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NOISE IMPACT REPORT:

Re

Wind Turbine Generator Proposal

at

Hill Top Cottage, Dick Edge Lane, Cumberworth HD8 8YE

prepared for

Investment Renewables Ltd
Unit 2, 14 Wakefield Road
Grangemoor
Wakefield
WF4 4DS
Attention: Mr Ross Weaver

Report Reference : RJ216501.DOCX
Date : 21/12/2012

Signed : 

Principal Consultant
L F Ellison C.Eng. MSc. MBA MIEE MIOA.

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1. SUMMARY

1.1 A noise impact assessment has been performed for a proposed wind turbine generator installation at Hill Top Cottage, Dick Edge Lane, Cumberworth in Huddersfield.

1.2 Noise measurements have been performed at the site locality and are reported here.

1.3 Predictions of noise impact affecting the nearest dwellings have been facilitated using a computer program specialised for environmental noise calculations.

1.4 The Local Planning Authority prefers that the new noise should be -5dB below the prevailing background.

1.5 This assessment shows that the wind turbine noise will be some 7dBA below the background. As such the situation falls positively into the ‘complaints unlikely’ category terms of British Standard BS4142. The noise at dwelling receptors, for night time and day-time (garden) amenity, will easily be compliant with World Health Organisation (WHO) guidance criteria.

1.6 It is recommended that this report be passed to the relevant parties with the expectation of acceptance for the scheme from a noise impact aspect.

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2. INTRODUCTION

2.1 WTG Site Address and Application:

- Ms Janet Maskell, Hill Top Cottage, Dick Edge Lane, Cumberworth HD8 8YE
- Kirklees Council Planning Application Number : 2012/62/93068/W

2.2 Purchase Order and References Supplied:

- Instructed by Ross Weaver, Investment Renewables Ltd as agent, on 10 December 2012.
- Purchase Order Number: Email dated 10 December 2012.

2.3 Instructions and Objectives

The proposed installation of a wind turbine generator (WTG) has the potential to change the noise climate affecting residential neighbours. Accordingly, the Local Authority requires a background noise survey together with predicted noise levels in the garden of the nearest residential properties. If excessive, and thus a nuisance to residential neighbours, they would expect noise amelioration. After discussion with the Council the preferred approach is to achieve a WTG noise 5dB below background, therefore safely ensuring no loss of amenity to neighbours.

2.4 Site Description

The proposed site is at an elevated location in the rural Cumberworth area of Huddersfield, approximately 1km from the A616 Sheffield Road, in the region of 4km from the village of Holmfirth, and 10km from Huddersfield.

2.5 Locality Noise Context – Other Sources etc.:

- Rural location, animals and farming in the vicinity.
- Topology- the area of interest is on a small gradient but can be considered relatively flat for acoustic purposes.

2.6 Noise-Sensitive Receptors:

- Nearest neighbouring properties (2 in number) are to the north east and south east of the WTG proposed location. Both would be 80+ metres from the WTG.

2.7 NVM performed the site environmental noise measurements and calculations using current practice and guidelines.

2.8 Abbreviations and a glossary are provided at Section 9 Appendix 1. Also, definitions of terms and further references are readily available at local authority websites, on the internet, etc.

***Important**:*

This report addresses only the issues as stated above.

The use of this report is strictly limited to the named client for the specific purposes in the project defined above. Recipients or users are requested to contact NVM to confirm currency of this report.

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3. WTG INSTALLATION

3.1 Figure 11-1 shows the site plot plan, the survey measurement location, and the proposed location of the wind turbine generator. The nearest dwellings are roughly south east and north east of the proposal site, both some 80metres.

3.2 The proposal is understood to be for an Evance R9000 5kW wind turbine on a 12m monopole mast. The cut-in speed is 3m/s and the rotor speed is 200rpm nominal. Detailed information is available at the website www.evancewind.com/products/detail/r9000-specification.

3.3 As a point of reference, a noise level is stated in the manufacturer's literature as 45dB(A) at 60m distance for a 8m/s wind speed. The detailed data used in this study was obtained from an Evancewind report titled *Analysis of TR087 MCS noise data for comparison with ETSU guidelines*, Issue 4, provided by Investment Renewables.

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4. CRITERIA

4.1 Kirklees Council's preferred approach to WTG assessment is to achieve a WTG noise 5dBA or greater below the background noise level (LA_{90}). Further supporting reference material follows.

4.2 British Standard BS 4142:1997, 'Method for rating noise affecting mixed residential and industrial areas' is used for determining the difference between a 'rated' industrial noise and background noise and is deemed to anticipate the likelihood of complaints from residents exposed to industrial sources. The greater this difference the greater is the likelihood of complaints. A difference of around +10dB or more indicates that complaints are likely. A difference of around +5dB is of marginal significance. If the rating level is more than 10dB below the measured background level then this is a positive indication that complaints are unlikely. Noise is averaged over a period of one hour for daytime events and five minutes for night events. Night is usually defined as 2300-0700hours. Hence a noise criterion may be based upon the background noise level pertaining to the complainant addresses. For example, the level considered acceptable may be equal to the measured background $L_{Aeq(90)}$ level plus 5dBA in order that the noise be of 'marginal significance'. Note that the BS4142 is not applicable to background noise situations less than 30dBA.

4.3 'Guidelines for Community Noise' are issued by the World Health Organisation (WHO). The WHO suggests that good sleeping conditions are provided at an internal dwelling noise limit level of 30dBA L_{eq} and moderate annoyance occurs for internal levels above 35dBA L_{eq}. The difference of noise level between outside noise and inside with a window partially open for ventilation may be taken to be 10 to 15dBA. Hence a noise level limit outside a bedroom may be 45 to 50dBA L_{eq}. A standard for daytime noise levels affecting dwelling gardens is that they should not exceed 50dBA L_{eq} (1hour).

4.4 If a 'façade' noise level is required based upon noise measured in the free field (away from all significant reflecting surfaces other than the ground), then this can be taken as the free field noise level plus 3dB.

4.5 Generally, background noise levels are higher in the day than those in the night.

4.6 Background related to wind noise tends to increase in tandem with, or faster than, noise from a WTG. Prominent noise level due to a WTG tends to occur at or just above its cut-in speed e.g. 3 to 5m/s wind speed. 'Natural' noise due to the wind then provides a certain 'masking' of the WTG noise.

4.7 Local Planning Authorities have the power to set and vary the noise limit conditions to a degree but should provide justification for a variation from the normal standards and codes.

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5. BASELINE CONDITIONS

5.1 The measurement approach, methodology and instrumentation list is set out in Section 10, Appendix 2. Meteorological conditions and notes are tabled also in Section 10. The instrumentation deployed at site is illustrated in photographs, Figure 10-1.

5.2 A survey was performed to establish the relevant baseline or background noise conditions at the proposal site. The survey data is tabled in Section 11, Appendix 3. Figure 11-1 identifies the measurement location in the application site plot plan.

5.3 The noise survey was undertaken in accordance with normal good practice. The events surveyed were considered typical and representative in the site locality. The noise comprised mainly: occasional vehicle passing, distant traffic, animal (horse neigh) sounds, boiler noise occasionally from the immediate neighbour property and passenger aircraft, etc.

5.4 Based upon the measurement survey, the pertinent information is:

- Night time- L_{A90} (10 minute) = 32 to 35dB.
- Day time- on a cautious basis- the same as night.

5.5 Note that the wind speed for this survey was, for a time, at the WTG cut-in speed (e.g. about 3 to 4m/s).

5.6 These noise levels are to be the criteria against which the WTG noise will be judged.

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6. PROPOSAL IMPACT

6.1 Noise Assessment

6.1.1 There are two relevant noise receptor locations identical in distance from the proposed WTG. One of two affected noise receptor locations is considered. Both internal amenity and garden amenity are treated.

6.1.2 Table 12-2, presents the basic facts for the assessment.

6.2 Noise Impact

6.2.1 It is important to appreciate that the impact of WTG noise is dependent upon the prevailing masking background environmental effects including wind-in-foliage noise.

6.2.2 Referring to Table 12-2, an ‘impact’ for the proposal is derived. In effect, the WTG noise will be on average 7dBA below the background noise level.

6.2.3 As such, the proposal noise, being more than 5dBA below the background, is clear compliance with the Local Authority requirement.

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7. CONCLUSIONS

7.1 Background noise at the proposal area sensitive receptors has been measured, the specific wind turbine generator noise at the same receptors predicted, and the results compared with the Planning Authority requirement.

7.2 The effect or impact of the WTG is assessed as acceptable.

7.3 For the sake of completeness: There should be no concern at all for this proposal's WTG noise effect on animals since it is widely acknowledged that animals grazing in the immediate vicinity of large WTG farms are unconcerned about the noise.

7.4 The noise impact on public access areas is negligible. Ground borne noise will also be negligible.

7.5 Noise is not expected to be an obstacle in the planning process

8. RECOMMENDATIONS

8.1 As the noise levels will be acceptable (not being intrusive to neighbours), recommendations for noise amelioration are unnecessary. The proposal should be acceptable.

9. APPENDIX 1 – ABBREVIATIONS AND GLOSSARY

Table 9-1 Abbreviations

BS	British Standard
dB, dBA, dB(A)	Noise level, A-weighted, decibels, dB
EIA	Environmental Impact Assessment
ES	Environmental Statement
Hz, kHz	Unit of frequency, one cycle per second; one thousand cycles per second
LAeq, $L_{Aeq,T}$	A-weighted equivalent noise level in dB, usually for a defined time duration, T
L_{A10}	The noise level exceeded for 10% of the measurement period, often used to assess traffic noise
L_{A90}	The noise level exceeded for 90% of the measurement period, often used as a proxy for background noise
LA max	A-weighted maximum noise level
m/s	Metres per second, speed
SPL	Sound Pressure Level
SWL	Sound Power Level

Table 9-2 Glossary

A-weighted Decibel	The most frequently used noise measurement representing the sound pressure level weighted to correspond to the frequency response for the human ear. A difference of 3 dB(A) may just be noticeable, and a difference of 10 dB(A) represents a subjective doubling or halving of loudness
Baseline Conditions	The conditions against which potential impacts arising from the Scheme are identified and evaluated
Decibel	Logarithmic ratio used to relate sound pressure to a standard reference value
Environmental Impact Assessment	A systematic study of the likely environmental effect of a project
Environmental Statement	Document that reports the findings of an Environmental Impact Assessment
Mitigation measure	Actions proposed to moderate adverse impacts and to enhance the beneficial ones arising from the whole or specific elements of the Scheme
Neighbour noise	- that produced by a person's neighbour
Neighbourhood noise	- that produced in the neighbourhood such as noise from pubs, commercial or local industry and construction sites, but not from transportation unless specifically stated
Noise	Unwanted sound
Noise spectrum	Noise described by analysis into frequency components
Octave	- ratio of 2:1 between adjacent frequency bands
Spatial	Regarding geographical space
Temporal	Regarding time

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10. APPENDIX 2 – NOISE MEASUREMENT METHODOLOGY

10.1 Noise measurements were made using microphone, fitted with a windshield, connected to an integrating and logging sound level meter designed for these purposes. The microphone was in the approximate free field (2m from a low-height porch) 1.6m above the ground. The measurement location was chosen to be equivalent to a quiet point in a representative garden.

10.2 All acoustic data are in decibels (dB) referenced to 20 micro Pascals. The instrumentation was calibrated before and after the survey: the calibration remained accurate and constant within 0.1dB. Measurements are free field unless otherwise mentioned.

10.3 The equipment was installed on Tuesday 11 December and collected on Thursday 13 December. The monitoring was continuous and largely unattended.

10.4 Noise data was stored in the computer memory and post-processed using proprietary software. The data was also passed to a computer spreadsheet program to further facilitate detailed inspection, graphing, and calculations.

Table 10-1 Instrumentation list

Item	**Manufacturer**	**Model**	**Serial No.**
Svan 912A sound level analyser	Svantek, Poland	Svan 912A	2353
Microphone, 12.5mm, condenser type	GRAS Sound & Vibration aps	40AF	7840
Microphone windshield, including secondary windshield and bird-spike	B&K	UA	
PC operating software	MicroSoft	Windows XP Pro	
MS Excel spreadsheet	MicroSoft	Excel 2010	

10.5 At set up, the weather was cool but sunny, 3ºC, with low wind at less than 2m/s. Further weather details follow in the table below.

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Table 10-2 Site measurement conditions (source; metoffice.gov.uk)

UK local time	Summary	Precipitation probability (%)	Temp (°C)	Wind speed m/s	Wind Direction
Tues 11/12/2012 12:00	Sunny day	<5	**2**	2.4	WNW
11/12/2012 15:00	Sunny day	<5	**2**	1.5	WSW
11/12/2012 18:00	Clear night	<5	**-1**	2.4	W
11/12/2012 21:00	Clear night	<5	**-1**	2.9	W
Weds 12/12/2012 00:00	Clear night	<5	**-2**	3.4	W
12/12/2012 03:00	Clear night	<5	**-2**	2.9	W
12/12/2012 06:00	Clear night	<5	**-2**	2.9	W
12/12/2012 09:00	Sunny day	<5	**-1**	1.9	WSW
12/12/2012 12:00	Sunny intervals	<5	**0**	1.0	W
12/12/2012 15:00	Sunny intervals	<5	**0**	2.4	WSW
12/12/2012 18:00	Cloudy	<5	**0**	1.0	WSW
12/12/2012 21:00	Cloudy	<5	**-1**	1.0	SE
Thurs 13/12/2012 00:00	Partly cloudy	<5	**-1**	1.0	SSE
13/12/2012 03:00	Partly cloudy	<5	**-1**	1.5	SE

10.6 The site situation and measurement microphone locations are illustrated below.



Figure 10-1 Photographs showing the microphone situation on site

11. APPENDIX 3 –SITE AND MEASURED NOISE DATA

11.1 The site and measurement location is shown below.

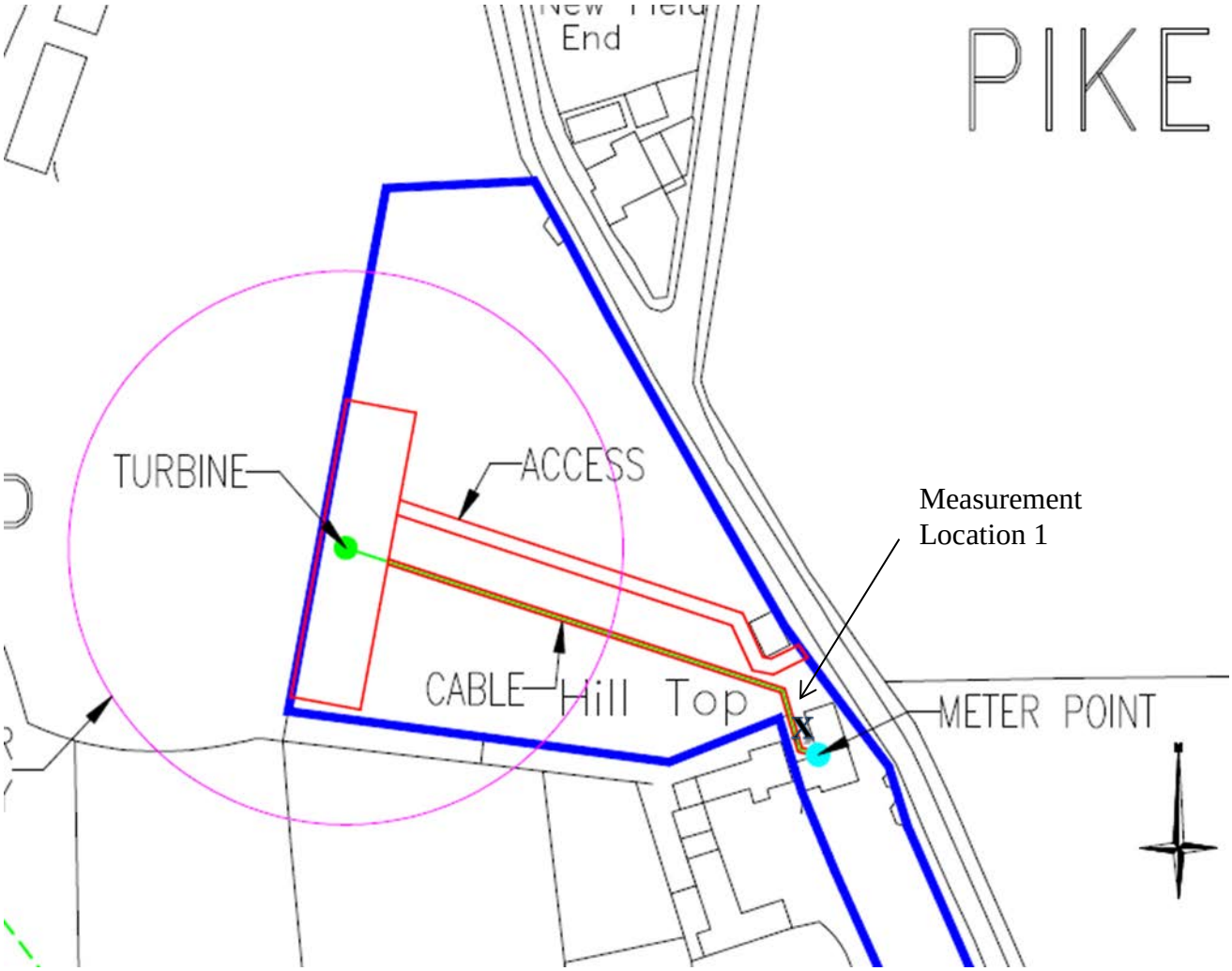


Figure 11-1 Site layout and noise measurement location

11.2 The figure above shows the site area and the noise measurement location within the site namely:

- Location 1 a secluded unobtrusive place, representative of the rear dwelling noise climate, certainly for the receptor address next door to the WTG proposal owner, immediately to the west of the measurement location. The noise measurement location was chosen to be representative for the neighbour's garden amenity.

- Note that the other potential receptor location lies to north of the NNW of the measurement position at the junction of Scar Hole Lane and Intake Lane. Noise data for this dwelling property location has not been obtained as it is safe to assume it would not be quieter.

11.3 The noise measured, in 10 minute durations, is summarised in the next table.

Table 11-1 Measured noise data, SPL dB

Date & Time	L10	L50	L90
11/12/2012 12:30	40.7	37.8	35.4
11/12/2012 12:40	54.5	47.4	38.3
11/12/2012 12:50	40.3	38.7	37.1
11/12/2012 13:00	40.6	37.4	34.9
11/12/2012 13:10	40.9	37.6	35.4
11/12/2012 13:20	39.1	35.6	33.5
11/12/2012 13:30	39.0	37.2	34.6
11/12/2012 13:40	39.6	36.6	34.9
11/12/2012 13:50	42.1	37.2	34.9
11/12/2012 14:00	39.6	36.4	34.0
11/12/2012 14:10	42.3	38.3	36.2
11/12/2012 14:20	41.3	37.8	35.3
11/12/2012 14:30	40.8	37.7	35.6
11/12/2012 14:40	38.9	37.4	35.0
11/12/2012 14:50	39.5	37.3	34.7
11/12/2012 15:00	40.7	37.7	36.4
11/12/2012 15:10	38.8	37.1	35.1
11/12/2012 15:20	40.8	39.4	37.6
11/12/2012 15:30	41.7	40.0	38.6
11/12/2012 15:40	42.4	40.1	38.9
11/12/2012 15:50	41.5	39.2	37.4
11/12/2012 16:00	45.4	41.7	39.5
11/12/2012 16:10	41.5	39.4	38.2
11/12/2012 16:20	45.1	39.6	37.3
11/12/2012 16:30	42.0	39.4	37.4
11/12/2012 16:40	41.1	39.4	37.8
11/12/2012 16:50	45.1	42.1	39.7
11/12/2012 17:00	41.3	39.6	38.5
11/12/2012 17:10	41.8	40.1	39.2
11/12/2012 17:20	41.1	38.8	37.7
11/12/2012 17:30	41.7	39.5	38.2
11/12/2012 17:40	44.3	39.1	37.2
11/12/2012 17:50	47.8	43.4	40.2
11/12/2012 18:00	41.7	39.9	38.6
11/12/2012 18:10	43.5	41.0	39.6
11/12/2012 18:20	41.9	39.9	38.0
11/12/2012 18:30	41.5	39.0	37.0
11/12/2012 18:40	41.4	39.7	38.2
11/12/2012 18:50	43.4	39.3	37.2
11/12/2012 19:00	41.1	39.6	37.8
11/12/2012 19:10	41.4	38.7	36.8
11/12/2012 19:20	40.5	39.1	37.9
11/12/2012 19:30	40.0	38.7	37.8
11/12/2012 19:40	40.2	38.3	37.2
11/12/2012 19:50	40.2	38.8	36.8
11/12/2012 20:00	49.0	41.3	36.8
11/12/2012 20:10	41.6	39.3	37.5
11/12/2012 20:20	39.7	36.7	35.0
11/12/2012 20:30	40.6	38.9	37.0
11/12/2012 20:40	40.6	38.3	36.6
11/12/2012 20:50	40.6	38.7	37.6
11/12/2012 21:00	38.8	37.2	34.7
11/12/2012 21:10	39.9	38.1	35.9
11/12/2012 21:20	47.1	37.5	35.4
11/12/2012 21:30	38.5	36.5	34.0
11/12/2012 21:40	39.5	37.8	36.5
11/12/2012 21:50	37.4	35.8	34.1
11/12/2012 22:00	39.7	38.1	36.8
11/12/2012 22:10	37.2	35.4	33.7
11/12/2012 22:20	39.3	37.2	35.7
11/12/2012 22:30	37.7	36.0	34.2
11/12/2012 22:40	41.6	38.2	36.4
11/12/2012 22:50	44.8	38.7	35.5
11/12/2012 23:00	39.3	37.5	35.2
11/12/2012 23:10	38.2	36.9	36.1
11/12/2012 23:20	37.8	36.3	34.4
11/12/2012 23:30	37.9	36.3	34.0
11/12/2012 23:40	37.6	35.9	32.8
11/12/2012 23:50	43.7	37.2	36.1
12/12/2012 00:00	36.8	35.0	33.0
12/12/2012 00:10	38.8	37.5	35.6
12/12/2012 00:20	36.9	34.9	32.9
12/12/2012 00:30	38.5	37.3	35.1
12/12/2012 00:40	36.6	34.8	32.4
12/12/2012 00:50	38.3	36.6	35.1
12/12/2012 01:00	37.1	35.7	32.5
12/12/2012 01:10	37.8	36.5	33.9
12/12/2012 01:20	36.9	35.7	34.9
12/12/2012 01:30	37.7	35.6	33.5
12/12/2012 01:40	38.3	36.3	33.5
12/12/2012 01:50	37.0	35.4	32.3
12/12/2012 02:00	39.2	37.0	35.0
12/12/2012 02:10	40.1	35.3	33.7
12/12/2012 02:20	38.3	37.3	35.8
12/12/2012 02:30	36.7	34.9	32.7
12/12/2012 02:40	38.4	37.2	34.9
12/12/2012 02:50	37.1	34.6	32.5
12/12/2012 03:00	37.7	36.4	33.6
12/12/2012 03:10	37.0	35.6	34.6
12/12/2012 03:20	37.1	35.6	34.6
12/12/2012 03:30	37.7	36.3	33.6
12/12/2012 03:40	37.0	36.0	32.0
12/12/2012 03:50	38.3	36.5	34.7
12/12/2012 04:00	36.2	34.6	32.3
12/12/2012 04:10	38.4	37.2	35.5
12/12/2012 04:20	36.9	34.6	32.6
12/12/2012 04:30	37.4	36.5	34.7
12/12/2012 04:40	37.0	35.5	32.2
12/12/2012 04:50	38.4	36.7	34.5
12/12/2012 05:00	37.6	36.3	35.6
12/12/2012 05:10	38.5	36.5	34.9
12/12/2012 05:20	38.4	37.0	34.7
12/12/2012 05:30	38.5	36.7	34.3
12/12/2012 05:40	40.4	38.9	37.5
12/12/2012 05:50	43.6	39.8	37.9
12/12/2012 06:00	41.7	40.5	39.1
12/12/2012 06:10	43.7	39.9	38.0
12/12/2012 06:20	42.2	40.8	39.7
12/12/2012 06:30	42.3	39.4	38.3
12/12/2012 06:40	40.4	39.2	37.9
12/12/2012 06:50	41.5	38.5	36.6
12/12/2012 07:00	41.2	39.5	38.0
12/12/2012 07:10	40.1	38.6	37.5
12/12/2012 07:20	42.7	39.7	38.0
12/12/2012 07:30	42.4	40.4	38.2
12/12/2012 07:40	47.7	42.1	39.2
12/12/2012 07:50	41.5	39.8	38.2

Date & Time	L10	L50	L90
12/12/2012 08:00	47.5	41.2	39.2
12/12/2012 08:10	50.1	41.6	40.4
12/12/2012 08:20	42.9	40.3	39.2
12/12/2012 08:30	43.5	41.4	39.6
12/12/2012 08:40	52.5	41.4	39.0
12/12/2012 08:50	43.0	40.7	39.4
12/12/2012 09:00	42.1	40.2	38.6
12/12/2012 09:10	43.6	41.3	39.9
12/12/2012 09:20	44.8	40.4	38.7
12/12/2012 09:30	42.1	40.8	39.7
12/12/2012 09:40	42.7	40.4	38.6
12/12/2012 09:50	43.3	41.0	39.4
12/12/2012 10:00	44.0	41.6	40.2
12/12/2012 10:10	50.3	44.1	40.5
12/12/2012 10:20	50.8	45.8	41.0
12/12/2012 10:30	48.6	42.2	39.9
12/12/2012 10:40	47.8	41.1	39.5
12/12/2012 10:50	41.7	39.8	38.3
12/12/2012 11:00	44.1	41.2	39.9
12/12/2012 11:10	42.2	40.5	39.1
12/12/2012 11:20	43.9	41.8	40.3
12/12/2012 11:30	42.4	40.9	39.1
12/12/2012 11:40	44.0	41.8	40.7
12/12/2012 11:50	43.2	40.9	39.4
12/12/2012 12:00	42.5	40.5	38.7
12/12/2012 12:10	41.3	39.5	37.8
12/12/2012 12:20	44.7	40.6	38.9
12/12/2012 12:30	45.5	41.8	39.5
12/12/2012 12:40	42.9	39.9	37.8
12/12/2012 12:50	41.0	39.5	38.6
12/12/2012 13:00	43.8	40.1	38.1
12/12/2012 13:10	42.3	39.3	37.8
12/12/2012 13:20	40.6	38.7	37.1
12/12/2012 13:30	42.7	40.6	39.0
12/12/2012 13:40	42.0	39.5	37.9
12/12/2012 13:50	43.5	40.8	39.3
12/12/2012 14:00	51.0	40.5	36.8
12/12/2012 14:10	44.3	40.9	39.0

Date & Time	L10	L50	L90
12/12/2012 14:20	48.3	41.1	36.8
12/12/2012 14:30	41.2	38.9	37.5
12/12/2012 14:40	40.4	37.9	36.2
12/12/2012 14:50	41.5	39.4	37.6
12/12/2012 15:00	42.9	39.2	37.2
12/12/2012 15:10	40.9	39.0	37.6
12/12/2012 15:20	39.8	38.1	36.3
12/12/2012 15:30	40.8	38.7	37.7
12/12/2012 15:40	39.1	37.7	35.4
12/12/2012 15:50	42.5	39.6	37.5
12/12/2012 16:00	39.5	37.4	35.2
12/12/2012 16:10	39.7	38.0	36.4
12/12/2012 16:20	41.7	37.4	35.6
12/12/2012 16:30	39.8	37.5	35.4
12/12/2012 16:40	40.2	37.5	36.5
12/12/2012 16:50	39.0	36.9	35.6
12/12/2012 17:00	39.5	37.5	36.0
12/12/2012 17:10	38.9	36.5	34.7
12/12/2012 17:20	40.9	38.3	35.9
12/12/2012 17:30	40.1	37.9	36.8
12/12/2012 17:40	40.0	38.3	37.4
12/12/2012 17:50	48.4	41.4	35.0
12/12/2012 18:00	40.8	37.7	35.4
12/12/2012 18:10	40.7	37.9	35.7
12/12/2012 18:20	38.7	36.4	34.6
12/12/2012 18:30	38.3	36.9	34.7
12/12/2012 18:40	39.6	37.5	35.6
12/12/2012 18:50	39.9	37.8	35.2
12/12/2012 19:00	39.4	36.2	34.5
12/12/2012 19:10	39.1	37.5	35.2
12/12/2012 19:20	42.1	38.6	35.2
12/12/2012 19:30	40.5	37.4	34.9
12/12/2012 19:40	44.6	38.6	35.7
12/12/2012 19:50	51.4	37.2	34.4
12/12/2012 20:00	37.7	35.9	34.8
12/12/2012 20:10	38.3	37.4	36.5
12/12/2012 20:20	38.3	36.9	36.2
12/12/2012 20:30	39.8	36.1	35.3

Date & Time	L10	L50	L90
12/12/2012 20:40	38.4	37.2	35.6
12/12/2012 20:50	38.7	36.6	34.8
12/12/2012 21:00	38.0	36.4	32.5
12/12/2012 21:10	38.5	37.2	34.9
12/12/2012 21:20	38.3	36.2	34.5
12/12/2012 21:30	38.5	36.3	32.4
12/12/2012 21:40	39.0	37.1	34.6
12/12/2012 21:50	38.3	37.3	34.5
12/12/2012 22:00	38.7	35.2	31.7
12/12/2012 22:10	38.4	36.4	34.5
12/12/2012 22:20	38.2	36.9	34.4
12/12/2012 22:30	37.6	35.3	31.8
12/12/2012 22:40	38.3	36.7	34.4
12/12/2012 22:50	38.5	36.8	34.5
12/12/2012 23:00	37.7	36.0	32.0
12/12/2012 23:10	38.5	36.5	34.4
12/12/2012 23:20	38.7	37.2	34.7
12/12/2012 23:30	37.7	35.6	32.1
12/12/2012 23:40	38.2	36.4	34.7
12/12/2012 23:50	38.9	37.7	36.4
13/12/2012 00:00	37.6	35.5	32.4
13/12/2012 00:10	38.3	36.5	34.9
13/12/2012 00:20	38.3	37.1	34.8
13/12/2012 00:30	37.7	35.5	32.2
13/12/2012 00:40	38.7	36.7	35.2
13/12/2012 00:50	38.5	37.4	35.3
13/12/2012 01:00	37.7	35.6	32.2
13/12/2012 01:10	38.3	36.5	34.7
13/12/2012 01:20	38.3	37.1	35.4
13/12/2012 01:30	37.5	35.6	34.5
13/12/2012 01:40	37.7	36.5	35.9
13/12/2012 01:50	38.3	37.2	36.4
13/12/2012 02:00	36.2	35.6	34.7
13/12/2012 02:10	38.1	36.9	36.0
13/12/2012 02:20	38.9	37.2	35.9

11.4 The above tabled data: LA10, LAF50, LAF90, are the levels exceeded 10%, 50%, 90%, of the time respectively.

11.5 The following figure illustrates example noise trends (LA 10minute) for the measurement location 1.

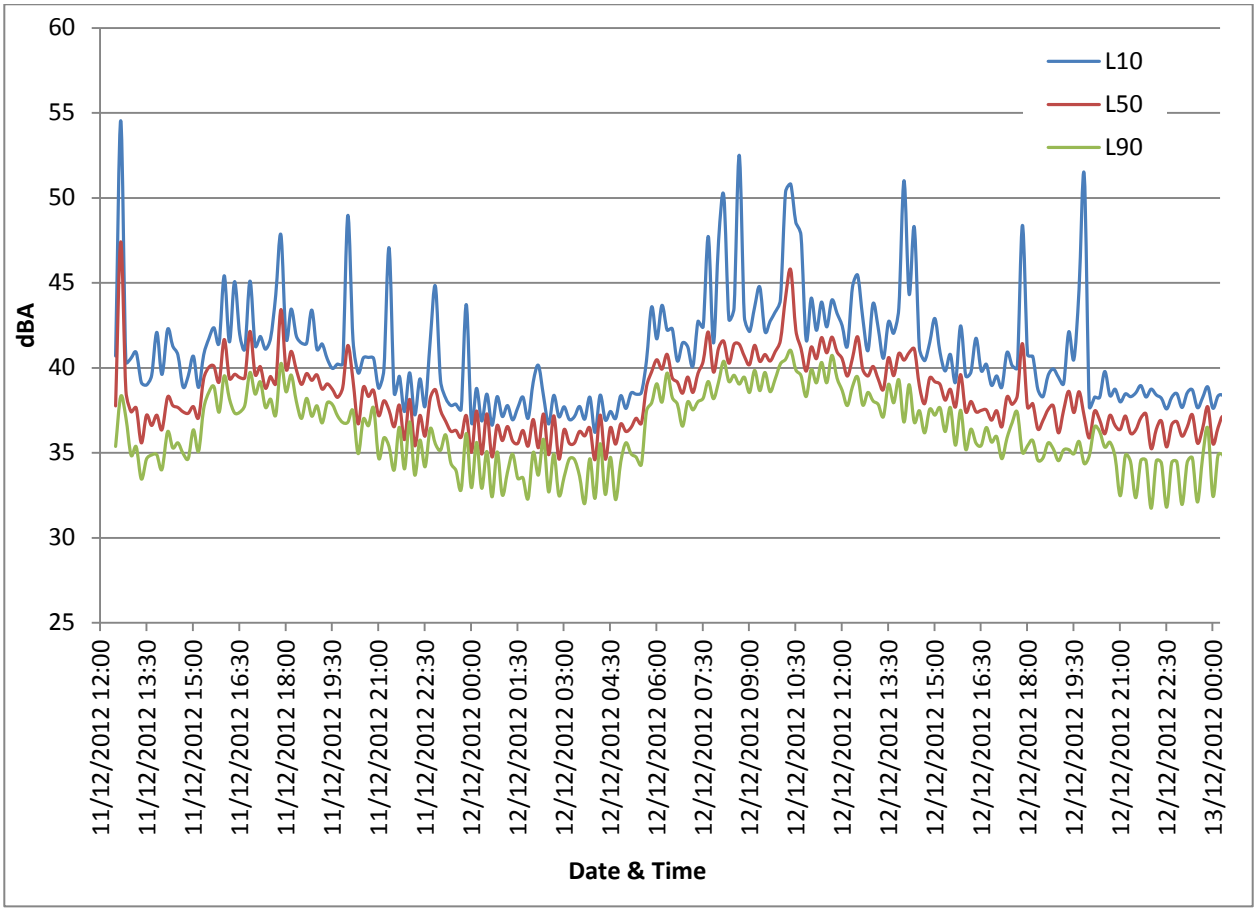


Figure 11-2 Location 1 noise trends

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12. APPENDIX 4 – PROPOSAL NOISE PREDICTION

12.1 Modelling Principles

12.1.1 The noise calculation computer program Cadna A (Computer Aided Noise Abatement, a proprietary package by Datakustik) is a leading software package for calculation and presentation of environmental noise. It has been used here to predict the noise emission to the locality i.e. noise modelling. The model incorporates:

- distance or range between source and receiver
- distance above ground
- site topology
- multiple noise sources (point, line, and surface types)
- octave bandwidths 31Hz to 8KHz covering the main audible frequency range
- screening (top and sides) effects of buildings etc
- reflection from buildings and the ground
- meteorological conditions
- acoustically variable surfaces for the ground and reflecting wall surfaces
- noise contours, colour coded, may be produced (e.g. spaced at 1dBA intervals for 1.5metres above the ground on a 3m x 3m grid unless specified otherwise).
- In the model noise maps and when appropriate, noise 'point' sources are denoted with the symbol: . Line sources such as roads are identified using parallel dotted lines. Horizontal area emitting sources (e.g. industrial area, roofs) are shown as a solid blue lined rectangle and/or : . Vertical plane area sources and horizontal area sources are shown in as heavy red lines (e.g. walls radiating noise).
- Noise measurement locations or calculated receiver/receptor/immission points are signified with a symbol:  . A label alongside the symbol may identify the receiver location number with a noise level in dBA. Unless mentioned otherwise, the noise levels are for 1.5m above the ground surface.
- Barriers and bunds may be shown as heavy red lines.

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12.1.2 The WTG may be assumed to radiate noise as a 'point' type source.

12.1.3 Buildings as barriers or reflectors are not relevant. Two orders of reflection from surfaces were used. A ground absorption of 0.0 was used representative of a worst case low attenuation path. A 'structured' type surface (giving some absorption) was used for all building walls.

12.1.4 An environmentally neutral meteorology (relative humidity of 70% and air temperature 10C with zero wind speed) was used unless stated otherwise.

12.2 Noise Model Details

12.2.1 The WTG sound power levels are taken from the Evance report for use in the ensuing assessment:

Table 12-1 Evance R9000 sound power emission levels with wind speed

Wind speed at 10m Height m/s	3	4	5	6	7	8	9	10	11
Calculated Turbine Sound Power Level (L_{AW90})	78.2	77.9	79.4	81.6	83.6	85.1	86.4	87.9	90.6

12.2.2 In this modelling calculation, the noise radiation strength from the WTG was set at SWL 78dBA (for a 4m/s wind speed) 12m above the ground as a point source per the information supplied from the client.

12.2.3 The noise model results for the WTG and its environs are shown in the figure below.

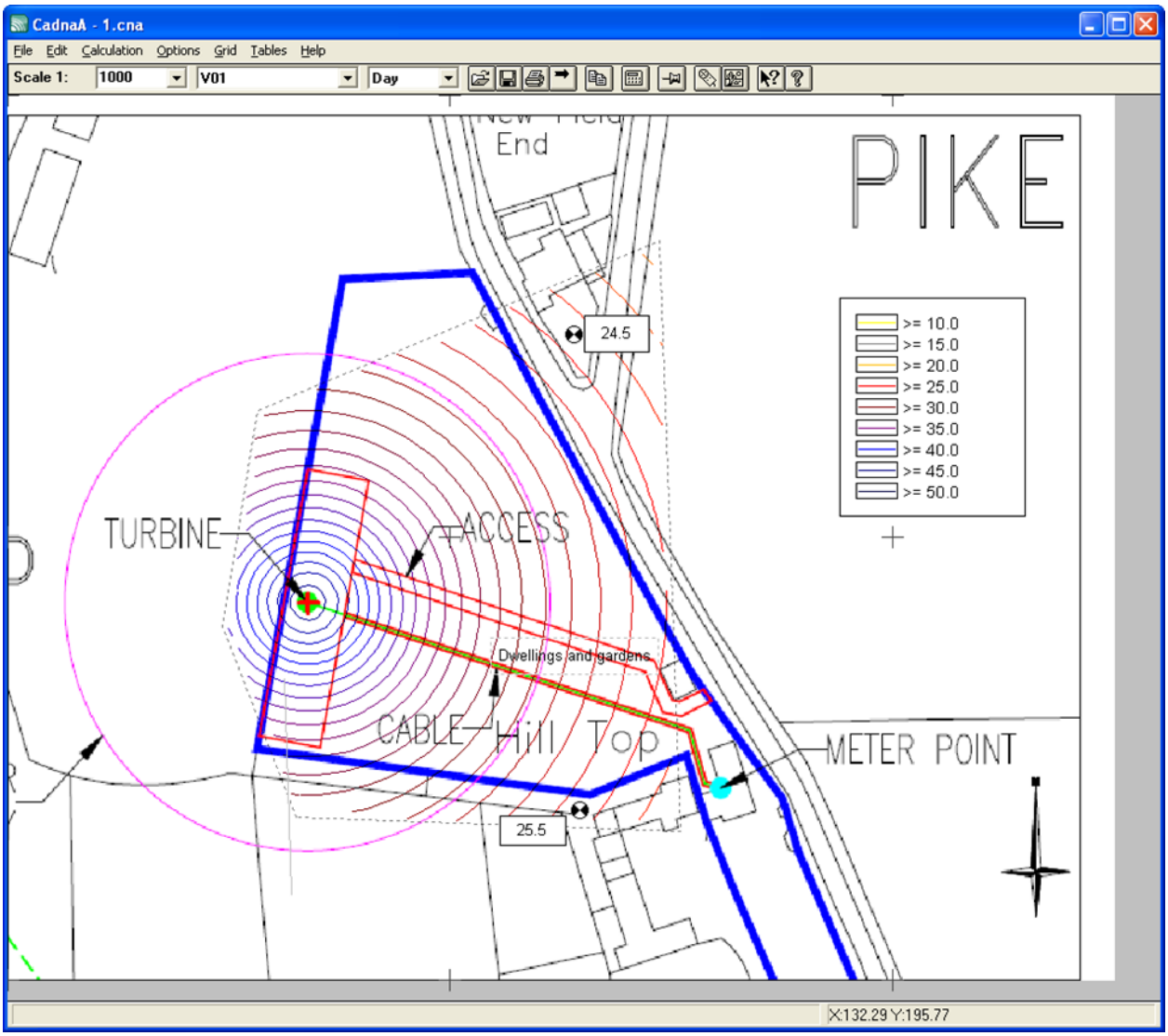


Figure 12-1 Site noise prediction

12.2.4 The figure above shows the proposed WTG noise source (red cross), and noise contours radiating spherically (within a 'calculation area' dotted). In the garden of the nearest affected dwelling properties, receptor locations are shown with a legend containing a dBA value (25 to 26). The ground absorption in the sound path was set to 0.7 (a typical value).

12.2.5 The following table presents the results of the assessment and arrives at the noise impact.

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Table 12-2 Evance R9000 predicted noise impact

Wind speed at 10m Height m/s	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
SWL, ($L_{A90\ dB}$) per Evance report	78.2	78.0	79.4	81.6	83.6	85.1	86.4	87.9	90.6
Predicted Receptor SPL ($L_{A90\ dB}$)	25.2	25.0	26.5	28.7	30.7	32.2	33.5	35.0	37.7
Background	31	32	33	35	37	39	41	43	45
LA90 dB impact	**-6**	**-7**	**-7**	**-7**	**-7**	**-7**	**-8**	**-8**	**-7**

12.2.6 The table above gives the impact (background noise minus the predicted noise at the receptor location) of the proposal as dBA below the background noise level for the range of wind speed of interest.

12.2.7 Basically, the sound power level at 4m/s wind speed from the Evance report was used in a calculation that gave the receptor noise level 25dB. The background noise at 3 and 4m/s was measured at 31 and 32dB respectively. From this, the background noise for other wind speeds was obtained by use of a curve formula from other work. Hence, the impact across the whole WTG operational speed range was deduced.

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13. APPENDIX 5 – PROPOSAL NOISE ASSESSMENT/MITIGATION

13.1 Given the results of study (the impact is predicted to be acceptable), no mitigation is required.