreted that the maximum sound emission occurred at a wind speed of between 7 and 8 m/s. No tabulated values were included. The maximum sound emission levels provided a worst-case scenario for sound emission from this turbine type.

The 1/3rd octave band sound power levels of each of 100 such turbines was calculated and used to calculate A-weighted sound pressure level contours around the proposed WEF site in accordance with procedures contained in SANS 10357, *The calculation of sound propagation by the Concawe method* [4].

The resultant $L_{Req,T}$ contours are displayed in Figure 7. The contours are to be interpreted as the $L_{Req,T}$ at any point on the contour during meteorological conditions providing most favourable propagation of sound from the sound source to the listener.

8.2 Assessment of noise impact

The nearest noise sensitive site, Skaapvlei, lies between the 40 and 45 dBA contour lines. The measured ambient $L_{Aeq,T}$ of 36 and 34 dBA at location L3 and L4 were obtained during almost wind still conditions during daytime. Due to the presence of audible surf noise and the absence of audible man-made noise at most locations it was anticipated that the night-time levels would not be significantly lower.

In the Klipheuwel report $L_{Aeq,T}$ of the order of 45 dBA or higher were recorded for wind speeds in excess of 5 m/s prior to construction of the KWEDF. The sound levels were attributed to interaction between the wind and the foliage of trees, grass and other structures. The latter wind speed is the cut-in speed for many wind turbines that only operate during wind speeds in excess of 5 m/s. It was thus anticipated that the outdoor $L_{Req,T}$ due to noise emission from the wind turbines would not exceed an ambient $L_{Req,T}$ of 45 dBA, or higher, due to wind noise at Skaapvlei. In terms of SANS 10103 the outdoor $L_{Req,T}$ of noise emanating from the wind turbines would not be considered to be disturbing. In terms of the NCR the noise would not be considered to be a disturbing noise. No noise impact outdoors is therefore expected at Skaapvlei.

At the other noise sensitive sites, Nooitgedag and Skilpadvlei, the $L_{Req,T}$ due to wind turbine noise would be less than 35 dBA and thus 10 dB or more below the 45 dBA expected at these sites during windy conditions. No noise impact is therefore expected at Nooitgedag and Skilpadvlei.

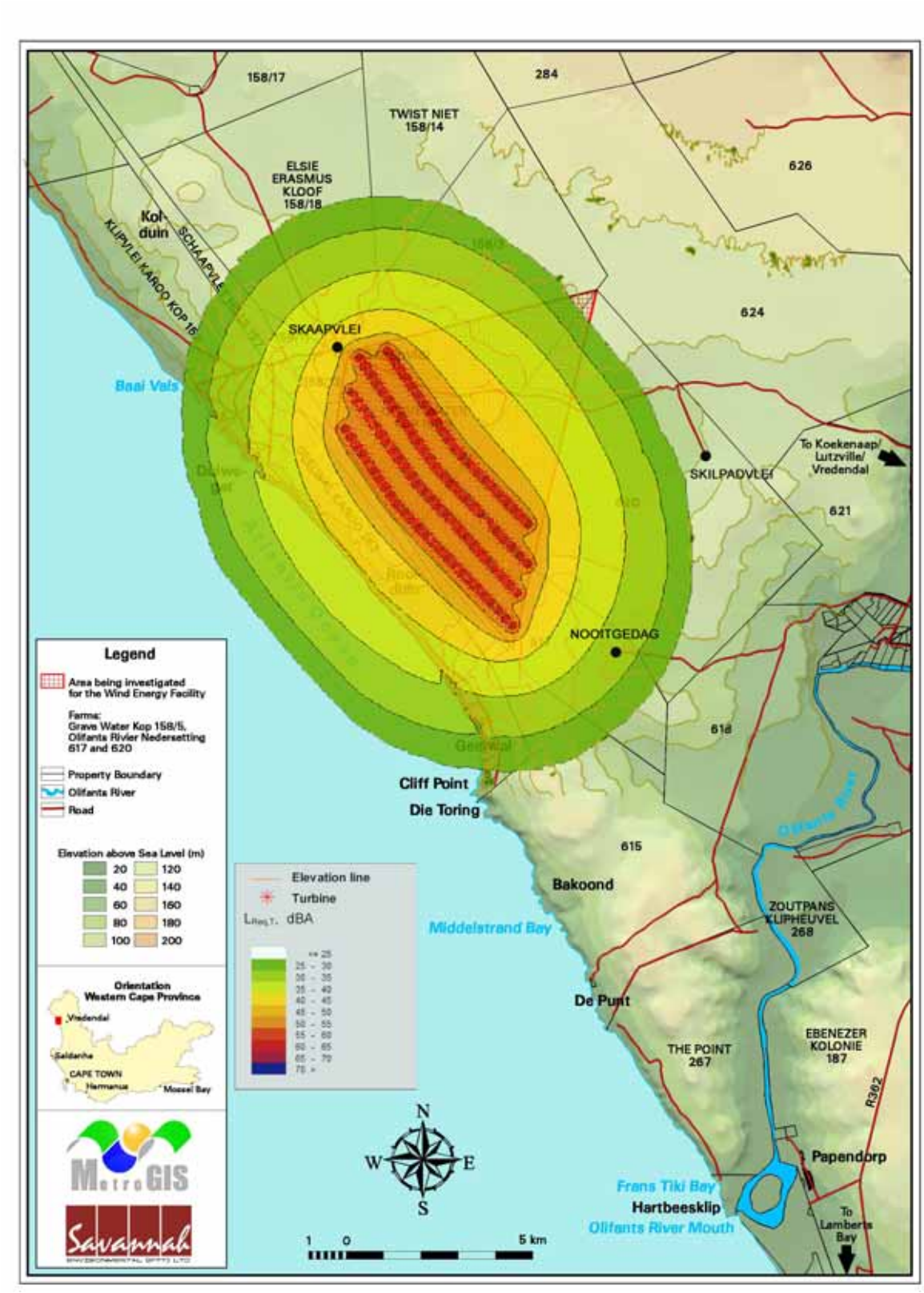

FIGURE 7 **$L_{Req,T}$ contours for 100 wind turbines - maximum sound emission**

8.3 Low frequency sound content

Perusal of international references regarding noise from wind turbines indicates that there is uncertainty whether, when there is public response to noise from wind turbines, the response is related to the presence, or not, of low frequency sound. This may partly be ascribed to the difficulty of measuring low frequency sound and particularly in isolating low-frequency sound of a source under investigation from the low-frequency ambient noise due to wind and human activities. Use of the standard metrics $L_{Aeq,T}$ and $L_{Req,T}$ for the measurement and assessment of sound do not provide an adequate relationship between the objective measurement of sound under consideration and the human subjective response to that sound when the sound contains strong low-frequency content. Low-frequency sound is understood to include all sound below a frequency of 125 Hz.

No standardised test and measurement procedure is yet available for the assessment of low-frequency noise. Annex B of SANS 10103 contains a procedure to determine whether noise at a receiver location contains sound with strong low frequency content. However, Annex B states: that “the procedure is only suitable to be applied indoors”.

Figure 8 contains a graph of the one-octave frequency band levels, in dB, calculated for the outdoor $L_{Req,T} \approx$ 44dBA at Skaapvlei. A Low Frequency Noise Rating, LFNR35 curve was superimposed onto this graph in accordance with Annex B. The calculated octave band levels exceed the LFNR curve below 125 Hz. Low frequency noise transmitting into indoor spaces might therefore be adjudicated as disturbing.

8.4 Assessment of low-frequency noise impact

Assessment of the potential impact of low-frequency sound indoors in accordance with Annex B of SANS 10103 would require knowledge of the sound insulation of the building(s) under consideration and the interior dimensions of the rooms. Room modes (resonance frequencies) associated with a room’s dimensions result in amplification of low-frequency sound entering the room if it contains energy at these particular frequencies.

Due to many variables associated with the construction of a particular building and between different buildings it is very difficult to calculate with any degree of accuracy the indoor sound level spectrum for an existing building from knowledge of the outdoor sound level spectrum without on-site measurements of the sound reduction between outdoors and indoor spaces of the building. The potential impact of low-frequency sound indoors at a particular site can therefore not be predicted with any degree of confidence.

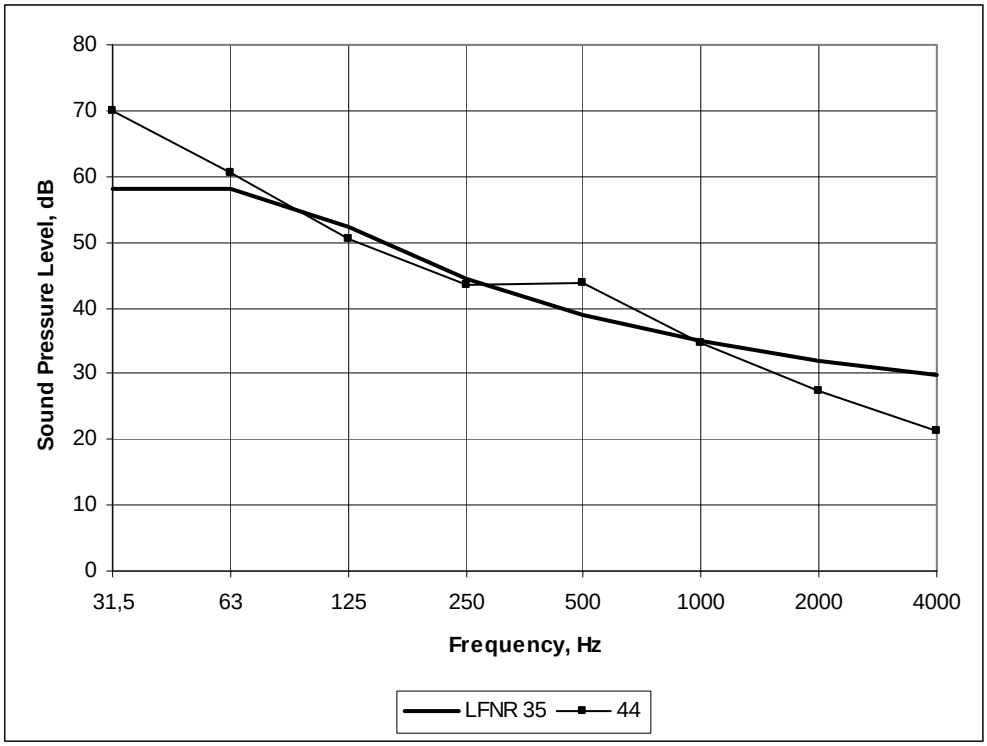

FIGURE 8 Low Frequency Noise Rating curve superimposed onto calculated outdoor octave band sound pressure levels at Skaapvlei

The results of this investigation do, however, indicate that noise emission from the proposed WEF might result in low-frequency sound being perceived within dwellings at Skaapvlei. Assuming, without any certainty, that the low-frequency noise were to cause the indoor $L_{Req,T}$ to increase by 5 dB the associated magnitude of impact would be minor. Refer to Section 4.4.

8.5 Summary of noise impact

	OPERATION PHASE		
NATURE	Noise impact on Skaapvlei residences		All other noise sensitive land
	Outdoors	Indoors	
EXTENT	Within 1 km (1)	Within 1 km (1)	Beyond 1 km (1)
DURATION	Long term (4)	Long term (4)	Long term (4)
MAGNITUDE	No effect (0)	Minor (2)	No effect (0)
PROBABILITY	Very Improbable (1)	Improbable (2)	Very Improbable (1)
SIGNIFICANCE	Low (5)	Low (14)	Low (5)
STATUS	Neutral	Negative	Neutral

9 CONSTRUCTION PHASE

It has been anticipated that the construction of the first 50 turbines would occur over a twelve month period and that construction of the total of 100 turbines would be completed after 18 months.

The following construction activities have been identified:

- Establishment of access roads to and within the site
- Site works, viz. preparation & clearance, excavation & construction of foundations
- Transport of components & equipment to site:
    - Wind turbine components
    - Substation & power line components
    - Cranes & lifting equipment
    - Other civils construction equipment
- Establishment of lay down areas on site
- Construct turbine
- Construct substation/s
- Establishment of ancillary infrastructure
- Connection of wind turbines to the substation
- Connect substation to power grid 132 kV power line
- Site remediation

9.1 Road construction

The existing gravel road from the intersection with the R363 to Skaapvlei via the cluster of smallholdings adjacent to the Skaapvlei Road is in poor condition and would probably be upgraded to provide access to the WEF site both for construction purposes and to provide access during the operation phase. Noise accompanying the upgrading of the gravel road would be typical of any road construction operation. The greatest impact would occur on several residential properties in the cluster of smallholdings situated along the road commencing at the intersection with the R363. It was not known what the duration of construction of the road would be. It was anticipated, however, that the negative impact due to road building and also of truck movement to the WEF site during construction, would be offset by the improved access to the affected residences.

In order to minimise the impact of noise on the smallholding residences construction of the road passed these residences should be limited to normal week day operating times.

The road surface texture will have a large influence on the noise emanating from vehicular traffic on the road. It is recommended that the road surface past the

smallholding residences and extending at least 500 m beyond the last residences comprise a well rolled, smooth asphalt surface containing aggregates no larger than 10 mm. A chip-and-spray surface, or similar, would generate noise levels up to 10dB higher than the recommended surface and should therefore not be considered. Beyond these limits the type of road surface would have little noise impact on inhabited land.

9.2 Site works and construction of turbine and infrastructure

The distances between the proposed WEF site and the nearest residences are:

Skaapvlei situated approximately 690 m west of the nearest turbine;
Nooitgedag situated approximately 2816 m south east of the nearest turbine;
Skilpadvlei situated approximately 5135 m east of the nearest turbine;

Table 2 provides indicative short-term A-weighted sound levels, L_A, (dBA) which may be experienced from typical heavy-duty items of equipment at the three above mentioned sites. These are based on sound power emission levels contained in BS 5228 – 1 [5]. It is to be noted that these are not long-duration $L_{Req,T}$ values.

TABLE 2 Predicted typical sound levels (dBA) of construction equipment

Equipment	Distance from equipment		
	690 m	2800m	5100 m
Front end loader/dozer	51	39	34
Excavator	49	37	32
Grader	47	35	30
Tip lorry	48	36	31
Concrete mixer	39	27	22
Crane	43	31	26

Site and construction work at the north western part of the proposed WEF site would be distinctly audible at Skaapvlei. During continuous operation of heavy earth moving equipment at that part of the site it anticipated that the daytime $L_{Req,d}$ would be exceeded by between 0 and 10 dB. With reference to Section 4.4 it was anticipated that the magnitude of noise impact would range between low and moderate but for short duration and of low significance. With increased separation distance the associated L_A and $L_{Req,d}$ due to construction noise would reduce to insignificant levels.

Site and construction work at the south eastern part of the proposed WEF site would be barely audible at Nooitgedag above the ambient sound level on a wind still day and inaudible during the prevailing SSE wind. It anticipated that the residual daytime $L_{Req,d}$ would not be exceeded. With reference to Section 4.4 the magnitude of noise impact would be negligible and of low significance.

Site and construction work anywhere on the proposed WEF site would be inaudible at Skilpadvlei and any other noise sensitive site further removed from the WEF site.

It was thus anticipated that on-site construction noise would not impact on any noise sensitive land other than in the vicinity of Skaapvlei.

9.3 Transport of components & equipment to site

It is assumed that construction and transportation vehicles to the site will travel through the towns of Vredendal and Lutzville along the R363. It is understood that these routes already bear a significant amount of traffic with a significant percentage of heavy-duty vehicles although measured traffic counts were not available. The anticipated number of construction-related vehicles per day for the WEF site was also not available. However, the traffic flow on an existing road would need to double for the level of noise at a receiver location to increase by 3 dB. This difference is insignificant in terms of human response to sound. It is considered unlikely that the number of construction-related vehicles per day would cause a doubling of heavy-duty traffic and, therefore, that there would not be a significant noise impact along the route up to the turnoff to the Skaapvlei road at Koekenaap.

An anticipated exception would be the ultra-heavy-duty vehicle required to transport each of the 60 ton turbine nacelles to site. Although no details of the vehicle to be used were available, it is likely to emit high levels of low frequency diesel engine noise. Due to the very low travel speed on the road, prolonged exposure to noise from the vehicle is anticipated as it travels past affected communities. This aspect would need to be included in the Environmental Management Plan.

The existing traffic flow to the WEF site that passes the smallholding community on the Skaapvlei Road is very low. The increase in traffic flow, particularly of heavy-duty vehicles, is likely to result in a noise impact on residential land close to the road. The extent of the impact can only be predicted from a comparison of existing hourly traffic flow data and the hourly traffic flow anticipated during construction. This information was not available.

It is estimated, without any certainty, that the $L_{Req,d}$ due to transportation on a gravel surface is likely to exceed the existing $L_{Req,d}$ by between 5 and 10 dB with an associated moderate magnitude of impact. The road surface along this section of the access road has been recommended under Section 9.1 in order to reduce the impact. It is estimated, without any certainty, that the $L_{Req,d}$ due to transportation noise on the recommended road surface would range between 0 and 5 dB with an associated low magnitude of impact. Refer to Section 4.4.

9.4 Power transmission lines

The two alternative routes of the overhead transmission lines are displayed in Figure 1. The Juno wind farm alternative 1 would be located furthest from residential land and would therefore have the least impact of noise during the construction thereof compared to alternative 2 that would impact on Skilpadvlei and the smallholdings which straddle the Skaapvlei Road.

9.5 Summary of noise impact during construction phase

	SITE CONSTRUCTION	TRANSPORTATION	
NATURE	Noise impact on Skaapvlei residences	Noise impact on residences along Skaapvlei Road near R363 intersection	
		No mitigation	Low-noise road surface
EXTENT	Within 1 km (1)	Nearest residential properties (1)	
DURATION	Short (2)	Short (2)	Short (2)
MAGNITUDE	Low to Moderate (5)	Moderate (6)	Low (4)
PROBABILITY	Highly probable (4)	Highly probable (4)	Highly probable (4)
SIGNIFICANCE	Medium (32)	Medium (36)	Low (28)
STATUS	Negative	Negative	Negative

10 CONCLUSIONS

The results of the study into the potential impact of noise from operation of the proposed Wind Energy Facility indicated that the land surrounding the facility is very sparsely inhabited and that few, if any, residents would be affected by noise emanating from the facility during the operation phase. Other than at Skaapvlei, situated close to the proposed WEF site, it was anticipated that there would be no impact of noise at the nearest identified sites of Nooitgedag and Skilpadvlei and any other noise sensitive land further removed from the WEF site.

It was anticipated that during the construction phase the noise accompanying movement of construction and transportation traffic to the site would impact on residents of the smallholdings situated along the Skaapvlei access road.

11 RECOMMENDATIONS

For reasons outlined in Section 9.1 it is recommended that a low-noise road surface (as detailed in Section 9.1) be constructed where the road passes close to the smallholding residences.

It is further recommended that all construction related vehicular traffic along the access road to the WEF site only occur during daytime hours to minimise potential impacts.

REFERENCES

1 South African National Standard 10328, *Methods for environmental noise impact assessments.*

2 South African National Standard 10103, *The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication*.

3 World Health Organisation, *Protection of the Human Environment; Guidelines for Community Noise*.

4 South African National Standard 10357, *The calculation of sound propagation by the Concawe method.*

5 British Standard 5228 – 1, *Noise and vibration control on construction and open sites, Part 1. Code of practice for basic information and procedures for noise and vibration control*

THE AUTHOR

The author of this report, A.W.D. Jongens, M.Sc. (Elec.) Eng, UCT, has since 1971 conducted numerous studies and submitted reports and recommendations to government departments, defence institutions, local authorities, local & international industries and private bodies relating to noise & vibration control, building and architectural acoustics, community noise, environmental noise and transportation noise throughout sub-Saharan Africa. The following is an abridged list of previous contracts relating to the present study.

» Royal Dutch Shell oil refinery, Rotterdam, The Netherlands.
» Pretoria Portland Cement limestone mine, Eastern Cape.
» Rand Refinery, Germiston, Transvaal
» Natal Portland Cement Simuma cement factory, Oribi Gorge, Natal.
» Anglo Alpha limestone mine and cement factory, Saldanha, Cape.
» Maputo Steel mill and slurry pipeline from Phalaborwa to Maputo.
» Kudu gas power plant, Oranjemund, Namibia.
» Saldanha Steel Plant, Saldanha, Cape.
» African Portland Cement factory & mines, Otjiwarango, Namibia.
» De Beers diamond mines, Cullinan.
» Bellville South Waste Disposal site.
» Landfill alternative site investigations at Atlantis and Kalbaskraal.
» Eskom Open Cycle Gas Turbine plants at Atlantis and Mossel Bay.

APPENDIX

Glossary of terms used in the measurement and assessment of sound

This appendix contains definitions of terms used in SANS 10103.

Ambient noise

the totally encompassing sound in a given situation at a given time, and is usually composed of sound from many sources, both near and far. It includes the noise from the noise source(s) under investigation.

A-weighted sound pressure level (sound level), L_{pA}

the sound pressure level, in decibels, relative to a reference sound pressure, and incorporating an electrical filter network in the measuring instrument corresponding with the human ear's different sensitivity to sound at different frequencies.

Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$

A formal definition is contained in SANS 10103. The term "equivalent continuous" may be understood to mean the "average" A-weighted sound level measured continuously, or calculated, over a period of time, T.

Equivalent continuous rating level, $L_{Req,T}$

the equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$, measured or calculated during a specified time interval T, to which is added adjustments for tonal character, impulsiveness of the sound and the time of day. An adjustment of 5 dB is added for any tonal character, if present, plus a further 5 dB if the noise is also of an impulsive nature. Where neither is present, the $L_{Req,T}$ is equal to the $L_{Aeq,T}$.

Reference time interval

The time interval to which an equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$, or rating level of noise, $L_{Req,T}$, is referred. Unless otherwise indicated, the reference time interval is interpreted as follows:

– Day-time: 06:00 to 22:00hrs T=16 hours when $L_{Req,T}$ is denoted $L_{Req,d}$

– Night-time: 22:00 to 06:00hrs T=8 hours when $L_{Req,T}$ is denoted $L_{Req,n}$

Residual noise

the ambient noise that remains at a given position in a given situation when one or more specific noises (usually those under investigation) are suppressed.

Equivalent continuous day/night rating level, $L_{R,dn}$

$L_{Req,d}$ combined (on an energy basis) with ($L_{Req,n}$ + 10 dB). The reference period T = 24 hours. 10 dB is added to $L_{Req,n}$ because of the greater sensitivity to noise during night time.