



Appendix 5

Moorshield Wind Farm

Noise Planning Update by Hayes McKenzie, October 2021

Moorshield Wind Farm Limited

Moorshield Wind Farm
Response to AECOM Review of NIA
for Moorshield Wind Farm Limited
Andy McKenzie, Hayes McKenzie Partnership Ltd
543_N02_EXT2, 14 October 2021

1. INTRODUCTION

- 1.1 Hayes McKenzie have been asked to provide a response to the review, carried out by AECOM for East Renfrewshire Council (ERC) dated 9th June 2021, of the noise impact assessment (NIA) carried out by Arcus Consultancy Services Ltd for the proposed Moorshield wind farm planning application, ref 2020/0217/TP.
- 1.2 This note discusses the issues raised in turn.

2. ISSUES RAISED BY AECOM

NIA Para 1 - Substation

- 2.1 It is our understanding that the proposed substation is located at 900 metres from the nearest residential property, which is Shieldhill Farm. Substation noise at this distance will not be audible and can be scoped out of the assessment. It will be well below the level at which any significant impact would occur.

NIA Para 2.6 - Construction Noise

- 2.2 AECOM note that construction noise at financially involved properties has not been considered in the assessment, with particular reference to Shieldhill Farm which is the nearest property to the site. It is understood that this property is 442 metres from the closest turbine and 423 metres from the closest location of any access track works proposed at the site. The developer has provided a plant schedule for track works and for the turbine foundations which are given at Tables 1 and 2 (below), together with assumed 10 metre sound pressure level data taken from BS5228¹. This would result in worst case free-field noise levels of 51 dB L_{Aeq} and 54 dB L_{Aeq} at this property for these two activities, based on the BS5228 prediction methodology assuming 50 % soft ground and all plant acting together for 100% of the time. This is well below the threshold for potential significant effects of 65 dB L_{Aeq} provided in BS5228 for day-time and Saturday morning working, where existing noise levels are low. It is highly unlikely that both activities would

¹ BS5228, Code of Practice for Noise and Vibration Control on Construction and Open Sites, BSI 2014

occur at the same time given that track works would be required to allow access to the turbine locations for the foundation works. For construction work further from this property, construction noise levels would be lower.

Table 1 – Construction Plant Details for Track Works

Plant Item	BS5228 Table Ref	BS5228 Item in Table	Number of Items	A-Weighted 10 m noise level (dB LAeq)
Large Excavator	C5	18	1	80
Small Excavator	C2	5	1	76
Large Roller	C5	19	1	80
Dump Truck	C5	16	1	81
Dumper	C4	4	1	76
Small Vib Roller	C5	28	1	77

Table 2 – Construction Plant Details for Turbine Foundations

Plant Item	BS5228 Table Ref	BS5228 Item in Table	Number of Items	A-Weighted 10 m noise level (dB LAeq)
Large Excavator	C5	18	1	80
Small Excavator	C2	5	1	76
Large Roller	C5	19	1	80
Dump Truck	C5	16	1	81
Dumper	C4	4	1	76
Small Vib Roller	C5	28	1	77
Concrete Pump	C3	25	3	78
Concrete Mixer	C4	21	7	76

Para 2.8.3 – Noise Limits

- 2.3 It is (correctly) stated in NIA paragraph 2.8.3 that the noise limits in ETSU-R-97 apply to cumulative effects. For day-time periods, these are set at 5 dB above the ‘quiet day-time hours’ prevailing background noise level, with a lower limiting value of 35 – 40 dB LA90, depending on circumstances. A value of 40 dB LA90 has been adopted in this case, for the cumulative noise limits, as setting a lower value than this would mean that the limit could be exceeded cumulatively because Whitelee Wind Farm is permitted to operate at this level. Setting a cumulative noise limit below this would not be logical on this basis.

- 2.4 On this basis, it is also logical that noise levels below 30 dB L_{A90} are not significant because they would not cause a cumulative 40 dB L_{A90} limit, or higher, to be breached².
- 2.5 It appears, from comparison of the predicted noise levels at Table 7 of the NIA with Figure 1 that the figure shows the 30 dB L_{A90} contour for the development contrary to what is suggested by the legend to the figure which states 35 dB L_{A90}.

Para 2.8.5 – Candidate Turbine

- 2.6 The difference between the dimensions of the candidate turbine which has been assessed and those provided in the Supporting Statement is inconsequential.
- 2.7 Paragraph 4.1.6 of the Institute of Acoustics Good Practice Guide (GPG)³, as referred to in the AECOM review, states that ‘...it is therefore standard practice to consider a “candidate turbine” at the planning stage, which is representative of the range of turbines which may be installed at the site, to provide an appropriate estimate’. This does not necessarily, and normally does not, require evidence as to the representativeness of the chosen candidate which can be seen here as very closely matching the dimensions referred to in the Supporting Statement. We are informed that other turbine types fitting the dimensions are the Nordex N133 and the Enercon E138 which have noise specifications as shown in Table 2, below, both assuming the use of serrated trailing edges, as per the candidate turbine assumed in the ES, and with no curtailment in place. An assumed uncertainty factor of 2 dB has been added as per the recommendations of the GPG to allow comparison with the data for the candidate turbine as provided in the ES.

Table 3 – Sound Power Level for Potential Alternative Turbines

Alternative Turbine Type	Standardised 10 metre Height Wind Speed (m/s)									
	4	5	6	7	8	9	10	11	12	
	Sound Power Level (dB L _{Aeq})									
Nordex N133 HH83 m	96.2	101.7	105.9	106.5	106.5	106.5	106.5	106.5	106.5	
Enercon 138 HH 81 m	100.9	104.9	105.8	106.8	107.5	108.0	108.0	108.0	108.0	

- 2.8 It can be seen that source noise levels for the Nordex alternative are very similar to that for the candidate Vestas turbine but are generally higher for the Enercon alternative. No formal

² The addition of a noise level 10 dB below another noise level does not result in any significant increase in overall noise level.

³ A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Noise from Wind Turbines, UK Institute of Acoustics, 2013

assessment is proposed for these turbines as this would be carried out during the final turbine selection process to ensure the noise limits in planning conditions on any consent would be met in practice. It should be noted that, as stated in the GPG, '*the suitability of the final turbine model (post-consent) can be secured through the imposition of adequate planning conditions*'.

Para 2.8.6 – Cumulative Noise Assessment

- 2.9 At the time the NIA was compiled by Arcus, it would appear that there were no other wind farms in the vicinity which required consideration. The only other wind power development which has been added in the meantime is a 40m hub height turbine at Carrott Farm with planning application reference 2020/0310/TP, which is greater than 3 km from the nearest property potentially affected by this development (Greenfield Farm).
- 2.10 A cumulative noise assessment assuming all wind farms are operating at their consented limits at all properties, under all conditions of operation is ill-founded and un-necessary as this is simply not possible in practice.
- 2.11 Greenfield Farm is found to be subject to predicted noise levels from the proposed development of significantly less than 30 dB L_{A90} according to Figure 1 if, as discussed in Paragraph 2.5, the contour line shown is for 30 dB L_{A90} . On that basis the assumption that it can be excluded from further assessment is correct, and any curtailment used by Whitelee wind farm to meet its planning limits is not relevant because it can simply be assumed that it is meeting its limit.

Para 3.1 – Assessed Receptors

- 2.12 It is established above that the noise contour line shown on NIA Figure 1 is that for 30 dB L_{A90} . On this basis, the choice of receptors for assessment is quite logical as is the second sentence of this paragraph, as queried by AECOM. The threshold for further investigation of cumulative effects is a cumulative noise level of 40 dB L_{A90} as discussed at Paragraph 2.3 (above) and not 35 dB L_{A90} , as suggested by AECOM.

Para 3.2 – Baseline Conditions

- 2.13 The baseline noise data collected prior to the construction of Whitelee wind farm is provided in the report referenced in the Moorshield wind farm ES and is attached here as Appendix A. The report has been reviewed and it can be confirmed, and can be seen, that the measurements were carried out in line with current best practice. The baseline data provided in this report has been used for the assessment of all subsequent phases of Whitelee wind farm and, as such, it is suitable for the assessment of this development subject to comments in the next paragraph on hub height differences between the two sites.

2.14 It appears correct that no account has been taken of the difference in hub height between the Whitelee turbines and those proposed for Moorshield. Applying the difference in hub height between the Whitelee turbines (65 metres) and those proposed for Moorshield (81 metres) could result in an increase in the wind speeds used for the predictions, relative to the derived limits, depending on the level of wind shear at the site under given meteorological conditions. The most critical wind speed for this to occur is that just below the point at which the turbines cease to increase noise level with wind speed which, as can be seen from Table 7 in the NIA, is 6 m/s. Assuming a typically high level of wind shear, corresponding to an exponent of 0.4⁴, gives an increase in standardised 10 metre height wind speed at this point of 0.4 m/s causing, by interpolation of the predicted noise levels in Table 7, an increase in noise of 0.3 dB. It can be seen from NIA Table 8 that this does not cause any exceedance of the derived limits. There would similarly be no exceedances at lower wind speeds and, at higher wind speeds, the effect does not occur as turbine noise level does not increase with wind speed above 7 m/s.

Para 3.3 - Cumulative Noise Limits

2.15 AECOM suggest that background noise data from Greenfield Farm should have been used to be representative of all 3 properties considered, instead of that from Moor Farm. It is clear from Figure 1 in the NIA that Greenfield Farm is a considerable distance (around 3 km) from the properties considered in the assessment. Moor Farm is, in itself, one of the properties considered and is a similar distance from the main noise source which would have affected the measurements at lower wind speeds (the M77 motorway) at Shieldhill, and further from it than Highfield, thus representing a worst case. Background noise levels at Greenfield Farm are higher at higher wind speeds thus indicating greater wind induced noise so, in this respect, using the data from Moor Farm is again a worst case.

Para 3.4 - Apportioned Noise Limits

2.16 The text quoted by AECOM does appear to be in error, as does the statement that the '*apportioned limit is calculated by subtracting 10 dB from the cumulative limit*' as can be seen from comparison of the apportioned limits at NIA Table 6 with the cumulative limits provided at NIA Table 5. It is assumed that the apportioned limits have been derived as described at NIA paragraph 2.8.7.

2.17 Applying the text quoted in the AECOM review means that the night-time limits for Shieldhill should be 43.3 at wind speeds of 4, 5 and 6 m/s. This would mean that the margins for Shieldhill

⁴ Speed up due to wind shear is calculated as $WS_x = WS_y * (X/Y)^m$ where:
 WS_x = Wind Speed at Height X
 WS_y = Wind Speed at Height Y
M = Wind Shear Exponent

in NIA Table 8 for night-time would be the same as for day-time, for these wind speeds, with no resulting exceedance. The change to the limits should be reflected in the planning conditions in any consent for the proposed development.

Figure 2 – Financial Involvement

- 2.18 The text from AECOM refers to '*proposed consent condition wording*'. It is not clear whether this refers to a separate document as the condition wording included at NIA Appendix C is that agreed for the Soame development, which was refused at Appeal. In agreeing conditions on any consent for the proposed development, the financial involvement of any property would form part of discussions with ERC.
- 2.19 With reference to AECOM's comments on the noise contour lines, NIA Figure 2 states that these contour lines represent cumulative noise levels, except for the red dashed line which is stated to represent noise from the proposed the development only. It appears from comparison with NIA Figure 1, and the discussion at Paragraph 2.5, that this red dashed contour line represents the 30 dB L_{A90} contour value and not 35 dB L_{A90} as stated in the legend to Figure 2. Assuming this is correct, it would perfectly feasible for the 30 dB line, for noise from the proposed development only, to extend outside the 35 dB L_{A90} cumulative contour line.

3. SUMMARY AND CONCLUSIONS

- 3.1 The above has been compiled in response to the AECOM review of the NIA for Moorshield wind farm including:
- Comments on possible noise from the proposed sub-station.
 - An assessment of construction noise at Shieldhill Farm.
 - Details of alternative turbine types fitting the dimensions proposed for the development.
 - Details of additional wind turbine development in the area.
 - Supply and review of the baseline noise measurement report carried out in connection with the Whitelee development.
- 3.2 It is considered that the further information provided is sufficient to address the comments in the AECOM review. Further information can be provided, if required, as necessary.

APPENDIX A

Whitelee Wind Farm Background Noise Assessment

**WHITELEE
WIND FARM**

**BACKGROUND
NOISE
ASSESSMENT**



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**WHITELEE
WIND FARM**

**BACKGROUND
NOISE
ASSESSMENT**

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DATE: 6th June 2006

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SUMMARY

This report presents the results of background noise surveys around the consented Whitelee Wind Farm. The results of these surveys satisfy the requirements of the consent conditions and provide the background noise levels on which the operational noise limits for the site are based.

1 INTRODUCTION & METHOD

This report describes the assessment performed by Hoare Lea Acoustics on behalf of Scottish Power to determine background noise levels at fifteen locations around the consented Whitelee Wind Farm. The consent issued by the Scottish Executive¹ requires repeat measurements at twelve locations surveyed for the Environmental Statement and at a further three locations (see Table 1). Condition 7.41 of the consent requires:-

"7.41 Prior to the commencement of the development, background noise levels at the locations specified in this condition shall be measured and recorded in accordance with ETSU-R-97 Section 7 and ETSU-R-97 Appendix C. This work shall be undertaken by an independent noise consultant whose appointment shall require to be approved in writing by the planning authorities. For the purpose of this condition, background noise levels will be taken at all the following premises or such other 15 properties in the area surrounding the wind farm, as agreed with the relevant planning authority:

- *all properties list in the Environmental Statement Table 33, page 243;*
- *High Alderstocks;*
- *Craigendunton; and*
- *Hareshaw Lodge.*

Reason: To safeguard the noise amenity of local residents in accordance with ETSU-R-97"

Surveys are to be completed before the Wind Farm is built to establish baseline levels. The results of the surveys are directly referenced by the consent conditions when deriving the noise limits for the site and used to control operational noise immissions of the Wind Farm (Condition 7.39).

The background noise surveys were conducted following the method specified in 'Proposed Method Statement for the Assessment of Background Noise at the Proposed Whitelee Wind Farm' dated 20th January 2006.

ID	Name	Easting	Northing	ES/Added
01	High Overmuir	257200	644500	ES
02	Logoch	263800	645600	ES
03	Lochgoin Farm	253000	646980	ES
04	Greenfield Farm	254150	649850	ES
05	Laigh Alderstocks	261300	644100	ES
06	High Myers	256680	646550	ES
07	Ardochrig	263950	646500	ES
08	Moor Farm	250850	648050	ES
09	Laigh Huntlawrig	260900	648700	ES
10	Park Farm	257325	650200	ES
11	Carrot	257800	648250	ES
12	Laigh Overmuir	258050	643100	ES
13	High Alderstocks	261100	644700	Added
14	Craigendunton	251200	645200	Added
15	Hareshaw Lodge	250600	643660	Added
14A	Windy Hill Farm	250266	644900	Alternate

Table 1 List of properties at which background noise surveys were required (alternative to Craigendunton shown).

2 MONITORING LOCATIONS

The owners/occupiers of all properties except one gave consent to install the equipment for the monitor of noise levels. At Craignedunton contact with the owner/occupier was not possible and no permission was therefore obtained. The owner/occupier of an alternative location at Windy Hill Farm House gave permission to monitor and this location was agreed with all three Local Planning Authorities. The alternative choice of this location caused a one week delay to the start of monitoring at Windy Hill Farm House relative to the other locations. All monitoring locations are shown in Figure A1.1 in Appendix 1.

3 EQUIPMENT

The background noise monitoring exercise was conducted in a single phase with a sound level meter deployed at each of the fifteen locations simultaneously.

The equipment used comprised eight Svantek SVAN949 and seven Rion NL-31 logging sound level meters. All meters were enclosed in environmental cases with battery power to enable a maximum of approximately ten days continuous logging at the required 10 minute averaging periods. Regular visits were made to site at approximately weekly intervals to download data, change the batteries and perform calibrations checks. Outdoor windshield systems were used to reduce wind induced noise on the microphones and provide protection from rain. The Svantek based systems used two layer windshields with the inner windshields and rain protection provided by standard 01dB all weather outdoor microphone kits type BAP21. The outer secondary windshields were custom designed following the guidance given in the report Noise Measurements in Windy Conditions². The report indicates that the insertion loss of this type of windshield assembly is likely to be less than ± 1 dB between 50 Hz and 5 kHz. The windshield and weather protection for the Rion based systems were supplied by manufacturer and maintain the required performance of the whole measurement system when fitted. The environmental enclosures provided an installed microphone height of 1.5 m above the ground.

The sound level meters were located on the wind farm side of the property in question where possible, never closer than 3 m from the façade of the property and as far away as was practical from obvious atypical localised sources of noise such as running water, trees or boiler flues. An attempt was made to choose locations that were similar to those used for the previous surveys where this was known and was practical.

All measurement systems were calibrated on their deployment on 13th and 14th February 2006 (22nd February 2006 at Windy Hill) and during the periodic visits. No significant drifts in calibration were found to have occurred on any of the systems.

All measurement systems were set to log the $L_{A90,10min}$ and $L_{Aeq,10min}$ noise levels continuously over the deployment period. The internal clocks on the sound level meters were all synchronized with GMT by the use of a Global Positioning System (GPS) receiver. The clocks on the met masts from which wind data were collected for the analysis of the measured background noise as function of wind speed were also set to GMT.

There were a few equipment problems which resulted in loss of some data during the survey period. The monitoring system installed at Moor Farm was moved to Windy Hill Farm to replace the faulty system there. Table 2 shows the amount of monitoring at each location. At the time of the analysis met data were available for a period of 55 days and this therefore sets the maximum analysis period.

ID	Name	Days of Monitoring
01	High Overmuir	51
02	Logoch	58
03	Lochgoin Farm	57
04	Greenfield Farm	57
05	Laigh Alderstocks	57
06	High Myers	49
07	Ardochrig	51
08	Moor Farm	49
09	Laigh Huntlawrig	50
10	Park Farm	49
11	Carrot	58
12	Laigh Overmuir	46
13	High Alderstocks	49
14	Windy Hill Farm	23
15	Hareshaw Lodge	57

Table 2 Summary of the number of days of data at each of the monitoring locations.

4 DATA ANALYSIS

Met data were available from two 40 m height met masts installed at Corse Hill and at Topfoulds Hill for the period of noise monitoring. These locations are shown in Figure A1.1 in Appendix 1. Figures A2.1 to A2.4 in Appendix 2 show the range of wind conditions experienced during the noise survey period. Figures A2.1 and A2.2 show the largest data set whilst Figures A2.3 and A2.4 show the smallest. Wind speeds at 10 m height were calculated from the met mast data at other measurement heights. The method used to derived the 10 m wind speeds is described in Appendix 5.

Rain data were logged at both met mast locations, providing values of rainfall for each of the 10 minute measurement periods. Any ten minute periods of noise data which were concurrent with an indication of rain from either met mast were excluded from the analysis. During the survey there were periods of heavy snowfall. Data during periods of heavy snow were excluded from the data-set included in the final analysis.

Figures A4.1 to A4.30 of Appendix 4 show the results of the background noise measurements at each of the fifteen locations. The background noise data are presented in terms of $L_{A90,10min}$ background noise levels plotted as a function of 10 m height wind speed. Two plots are shown for each location, one for quiet day time periods and the other for night time periods, both derived in accordance with the time periods defined in ETSU-R-97³. The charts of background noise levels have only been shown within this report plotted against wind speeds from the Topfoulds met mast. The analysis was done separately for both of the masts and the results compared. The noise data plotted against met data from Corse Hill tended to produce more scatter in the charts with a less well defined relationship of change of noise levels with wind speeds. The met mast at Corse Hill is at a location within a large area covered by trees, whereas the Topfoulds mast is in an open area with no tree coverage. The location of the Topfoulds mast is therefore most likely to be similar in terms of the ground cover that will exist once the wind farm has been built.

Best-fit trend lines were generated on each chart using a polynomial fit of a maximum of 4th order and used to show the typical relationship of the change of background noise levels with wind speed. The equation of each trend line is given in the charts and can therefore be used to derive noise limits according to ETSU-R-97 that apply during the day time and night time periods up to 12 m/s.

5 CONCLUSIONS

Background noise levels have been measured at all fifteen locations around the consented Whitelee Wind Farm in accordance with the planning consent condition 7.41. Background noise levels have been plotted against wind speeds to derive the typical relationship of the change of noise level with wind speed. These typical relationships can be used by the consent planning conditions which control noise immissions from the site during operation.

6 REFERENCES

1. Consent and deemed planning permission by the Scottish Ministers for the construction and operation of a 322 MW wind powered electricity generating station at Whitelee, near Eaglesham. 5th May 2006.
2. Noise Measurements in Windy Conditions. R.A. Davies & M.C. Lower, ISVR Consultancy Services. ETSU Report W/13/00386/REP 1996.
3. ETSU-R-97. The Working Group on Noise from Wind Turbines: 'The Assessment and Rating of Noise from Wind farms', ETSU Report ETSU-R-97, 1996.
4. IEC61400-11 Ed 2 2002: Wind turbine generator systems - Part 11: Acoustic noise measurement techniques. International Electrotechnical Commission.

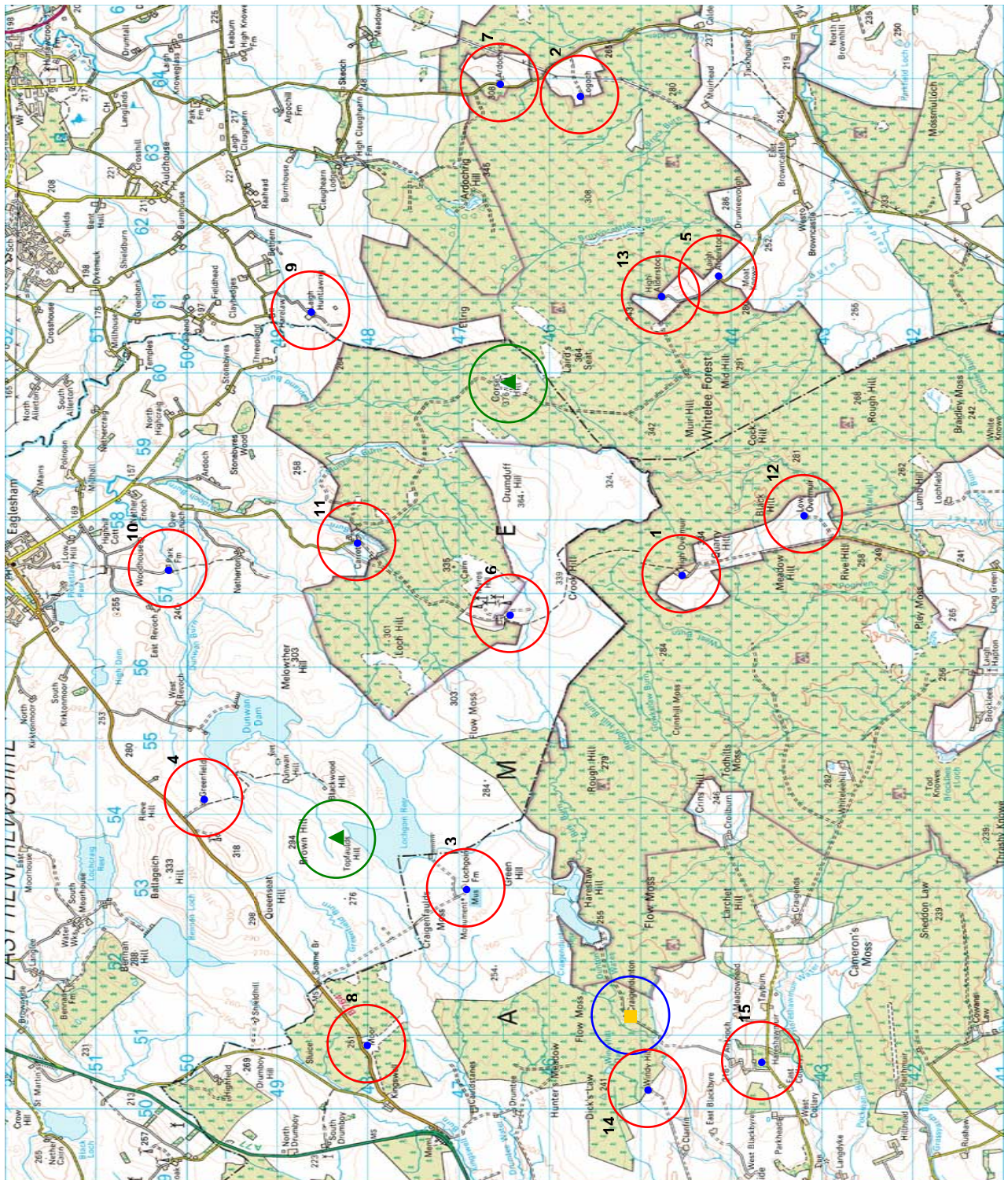
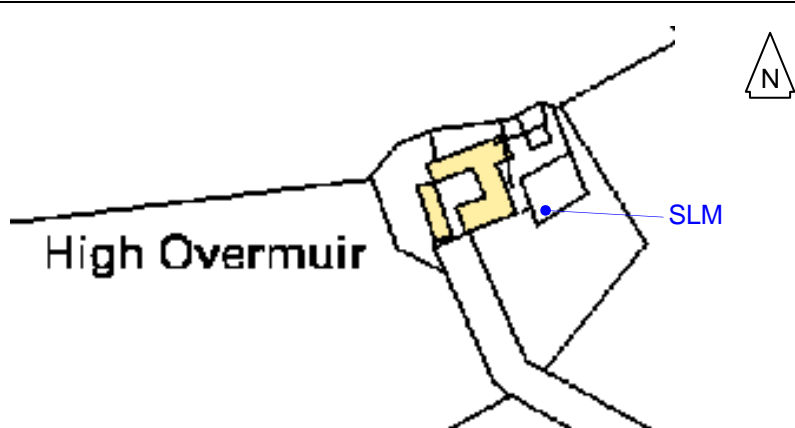


Figure A1.1 Map showing the background noise survey locations (blue dots within red circles), the survey location where access was not possible (orange square within blue circle) and the Topfoulds and Corse Hill Met Masts (green triangle within green circle).

Noise Monitoring Information Sheet	
Location	
Name	01 - High Overmuir
Description	Located the sound level meter in the open garden area above the house and furthest from the farmyard. Audible during the various visits were wind in the trees, birds, and occasional aircraft, with some intermittent dog barking. SLM Location: NS 57264 44513.
Site Plan	 <p>The site plan shows a house with a garden area above it. A blue dot labeled 'SLM' is located in the garden area. A north arrow is present in the top right corner. The text 'High Overmuir' is written across the plan.</p>

Noise Equipment			
Equipment	Type	Serial Number	Last Calibrated
Sound Level Meter	Svantek SVAN 949	6754	26/08/2005
Pre-amplifier	Svantek SV 12	5926	26/08/2005
Microphone	GRAS 40AE	49555	26/08/2005
Calibrator	B&K 4231	2498799	17/08/2005
SLM Range	20 – 100 dB(A)		

Data Collected						
File	Time Start [GMT]	Time End [GMT]	Cal Start	Cal End	Drift	Notes
01 High Overmuir - 01.svn	13/02/06 12:30	21/02/06 14:00	0.6	0.8	0.2	No significant drift
01 High Overmuir - 02.svn	21/02/06 14:40	02/03/06 09:40	0.8	0.7	0.1	No significant drift
-	-	-	-	-	-	-
01 High Overmuir - 04.svn	09/03/06 10:20	20/03/06 13:20	0.5	0.7	0.2	No significant drift
01 High Overmuir - 05.svn	20/03/06 13:50	03/04/06 11:50	0.7	0.6	0.1	No significant drift
01 High Overmuir - 06.svn	03/04/06 12:50	13/04/06 10:40	0.6	0.5	0.1	No significant drift

Table A2.1 Information on the equipment, measurement location, and noise data at High Overmuir.



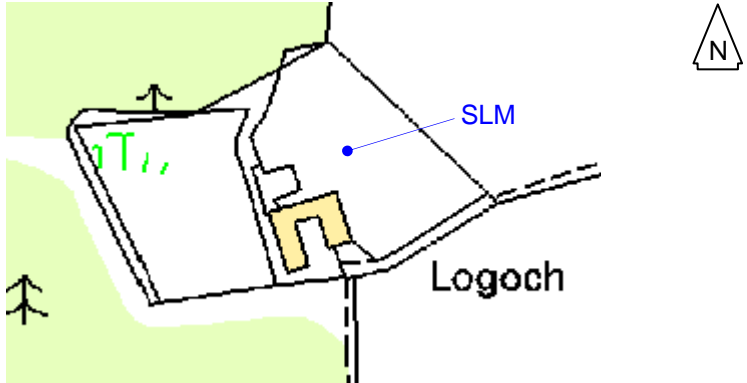
Figure A2.1 View of the monitoring location at High Overmuir looking West.



Figure A2.2 View of the monitoring location at High Overmuir looking East.



Figure A2.3 View of the monitoring location at High Overmuir looking South East.

Noise Monitoring Information Sheet	
Location	
Name	02 - Logoch
Description	Located the sound level meter on an open area of grass furthest from the house to minimise the influence on measured levels of the heating flue. Audible during visits to site were wind in the trees, birds and occasional aircraft noise. SLM Location: NS63773 45687.
Site Plan	

Noise Equipment			
Equipment	Type	Serial Number	Last Calibrated
Sound Level Meter	Svantek SVAN 949	6756	25/08/2005
Pre-amplifier	Svantek SV 12	5929	25/08/2005
Microphone	GRAS 40AE	49569	25/08/2005
Calibrator	B&K 4231	2498799	17/08/2005
SLM Range	20 – 100 dB(A)		

Data Collected						
File	Time Start [GMT]	Time End [GMT]	Cal Start	Cal End	Drift	Notes
02 Logoch - 01.svn	13/02/06 14:20	21/02/06 16:20	-0.7	-0.5	0.2	No significant drift
02 Logoch - 02.svn	21/02/06 16:40	02/03/06 12:20	-0.5	-0.7	0.2	No significant drift
02 Logoch - 03.svn	02/03/06 12:50	09/03/06 12:00	-0.7	-0.6	0.1	No significant drift
02 Logoch - 04.svn	09/03/06 12:40	20/03/06 16:00	-0.6	-0.5	0.1	No significant drift
02 Logoch - 05.svn	20/03/06 16:30	03/04/06 14:40	-0.5	-0.4	0.1	No significant drift
02 Logoch - 06.svn	03/04/06 15:30	13/04/06 08:10	-0.4	-0.4	0.0	No significant drift

Table A2.2 Information on the equipment, measurement location, and noise data at Logoch.



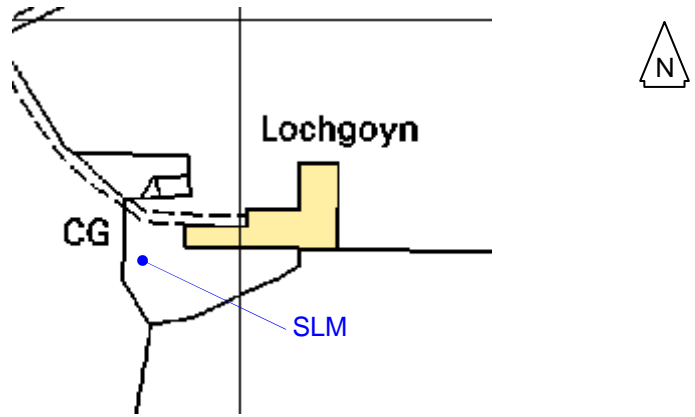
Figure A2.4 View of the monitoring location at Logoch looking South West



Figure A2.5 View of the monitoring location at Logoch looking North West.



Figure A2.6 View of the monitoring location at Logoch looking North East.

Noise Monitoring Information Sheet	
Location	
Name	03 - Lochgoyn Farm
Description	Located the sound level meter at a similar location to that used for the ES noise survey. This was within an area of trees away from the farmyard which was immediately next to the house. This location avoided areas that were to be used by the farmer during the survey period and would avoid the system needing to be moved. Audible during visits were wind in the trees and birds. SLM Location: NS52950 46881.
Site Plan	

Noise Equipment			
Equipment	Type	Serial Number	Last Calibrated
Sound Level Meter	Rion NL-31	00110047	31/08/2005
Pre-amplifier	Rion NH-21	02254	31/08/2005
Microphone	Rion UC-53A	101513	31/08/2005
Calibrator	Rion NC-74	34551669	30/08/2005
SLM Range	20 – 100 dB(A)		

Data Collected						
File	Time Start [GMT]	Time End [GMT]	Cal Start	Cal End	Drift	Notes
03 Lochgoyn Farm - 01.zip	14/02/2006 10:30	22/02/2006 11:00	94.1	-	-	No significant drift
03 Lochgoyn Farm - 02.zip	22/02/2006 11:10	02/03/2006 16:50	94.1	93.9	0.2	No significant drift
03 Lochgoyn Farm - 03.zip	02/03/2006 17:10	09/03/2006 16:00	94.1	94.3	0.2	No significant drift
03 Lochgoyn Farm - 04.zip	09/03/2006 16:20	21/03/2006 10:40	94.1	93.9	0.2	No significant drift
03 Lochgoyn Farm - 05.zip	21/03/2006 10:50	04/04/2006 10:50	94.1	94.2	0.1	No significant drift
03 Lochgoyn Farm - 06.zip	04/04/2006 11:10	12/04/2006 13:00	94.1	94.3	0.2	No significant drift

Table A2.3 Information on the equipment, measurement location, and noise data at Lochgoyn Farm.



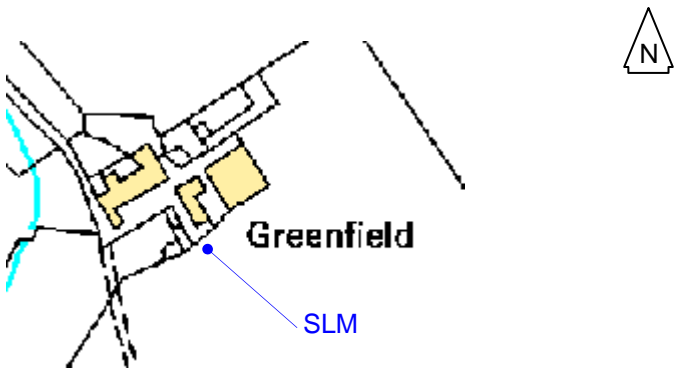
Figure A2.7 View of the monitoring location at Lochgoin Farm looking North East.



Figure A2.8 View of the monitoring location at Lochgoin Farm looking South West.



Figure A2.9 View of the monitoring location at Lochgoin Farm looking North West.

Noise Monitoring Information Sheet	
Location	
Name	04 - Greenfield Farm
Description	Located the sound level meter away from the immediate area of the house as these areas tended to be courtyards and therefore not free-field. The chosen location was in an open area with some trees nearby, similar to those near the house. Audible during visits were wind in the trees, birds, cows, some local road traffic and occasional aircraft. SLM Location: NS541999 49778.
Site Plan	

Noise Equipment			
Equipment	Type	Serial Number	Last Calibrated
Sound Level Meter	Rion NL-31	00110032	23/08/2005
Pre-amplifier	Rion NH-21	00134	23/08/2005
Microphone	Rion UC-53A	102143	23/08/2005
Calibrator	Rion NC-74	34551669	30/08/2005
SLM Range	20 – 100 dB(A)		

Data Collected						
File	Time Start [GMT]	Time End [GMT]	Cal Start	Cal End	Drift	Notes
04 Greenfield Farm - 01.zip	2006/02/14 09:40	2006/02/22 11:20	94.1	-	-	No significant drift
04 Greenfield Farm - 02.zip	2006/02/22 11:30	2006/03/02 17:20	94.1	93.9	0.2	No significant drift
04 Greenfield Farm - 03.zip	2006/03/02 17:30	2006/03/09 15:50	94.1	94.3	0.2	No significant drift
04 Greenfield Farm - 04.zip	2006/03/09 16:00	2006/03/21 10:10	94.1	93.9	0.2	No significant drift
04 Greenfield Farm - 05.zip	2006/03/21 10:30	2006/04/04 10:30	94.1	94.2	0.1	No significant drift
04 Greenfield Farm - 06.zip	2006/04/04 10:50	2006/04/12 13:20	94.1	94.3	0.2	No significant drift

Table A2.4 Information on the equipment, measurement location, and noise data at Greenfield Farm.




Figure A2.10 View of the monitoring location at Greenfield Farm looking North West.



Figure A2.11 View of the monitoring location at Greenfield Farm looking South East.



Figure A2.12 View of the monitoring location at Greenfield Farm looking South West.

Noise Monitoring Information Sheet	
Location	
Name	05 - Laigh Alderstocks
Description	<p>Located the sound level meter at a similar location to that used for the ES noise survey. The location was at the front of the house away from the sound of running water which was apparent in the rear garden. Audible during visits to this location were wind in the trees, birds, cows and occasional aircraft.</p> <p>SLM Location: NS61343 44126.</p>
Site Plan	

Noise Equipment			
Equipment	Type	Serial Number	Last Calibrated
Sound Level Meter	Rion NL-31	00610334	14/09/2005
Pre-amplifier	Rion NH-21	01541	14/09/2005
Microphone	Rion UC-53A	308431	14/09/2005
Calibrator	Rion NC-74	34551669	30/08/2005
SLM Range	20 – 100 dB(A)		

Data Collected						
File	Time Start [GMT]	Time End [GMT]	Cal Start	Cal End	Drift	Notes
05 Laigh Alderstocks - 01.zip	2006/02/14 13:50	2006/02/21 16:50	94.1	-	-	No significant drift
05 Laigh Alderstocks - 02.zip	2006/02/21 16:10	2006/03/02 11:40	94.1	94.2	0.1	No significant drift
05 Laigh Alderstocks - 03.zip	2006/03/02 12:00	2006/03/09 11:20	94.1	94.2	0.1	No significant drift
05 Laigh Alderstocks - 04.zip	2006/03/09 11:40	2006/03/20 15:30	94.1	94.0	0.1	No significant drift
05 Laigh Alderstocks - 05.zip	2006/03/20 15:50	2006/04/03 14:10	94.1	94.2	0.1	No significant drift
05 Laigh Alderstocks - 06.zip	2006/04/03 14:30	2006/04/13 09:20	94.1	94.3	0.1	No significant drift

Table A2.5 Information on the equipment, measurement location, and noise data at Laigh Alderstocks.



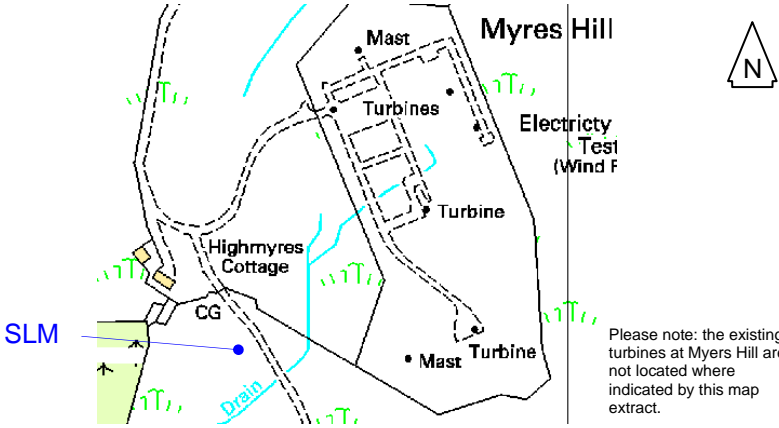
Figure A2.13 View of the monitoring location at Laigh Alderstocks looking North East.



Figure A2.14 View of the monitoring location at Laigh Alderstocks looking South East.



Figure A2.15 View of the monitoring location at Laigh Alderstocks looking North West.

Noise Monitoring Information Sheet	
Location	
Name	06 - High Myers
Description	<p>Located the sound level meter at a similar location to that used for the ES noise survey. This location was in an open area to the side of a property (not shown on the map extract below) called Carrotmoor Farm which is South of High Myers Lodge. Audible during visits to this location were the existing turbines at Myers Hill, wind in the trees and birdsong.</p> <p>SLM Location: NS56691 46446.</p>
Site Plan	 <p>Please note: the existing turbines at Myers Hill are not located where indicated by this map extract.</p>

Noise Equipment			
Equipment	Type	Serial Number	Last Calibrated
Sound Level Meter	Svantek SVAN 949	6757	26/08/2005
Pre-amplifier	Svantek SV 12	7013	26/08/2005
Microphone	GRAS 40AE	49562	26/08/2005
Calibrator	B&K 4231	2498799	17/08/2005
SLM Range	20 – 100 dB(A)		

Data Collected						
File	Time Start [GMT]	Time End [GMT]	Cal Start	Cal End	Drift	Notes
06 High Myers - 01.svn	13/02/2006 16:10	22/02/2006 13:00	-0.2	-0.4	0.2	No significant drift
-	-	-	-	-	-	-
06 High Myers - 03.svn	02/03/2006 15:40	09/03/2006 14:30	-0.1	-0.4	0.3	No significant drift
06 High Myers - 04.svn	09/03/2006 15:00	21/03/2006 08:40	-0.4	-0.2	0.2	No significant drift
06 High Myers - 05.svn	21/03/2006 09:20	04/04/2006 07:30	-0.2	-0.2	0.0	No significant drift
06 High Myers - 06.svn	04/04/2006 08:20	12/04/2006 15:20	-0.2	-0.4	0.2	No significant drift

Table A2.6 Information on the equipment, measurement location, and noise data at High Myers.



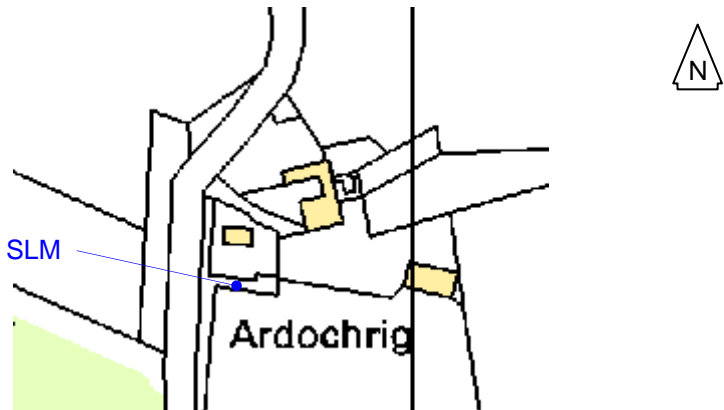
Figure A2.16 View of the monitoring location at High Myers looking North.



Figure A2.17 View of the monitoring location at High Myers looking East.



Figure A2.18 View of the monitoring location at High Myers looking South.

Noise Monitoring Information Sheet	
Location	
Name	07 - Ardochrig
Description	Located the sound level meter at the bottom of the rear garden which was an open area beyond the pond. Audible during visits to site were wind in the trees and long grass, birdsong, occasional aircraft and occasional local road traffic. SLM Location: NS63916 46475.
Site Plan	

Noise Equipment			
Equipment	Type	Serial Number	Last Calibrated
Sound Level Meter	Svantek SVAN 949	6749	24/08/2005
Pre-amplifier	Svantek SV 12	5916	24/08/2005
Microphone	GRAS 40AE	49372	24/08/2005
Calibrator	B&K 4231	2498799	17/08/2005
SLM Range	20 – 100 dB(A)		

Data Collected						
File	Time Start [GMT]	Time End [GMT]	Cal Start	Cal End	Drift	Notes
07 Ardochrig - 01.svn	13/02/2006 14:40	21/02/2006 16:50	-0.7	-0.9	0.2	No significant drift
07 Ardochrig - 02.svn	21/02/2006 17:10	02/03/2006 13:00	-0.9	-0.7		No significant drift
-	-	-	-	-	-	-
07 Ardochrig - 04.svn	09/03/2006 13:10	20/03/2006 16:30	-1.2	-0.8	0.4	No significant drift
07 Ardochrig - 05.svn	20/03/2006 17:00	03/04/2006 15:30	-0.8	-0.8	0.0	No significant drift
07 Ardochrig - 06.svn	03/04/2006 16:30	13/04/2006 07:30	-0.8	-0.8	0.0	No significant drift

Table A2.7 Information on the equipment, measurement location, and noise data at Ardochrig.



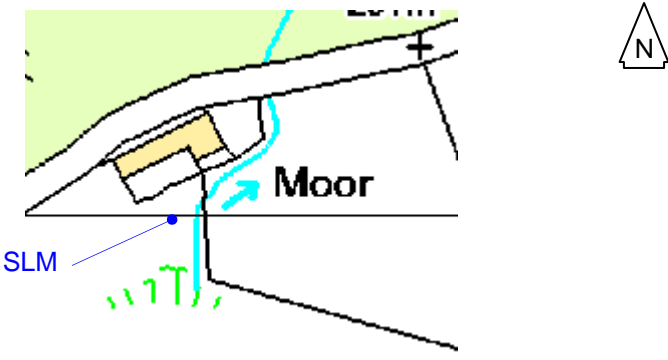
Figure A2.19 View of the monitoring location at Ardochrig looking North.



Figure A2.20 View of the monitoring location at Ardochrig looking South East.



Figure A2.21 View of the monitoring location at Ardochrig Farm looking West.

Noise Monitoring Information Sheet	
Location	
Name	08 - Moor Farm
Description	<p>Located the sound level meter in a small paddock to the rear of the property, furthest from the road and the central heating flue on the house. Audible during the various visits were local road traffic, distant road traffic on the A77, wind in the trees, birdsong, occasional aircraft and sometimes the central heating flue was just audible.</p> <p>SLM Location: NS50853 47999.</p>
Site Plan	

Noise Equipment			
Equipment	Type	Serial Number	Last Calibrated
Sound Level Meter	Rion NL-31	00910448	31/08/2005
Pre-amplifier	Rion NH-21	02286	31/08/2005
Microphone	Rion UC-53A	101792	31/08/2005
Calibrator	Rion NC-74	34551669	30/08/2005
SLM Range	20 – 100 dB(A)		

Data Collected						
File	Time Start [GMT]	Time End [GMT]	Cal Start	Cal End	Drift	Notes
08 Moor Farm - 01.zip	2006/02/14 11:00:00	2006/02/22 08:41:34	94.1	-	-	No significant drift
08 Moor Farm - 02.zip	2006/02/22 08:59:56	2006/03/02 16:27:38	94.1	94.0	0.1	No significant drift
08 Moor Farm - 03.zip	2006/03/02 16:40:00	2006/03/09 16:27:01	94.1	94.2	0.1	No significant drift
08 Moor Farm - 04.zip	2006/03/09 16:40:00	2006/03/21 11:01:53	94.1	93.9	0.2	No significant drift
08 Moor Farm - 05.zip	2006/03/21 11:10:00	2006/04/04 11:19:32	94.1	94.2	0.1	No significant drift
System moved to Windy Hill						

Table A2.8 Information on the equipment, measurement location, and noise data at Moor Farm.




Figure A2.22 View of the monitoring location at Moor Farm looking North West.



Figure A2.23 View of the monitoring location at Moor Farm looking South East.



Figure A2.24 View of the monitoring location at Moor Farm looking South West.

Noise Monitoring Information Sheet	
Location	
Name	09 - Laigh Huntlawrig
Description	Located the sound level meter in the rear open garden area towards the boundary of the field. Audible during visits to this location were wind in the trees around the house, birds and occasional aircraft. SLM Location: NS60789 48644.
Site Plan	

Noise Equipment			
Equipment	Type	Serial Number	Last Calibrated
Sound Level Meter	Svantek SVAN 949	6752	25/08/2005
Pre-amplifier	Svantek SV 12	5919	25/08/2005
Microphone	GRAS 40AE	49544	25/08/2005
Calibrator	B&K 4231	2498799	17/08/2005
SLM Range	20 – 100 dB(A)		

Data Collected						
File	Time Start [GMT]	Time End [GMT]	Cal Start	Cal End	Drift	Notes
09 Laigh Huntlawrig - 01.svn	2006/02/13 17:10:00	2006/02/21 17:29:42	0.9	0.7	0.2	No significant drift
09 Laigh Huntlawrig - 02.svn	2006/02/21 17:49:58	2006/03/02 13:56:26	0.7	0.7	0.0	No significant drift
-	-	-	-	-	-	-
09 Laigh Huntlawrig - 04.svn	2006/03/09 13:30:06	2006/03/20 17:09:40	0.6	0.7	0.1	No significant drift
09 Laigh Huntlawrig - 05.svn	2006/03/20 18:00:00	2006/04/03 16:39:28	0.7	0.8	0.1	No significant drift
09 Laigh Huntlawrig - 06.svn	2006/04/03 18:10:00	2006/04/12 14:39:40	0.8	0.6	0.2	No significant drift

Table A2.9 Information on the equipment, measurement location, and noise data at Laigh Huntlawrig.



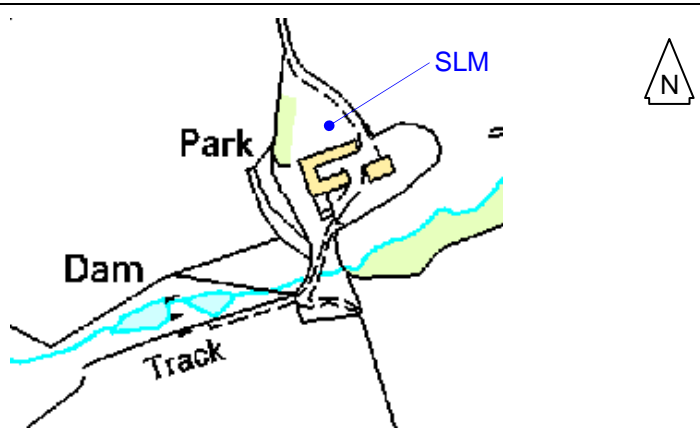
Figure A2.25 View of the monitoring location at Laigh Huntlawrig looking South.



Figure A2.26 View of the monitoring location at Laigh Huntlawrig looking West.



Figure A2.27 View of the monitoring location at Laigh Huntlawrig looking North.

Noise Monitoring Information Sheet	
Location	
Name	10 - Park Farm
Description	<p>Located the sound level meter in an open area on the approach to the property adjacent to a large outbuilding to the South and some trees to the West. The immediate garden area to the rear of the property was more likely to be affected by water noise and was therefore not chosen. Audible during visits to this location were wind in the trees adjacent to the measurement location and those around the house, occasional aircraft, birds and a distant tractor.</p> <p>SLM Location: NS57307 50198.</p>
Site Plan	

Noise Equipment			
Equipment	Type	Serial Number	Last Calibrated
Sound Level Meter	Svantek SVAN 949	6755	28/08/2005
Pre-amplifier	Svantek SV 12	5928	28/08/2005
Microphone	GRAS 40AE	49559	28/08/2005
Calibrator	B&K 4231	2498799	17/08/2005
SLM Range	20 – 100 dB(A)		

Data Collected						
File	Time Start [GMT]	Time End [GMT]	Cal Start	Cal End	Drift	Notes
10 Park Farm - 01.svn	2006/02/13 15:30:00	2006/02/22 11:39:42	-0.7	-0.9	0.2	No significant drift
-	-	-	-	-	-	-
10 Park Farm - 03.svn	2006/03/02 16:10:00	2006/03/09 15:19:44	-0.6	-0.8	0.2	No significant drift
10 Park Farm - 04.svn	2006/03/09 15:39:58	2006/03/20 18:09:36	-0.8	-0.7	0.1	No significant drift
10 Park Farm - 05.svn	2006/03/20 18:40:00	2006/04/04 09:29:32	-0.7	-0.7	0.0	No significant drift
10 Park Farm - 06.svn	2006/04/04 10:30:00	2006/04/12 13:39:44	-0.7	-0.8	0.1	No significant drift

Table A2.10 Information on the equipment, measurement location, and noise data at Park Farm.



Figure A2.28 View of the monitoring location at Park Farm looking South East.




Figure A2.29 View of the monitoring location at Park Farm looking South West.



Figure A2.30 View of the monitoring location at Park Farm looking West.

Noise Monitoring Information Sheet

Location	
Name	11 - Carrot
Description	<p>Located the sound level meter at the edge of a raised area of paddock on the opposite side of the road from Carrot House. The areas around Carrot Cottage and the rear garden of Carrot were all unsuitable due to the sound of flowing water being a more dominant noise source. The chosen location minimised the effect of water noise. Audible during the visits to this location were wind in the trees, some water noise, occasional aircraft, cockerels, dogs barking and birdsong. On one occasion the turbines at Myers Hill were just audible.</p> <p>SLM Location: NS57680 48052.</p>
Site Plan	

Noise Equipment			
Equipment	Type	Serial Number	Last Calibrated
Sound Level Meter	Svantek SVAN 949	6750	24/08/2005
Pre-amplifier	Svantek SV 12	5917	24/08/2005
Microphone	GRAS 40AE	49513	24/08/2005
Calibrator	B&K 4231	2498799	17/08/2005
SLM Range	20 – 100 dB(A)		

Data Collected						
File	Time Start [GMT]	Time End [GMT]	Cal Start	Cal End	Drift	Notes
11 Carrot - 01.svn	2006/02/13 10:50:00	2006/02/22 12:20:32	1.4	1.4	0.0	No significant drift
11 Carrot - 02.svn	2006/02/22 12:49:58	2006/03/02 14:40:28	1.4	1.4	0.0	No significant drift
11 Carrot - 03.svn	2006/03/02 15:10:00	2006/03/09 13:50:22	1.4	1.4	0.0	No significant drift
11 Carrot - 04.svn	2006/03/09 14:30:00	2006/03/21 09:20:40	1.4	1.4	0.0	No significant drift
11 Carrot - 05.svn	2006/03/21 10:00:00	2006/04/04 08:30:50	1.4	1.4	0.0	No significant drift
11 Carrot - 06.svn	2006/04/04 09:20:00	2006/04/12 15:40:30	1.4	1.2	0.2	No significant drift

Table A2.11 Information on the equipment, measurement location, and noise data at Carrot.




Figure A2.31 View of the monitoring location at Carrot looking East.



Figure A2.32 View of the monitoring location at Carrot looking South East.



Figure A2.33 View of the monitoring location at Carrot looking West.

Noise Monitoring Information Sheet	
Location	
Name	12 - Laigh Overmuir
Description	Located the sound level meter in an open area to the side of the property avoiding areas which were near the central heating flue. The area has some trees around the house and garden. Audible during visits to this location were wind in the trees, occasional aircraft and birdsong. SLM Location: NS58026 43169.
Site Plan	

Noise Equipment			
Equipment	Type	Serial Number	Last Calibrated
Sound Level Meter	Svantek SVAN 949	6753	25/08/2005
Pre-amplifier	Svantek SV 12	5925	25/08/2005
Microphone	GRAS 40AE	49556	25/08/2005
Calibrator	B&K 4231	2498799	17/08/2005
SLM Range	20 – 100 dB(A)		

Data Collected						
File	Time Start [GMT]	Time End [GMT]	Cal Start	Cal End	Drift	Notes
12 Laigh Overmuir - 01.svn	2006/02/13 13:10:00	2006/02/21 14:49:44	-0.2	0.1	0.1	No significant drift
12 Laigh Overmuir - 02.svn	2006/02/21 15:09:58	2006/03/02 10:29:38	0.1	0.0	0.1	No significant drift
-	-	-	-	-	-	-
12 Laigh Overmuir - 04.svn	2006/03/09 10:39:58	2006/03/20 14:09:36	-0.5	0.1	0.6	No significant drift
12 Laigh Overmuir - 05.svn	2006/03/20 15:00:00	2006/03/29 02:19:44	0.1	-0.4	0.5	No significant drift
12 Laigh Overmuir - 06.svn	2006/04/03 13:29:58	2006/04/13 11:19:40	-0.4	-0.5	0.1	No significant drift

Table A2.12 Information on the equipment, measurement location, and noise data at Laigh Overmuir.



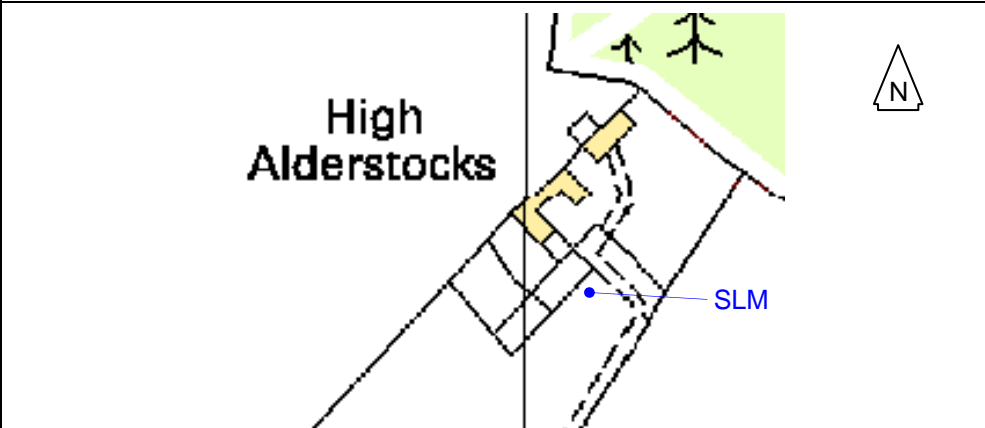
Figure A2.34 View of the monitoring location at Laigh Overmuir looking East.



Figure A2.35 View of the monitoring location at Laigh Overmuir looking South West.



Figure A2.36 View of the monitoring location at Laigh Overmuir looking North.

Noise Monitoring Information Sheet	
Location	
Name	13 - High Alderstocks
Description	Located the sound level meter away from the house to avoid influence of the central heating flue and to ensure the location was an open free-field position. The location was an area of rough grass adjacent to the approach to the house. SLM Location: NS61020 44692 .
Site Plan	

Noise Equipment			
Equipment	Type	Serial Number	Last Calibrated
Sound Level Meter	Rion NL-31	01141928	12/09/2005
Pre-amplifier	Rion NH-21	13573	12/09/2005
Microphone	Rion UC-53A	307685	12/09/2005
Calibrator	Rion NC-74	34551669	30/08/2005
SLM Range	20 – 100 dB(A)		

Data Collected						
File	Time Start [GMT]	Time End [GMT]	Cal Start	Cal End	Drift	Notes
13 High Alderstocks - 01.zip	2006/02/14 13:29:59	2006/02/21 15:40:21	94.1	-	-	No significant drift
13 High Alderstocks - 02.zip	2006/02/21 15:49:58	2006/03/02 11:26:36	94.1	94.2	0.1	No significant drift
13 High Alderstocks - 03.zip	2006/03/02 11:40:00	2006/03/09 11:10:58	94.1	94.2	0.1	No significant drift
13 High Alderstocks - 04.zip	2006/03/09 11:19:57	2006/03/20 15:24:22	94.1	93.8	0.3	No significant drift
13 High Alderstocks - 05.zip	2006/03/20 15:29:59	2006/03/29 19:49:59	94.1	94.3	0.2	No significant drift
13 High Alderstocks - 06.zip	2006/04/03 14:10:00	2006/04/09 14:09:59	94.1	94.4	0.3	No significant drift

Table A2.13 Information on the equipment, measurement location, and noise data at High Alderstocks.



Figure A2.37 View of the monitoring location at High Alderstocks looking North.

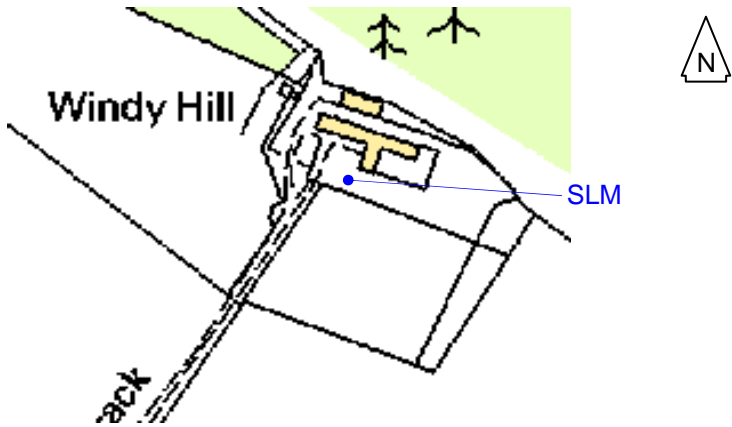


Figure A2.38 View of the monitoring location at High Alderstocks looking North East.



Figure A2.39 View of the monitoring location at High Alderstocks looking South West.

Noise Monitoring Information Sheet

Location	
Name	14 - Windy Hill
Description	This location was chosen as an alternative to Craigendunton. The sound level meter was located on the open lawn area to the front of the property and was furthest from likely influence by the central heating flue. Audible during visits to this location were wind in the trees, birdsong, occasional aircraft, sheep and dogs. SLM Location: NS50266 44900.
Site Plan	

Noise Equipment			
Equipment	Type	Serial Number	Last Calibrated
Sound Level Meter	Rion NL-31	00110060	14/09/2005
Pre-amplifier	Rion NH-21	07772	14/09/2005
Microphone	Rion UC-53A	307276	14/09/2005
Calibrator	Rion NC-74	34551669	30/08/2005
SLM Range	20 – 100 dB(A)		
Sound Level Meter	Rion NL-31	00910448	31/08/2005
Pre-amplifier	Rion NH-21	02286	31/08/2005
Microphone	Rion UC-53A	101792	31/08/2005
Calibrator	Rion NC-74	34551669	30/08/2005
SLM Range	20 – 100 dB(A)		

Data Collected						
File	Time Start [GMT]	Time End [GMT]	Cal Start	Cal End	Drift	Notes
-	-	-	-	-	-	-
14 Windy Hill - 02.zip	2006/02/22 09:59:59	2006/03/02 08:16:17	94.1	94.0	0.1	No significant drift
14 Windy Hill - 03.zip	2006/03/02 08:40:01	2006/03/09 16:55:43	94.1	94.2	0.1	No significant drift
-	-	-	-	-	-	-
-	-	-	-	-	-	-
14 Windy Hill - 06.zip	2006/04/04 13:20:00	2006/04/12 12:33:27	94.1	94.1	0.0	No significant drift

Table A2.14 Information on the equipment, measurement location, and noise data at Windy Hill.



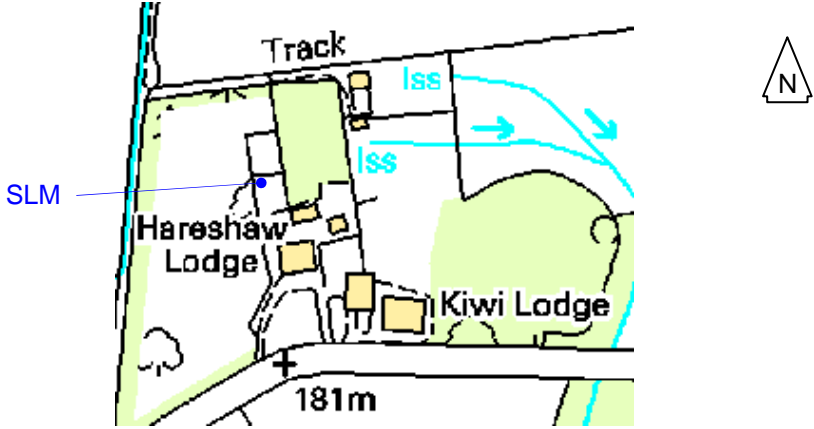
Figure A2.40 View of the monitoring location at Windy Hill looking South East.



Figure A2.41 View of the monitoring location at Windy Hill looking North West.



Figure A2.42 View of the monitoring location at Windy Hill looking South West.

Noise Monitoring Information Sheet	
Location	
Name	15 - Hareshaw Lodge
Description	<p>Located the sound level meter beyond the garage in the rear open garden area. This was away from the central heating flue at the rear of the house. The garden has a perimeter of trees on most sides. Audible during the visits to this location were wind in the trees, distant road traffic and occasional aircraft.</p> <p>SLM Location: NS50591 43709.</p>
Site Plan	

Noise Equipment			
Equipment	Type	Serial Number	Last Calibrated
Sound Level Meter	Rion NL-31	00910437	31/08/2005
Pre-amplifier	Rion NH-21	02275	31/08/2005
Microphone	Rion UC-53A	101775	31/08/2005
Calibrator	Rion NC-74	34551669	30/08/2005
SLM Range	20 – 100 dB(A)		

Data Collected						
File	Time Start [GMT]	Time End [GMT]	Cal Start	Cal End	Drift	Notes
15 Hareshaw Lodge - 01.zip	2006/02/14 12:00:00	2006/02/22 10:30:29	94.1	-	-	No significant drift
15 Hareshaw Lodge - 02.zip	2006/02/22 10:40:00	2006/03/02 08:53:51	94.1	94.2	0.1	No significant drift
15 Hareshaw Lodge - 03.zip	2006/03/02 09:09:46	2006/03/09 17:16:23	94.1	94.2	0.1	No significant drift
15 Hareshaw Lodge - 04.zip	2006/03/09 17:29:59	2006/03/21 12:07:28	94.1	94.0	0.1	No significant drift
15 Hareshaw Lodge - 05.zip	2006/03/21 12:20:00	2006/04/04 12:30:05	94.1	94.0	0.1	No significant drift
15 Hareshaw Lodge - 06.zip	2006/04/04 12:39:46	2006/04/12 12:12:28	94.1	94.0	0.1	No significant drift

Table A2.15 Information on the equipment, measurement location, and noise data at Hareshaw Lodge.



Figure A2.43 View of the monitoring location at Hareshaw Lodge looking South.



Figure A2.44 View of the monitoring location at Hareshaw Lodge looking East.



Figure A2.45 View of the monitoring location at Hareshaw Lodge looking West.

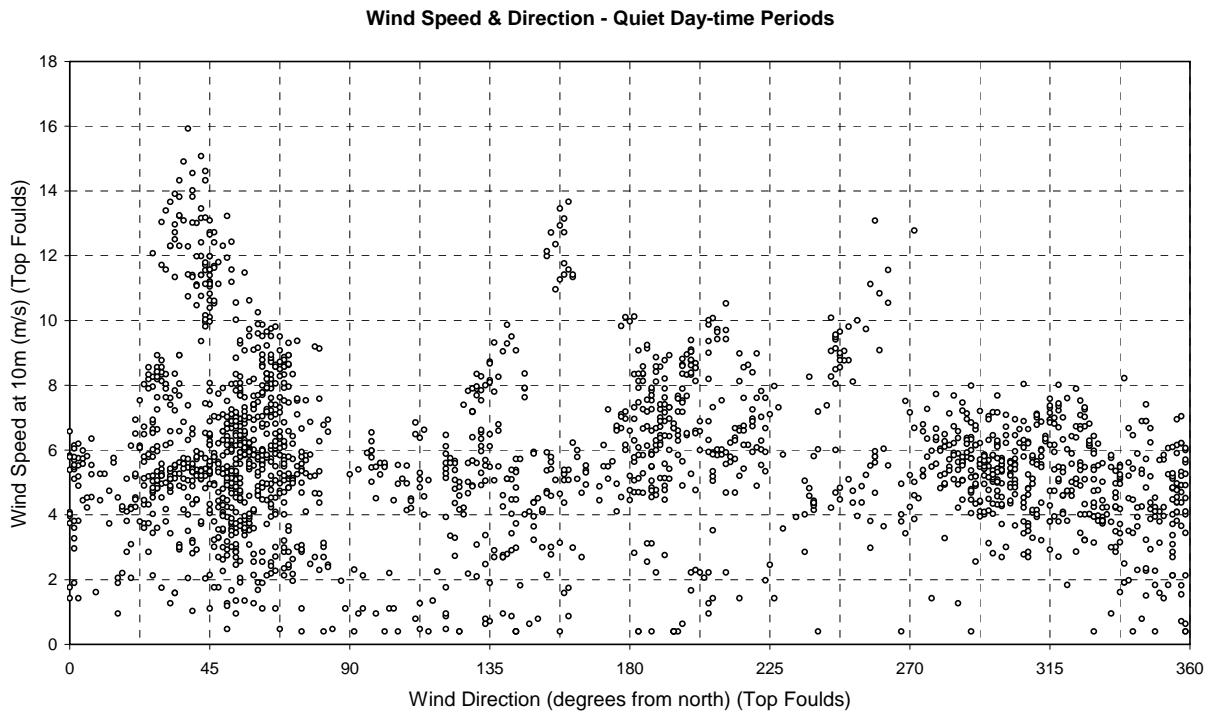


Figure A3.1 Wind speed and direction range during all quiet day-time periods. This is the longest data-set at Logoch.

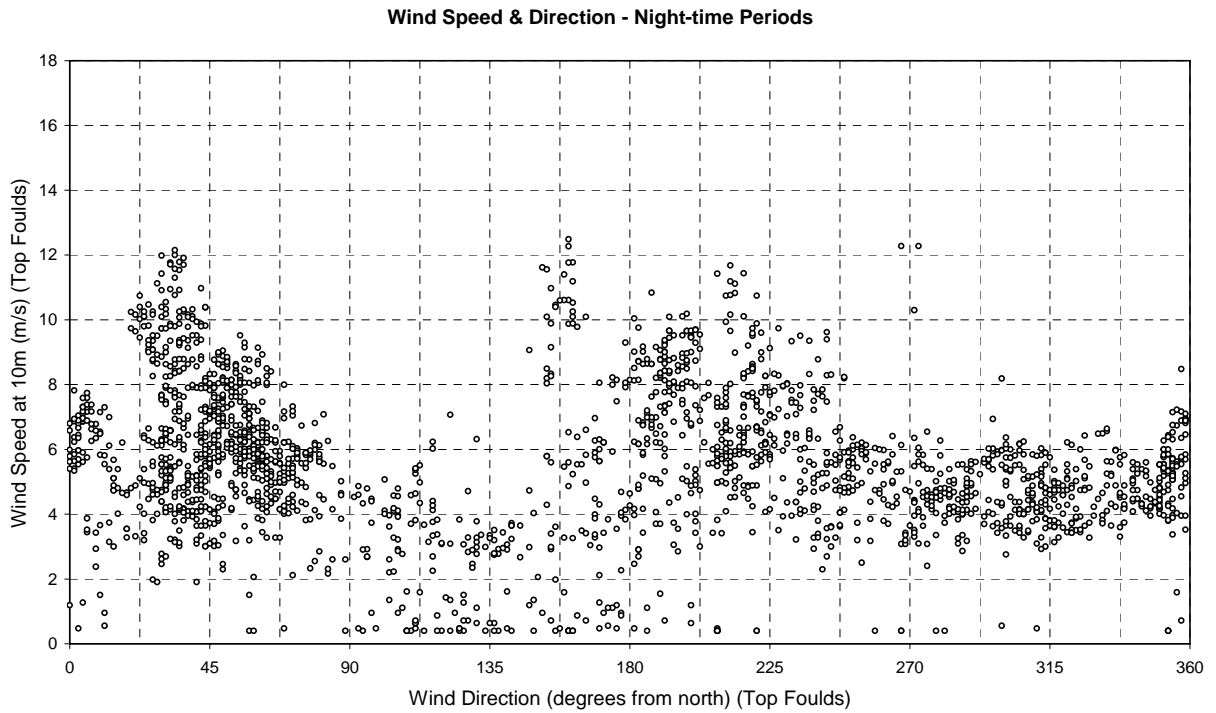


Figure A3.2 Wind speed and direction range during all night-time periods. This is the longest data-set at Logoch.

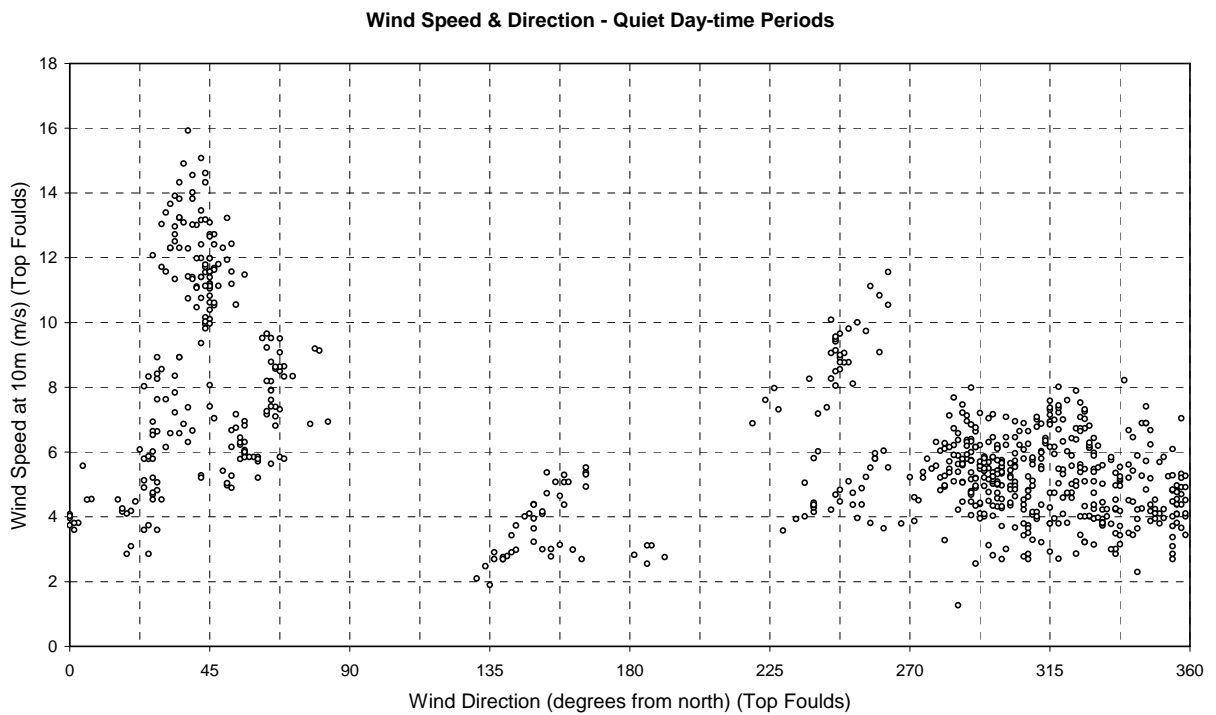


Figure A3.3 Wind speed and direction range during all quiet day-time periods. This is the shortest data-set at Windy Hill Farm.

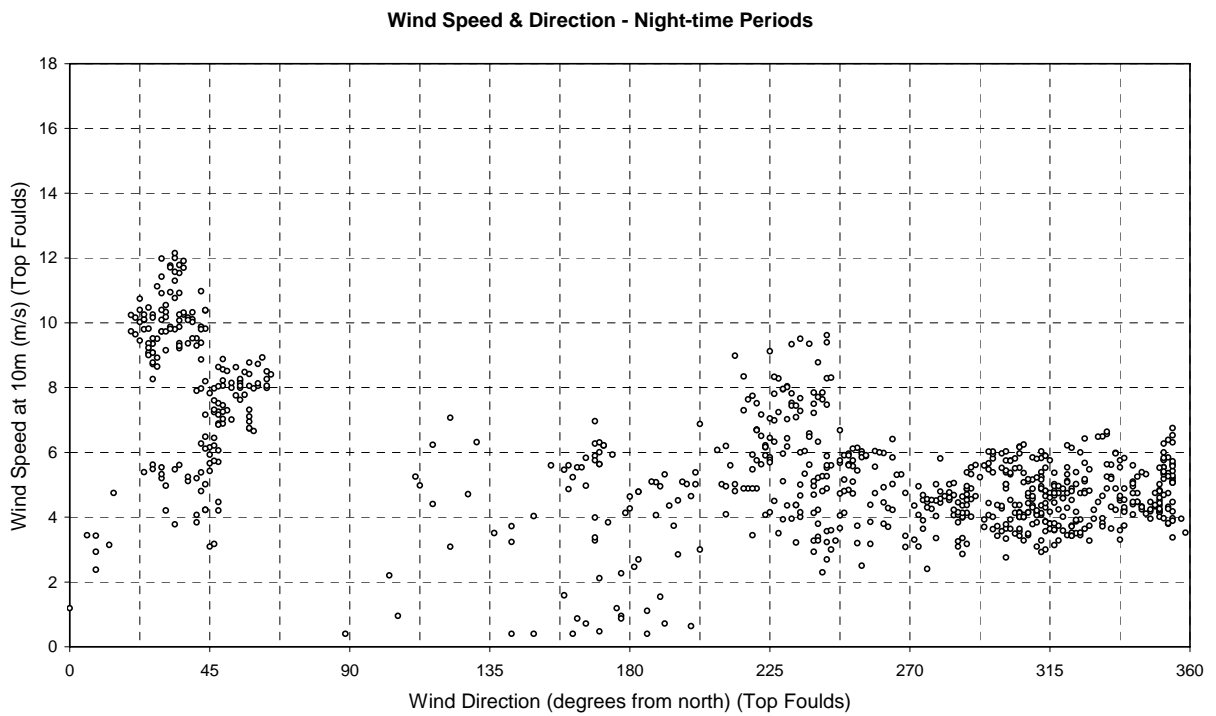


Figure A3.4 Wind speed and direction range during all night-time periods. This is the shortest data-set at Windy Hill Farm.

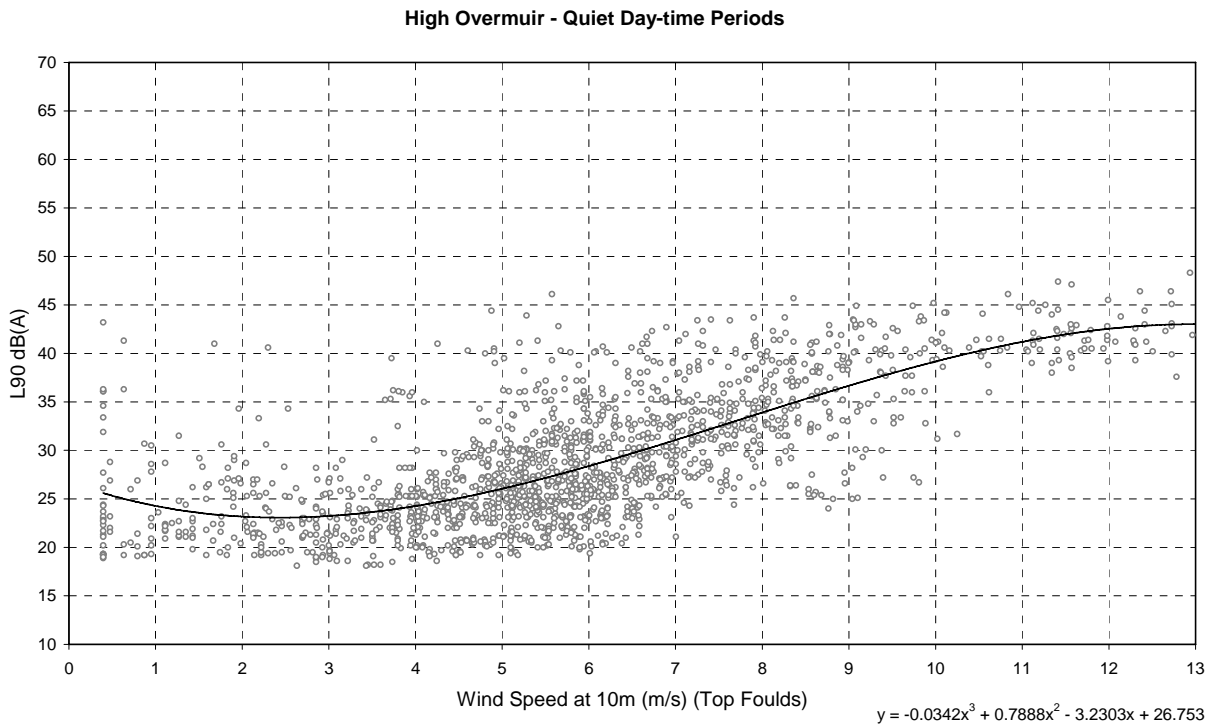


Figure A4.1 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 01 High Overmuir during quiet day-time periods.

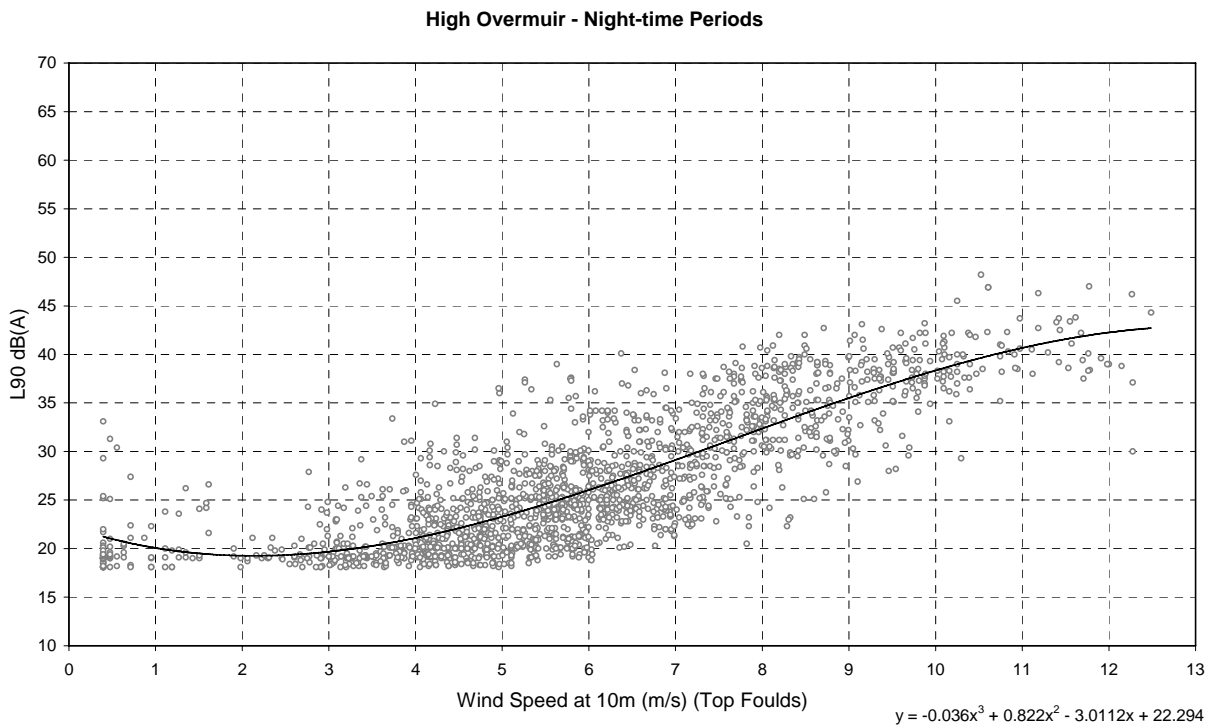


Figure A4.2 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 01 High Overmuir during night-time periods.

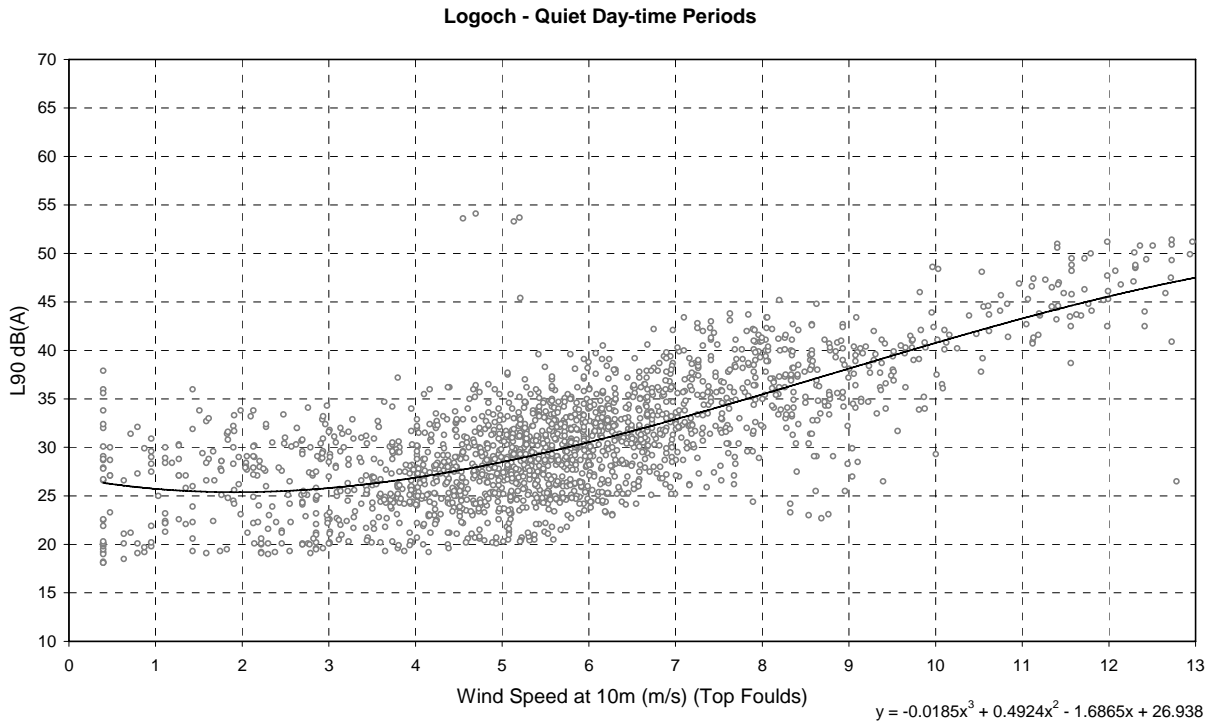


Figure A4.3 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 02 Logoch during quiet day-time periods.

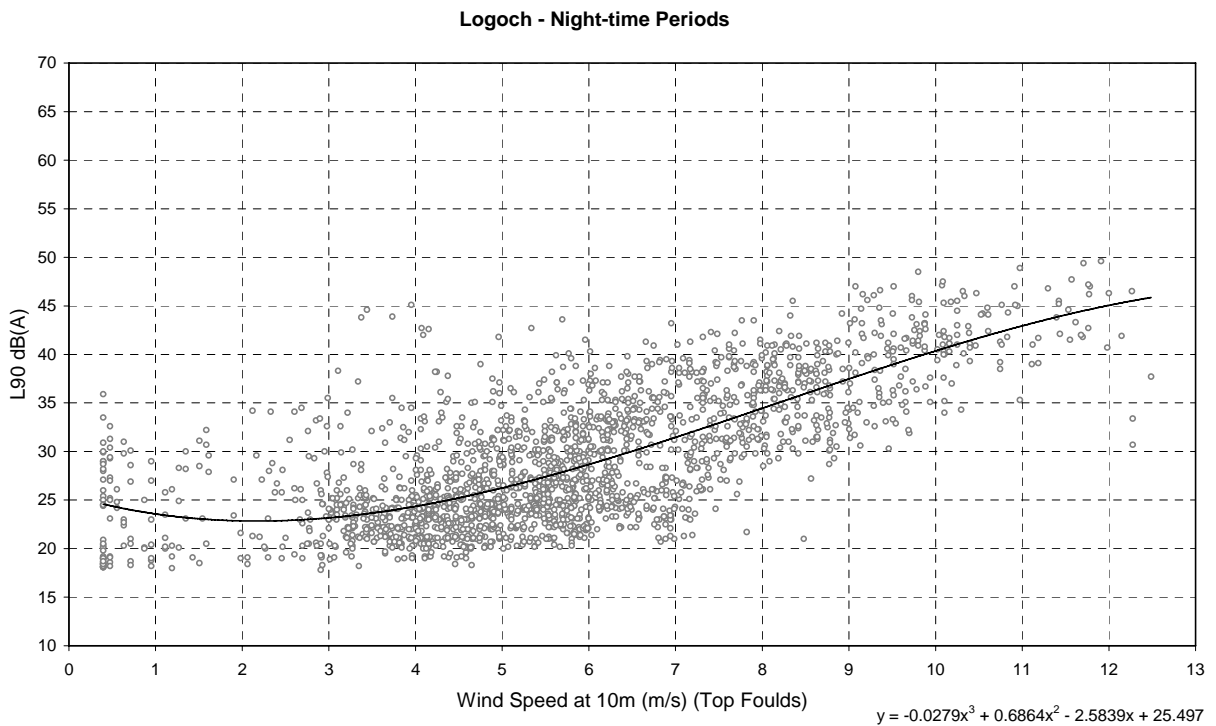


Figure A4.4 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 02 Logoch during night-time periods.

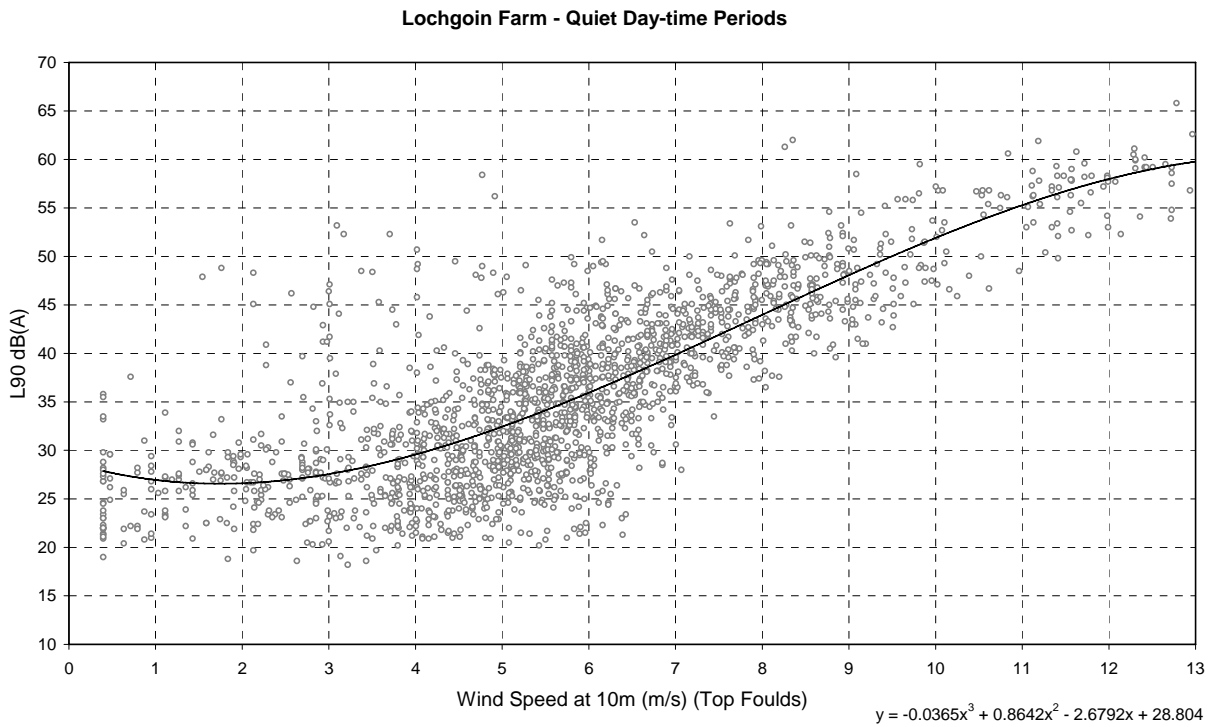


Figure A4.5 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 03 Lochgoin Farm during quiet day-time periods.

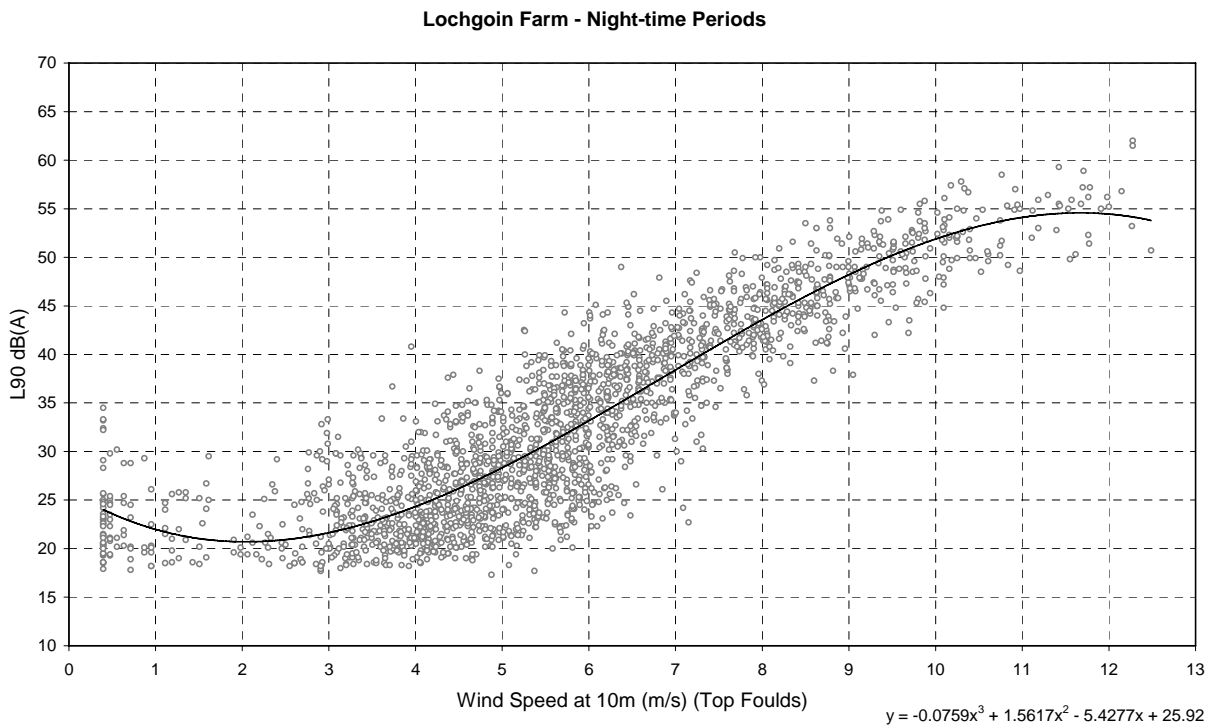


Figure A4.6 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 03 Lochgoin Farm during night-time periods.

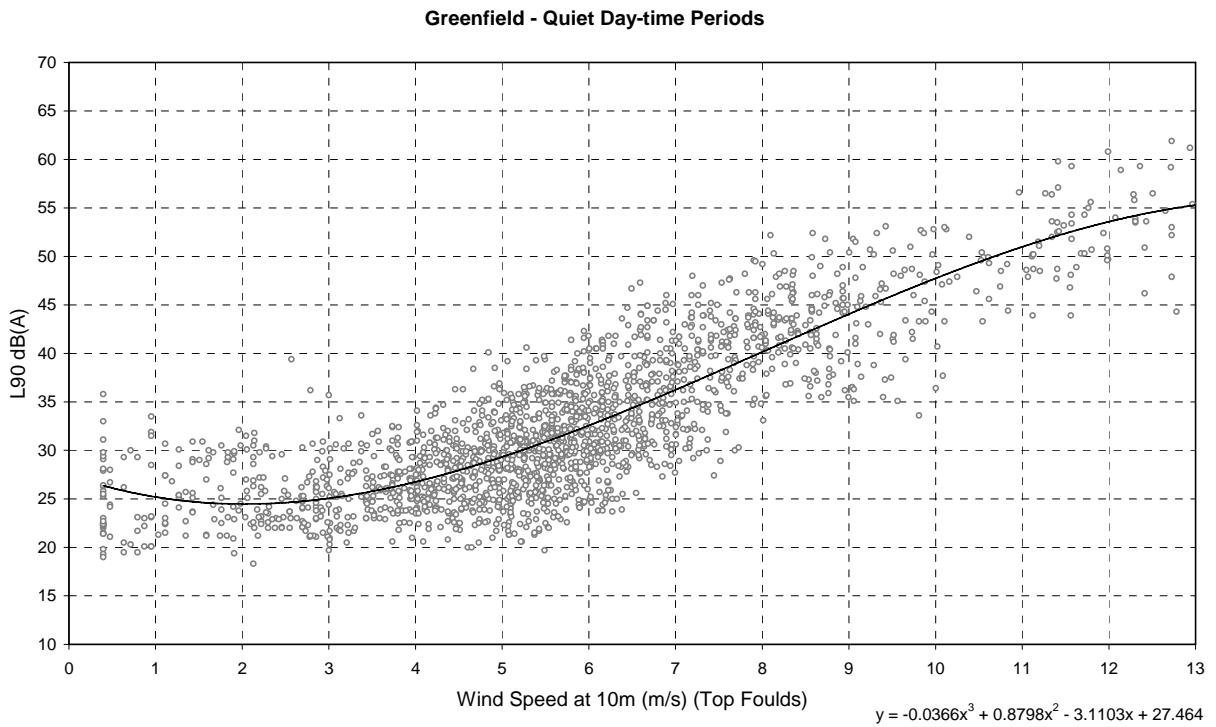


Figure A4.7 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 04 Greenfield Farm during quiet day-time periods.

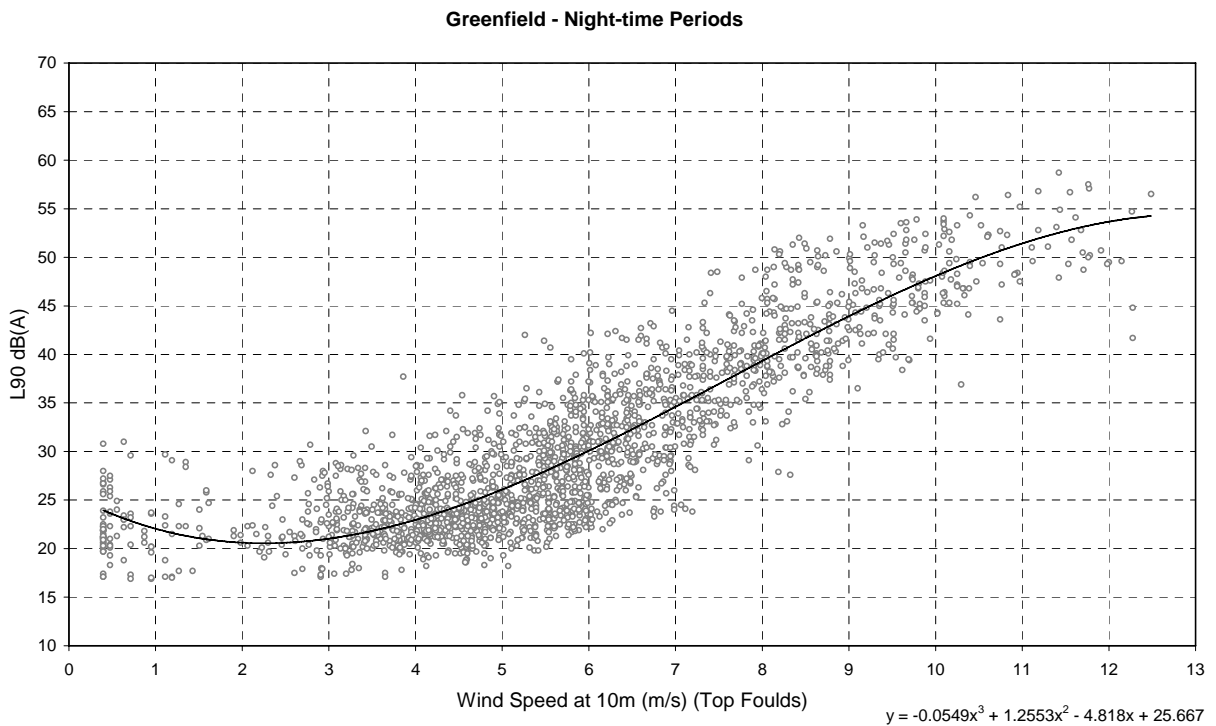


Figure A4.8 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 04 Greenfield Farm during night-time periods.

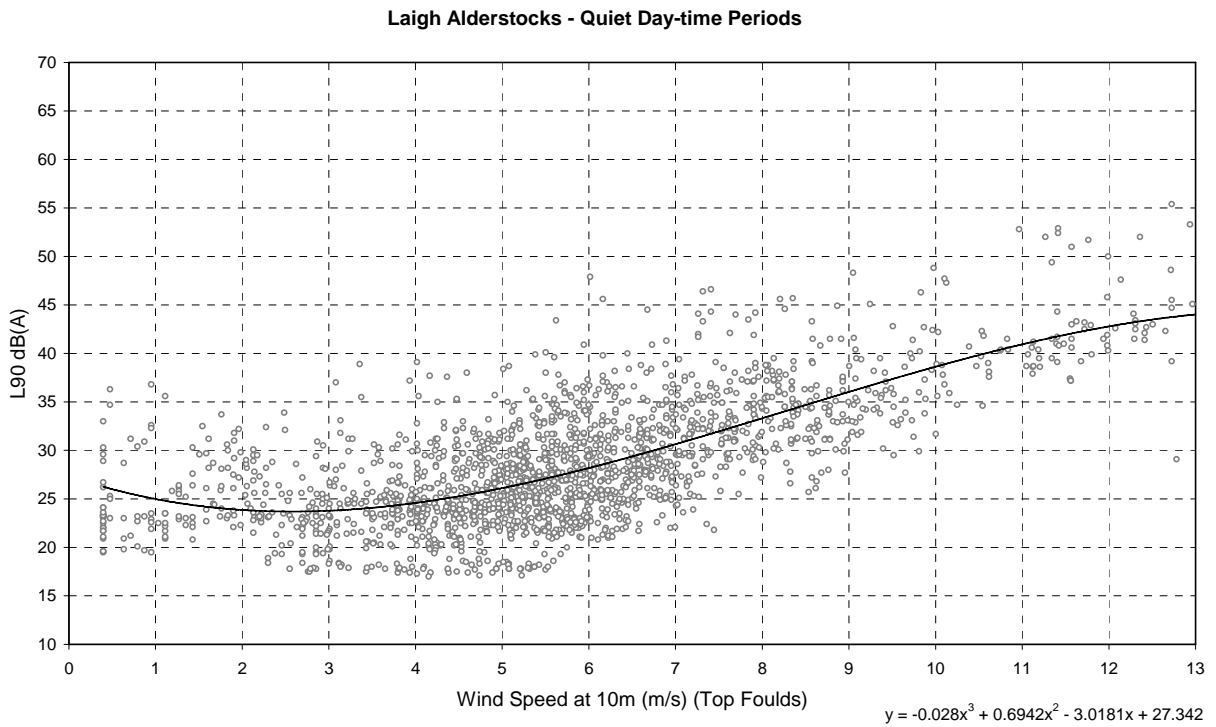


Figure A4.9 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 05 Laigh Alderstocks during quiet day-time periods.

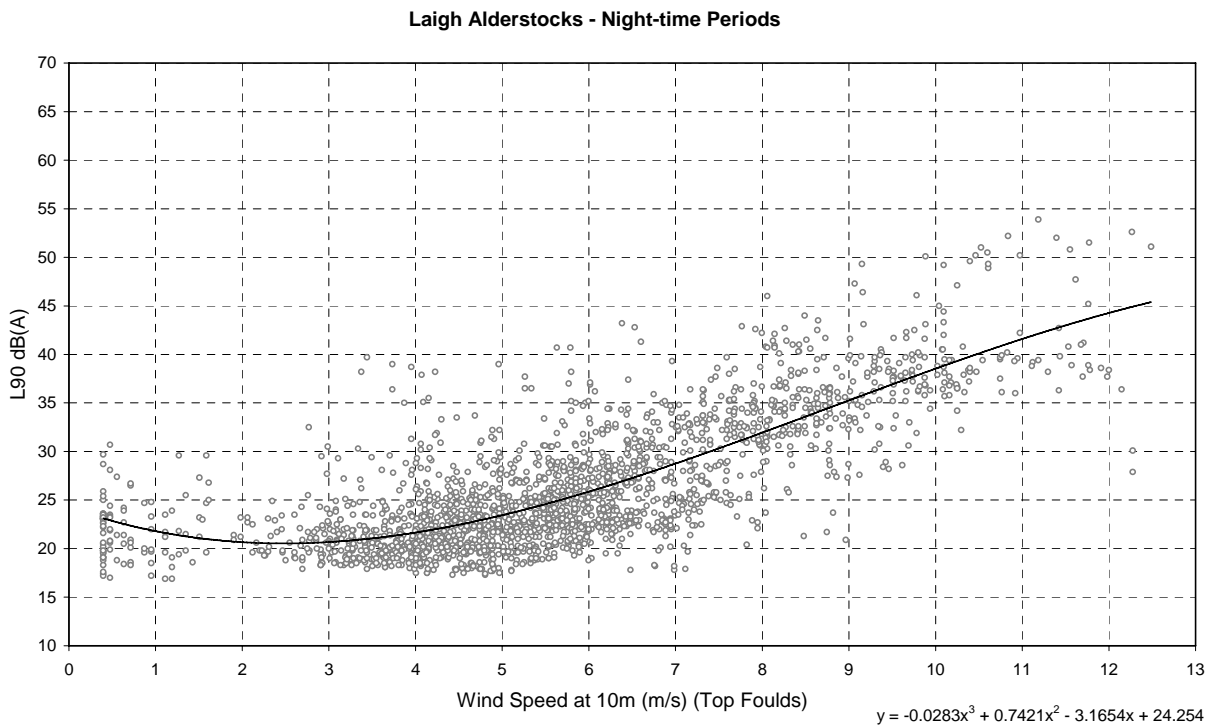


Figure A4.10 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 05 Laigh Alderstocks during night-time periods.

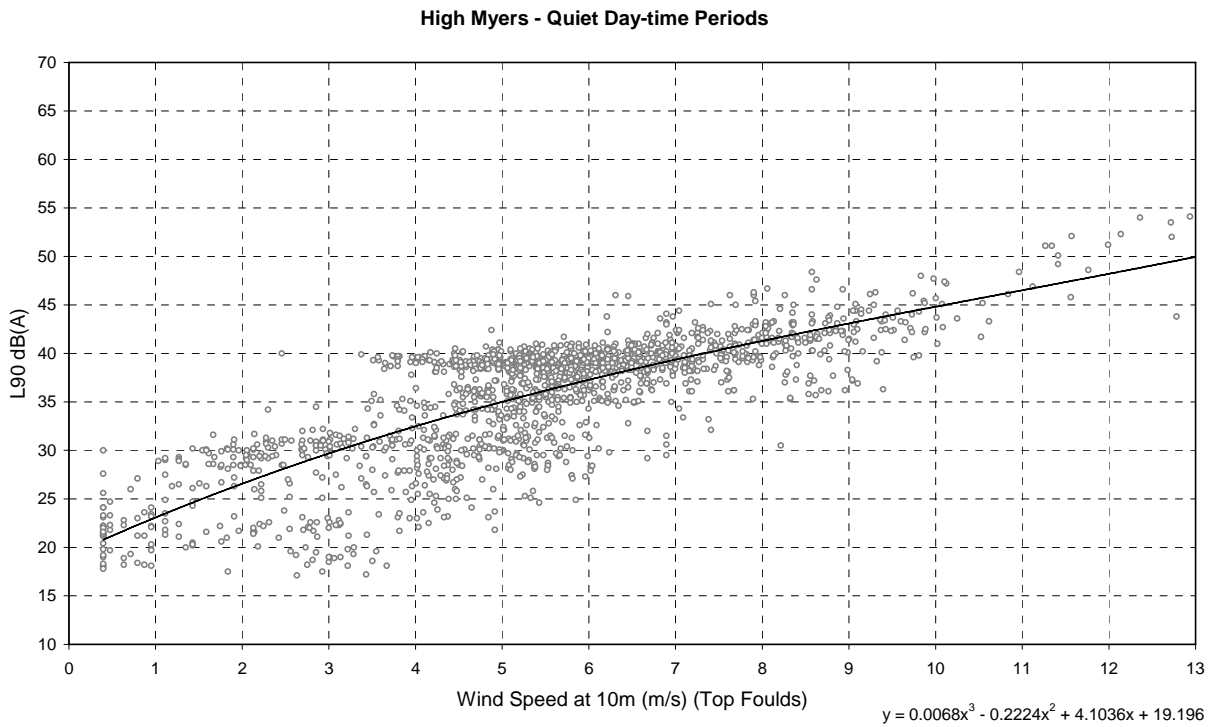


Figure A4.11 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 06 High Myers during quiet day-time periods.

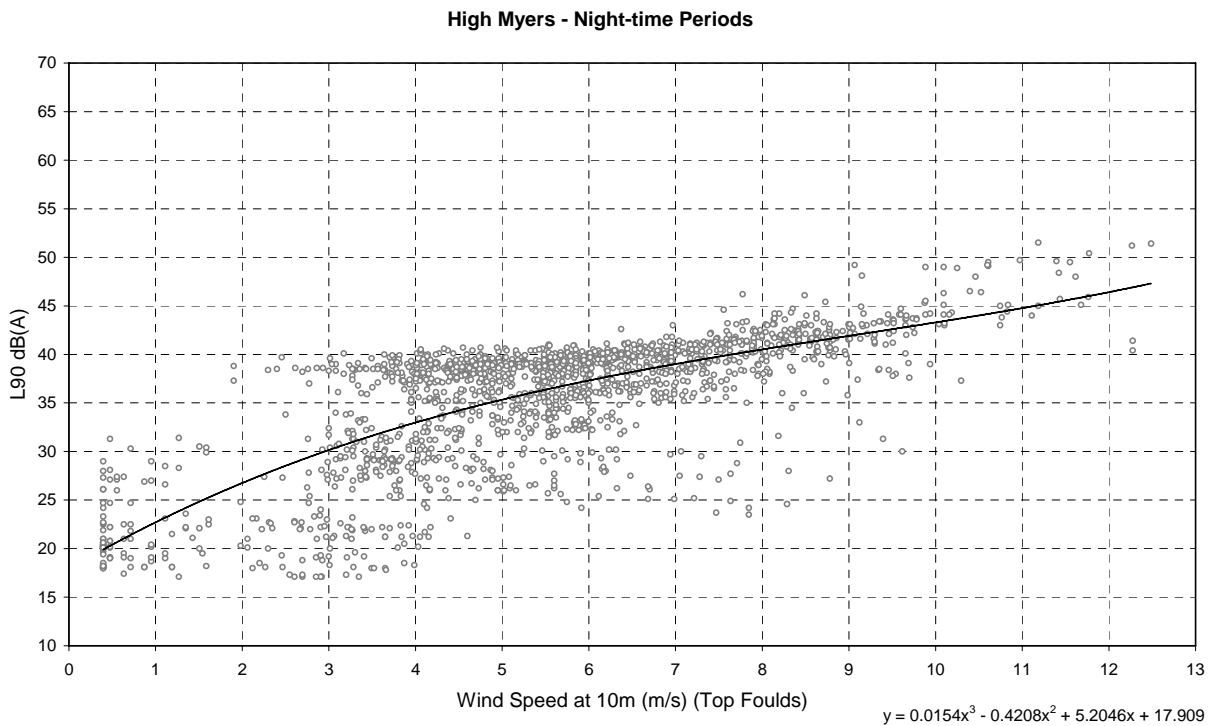


Figure A4.12 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 06 High Myers during night-time periods.

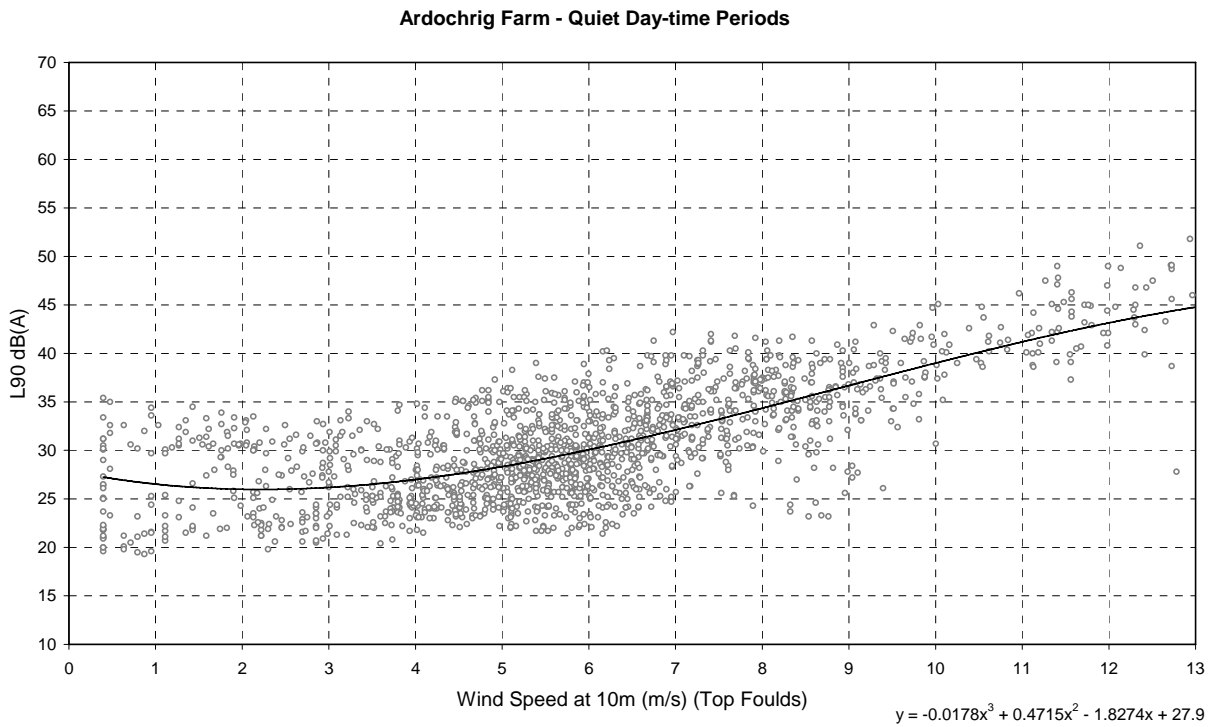


Figure A4.13 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 07 Ardochrig during quiet day-time periods.

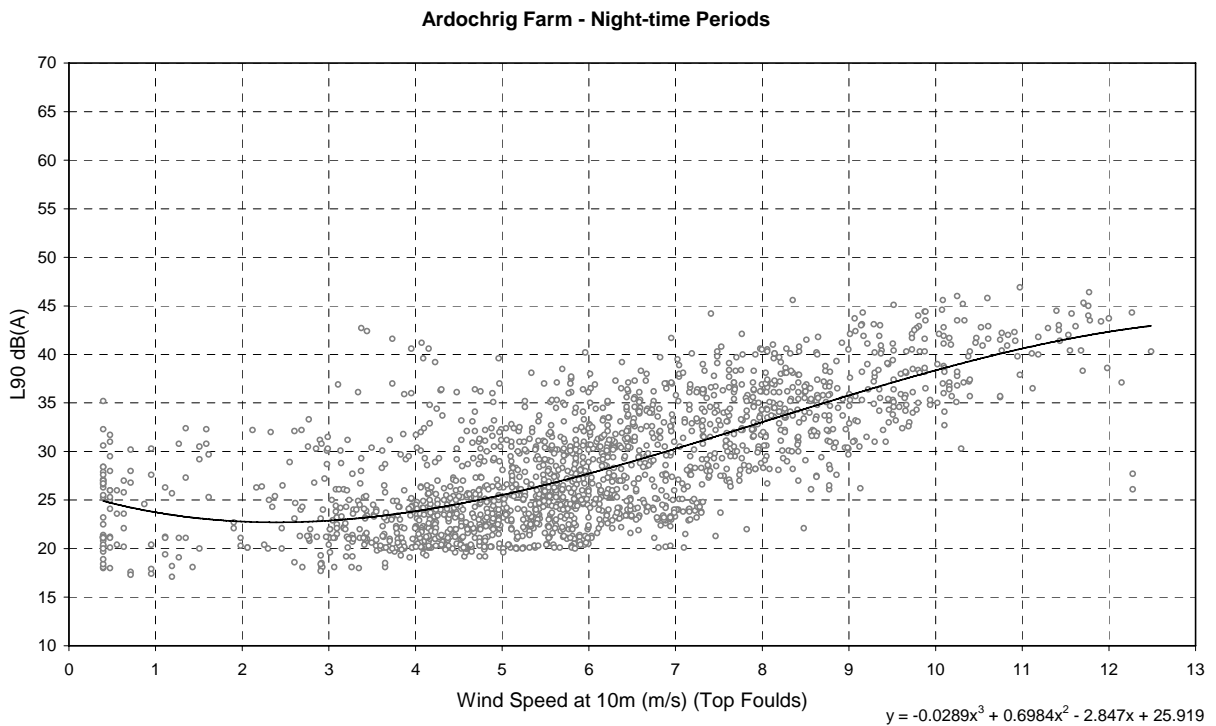


Figure A4.14 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 07 Ardochrig during night-time periods.

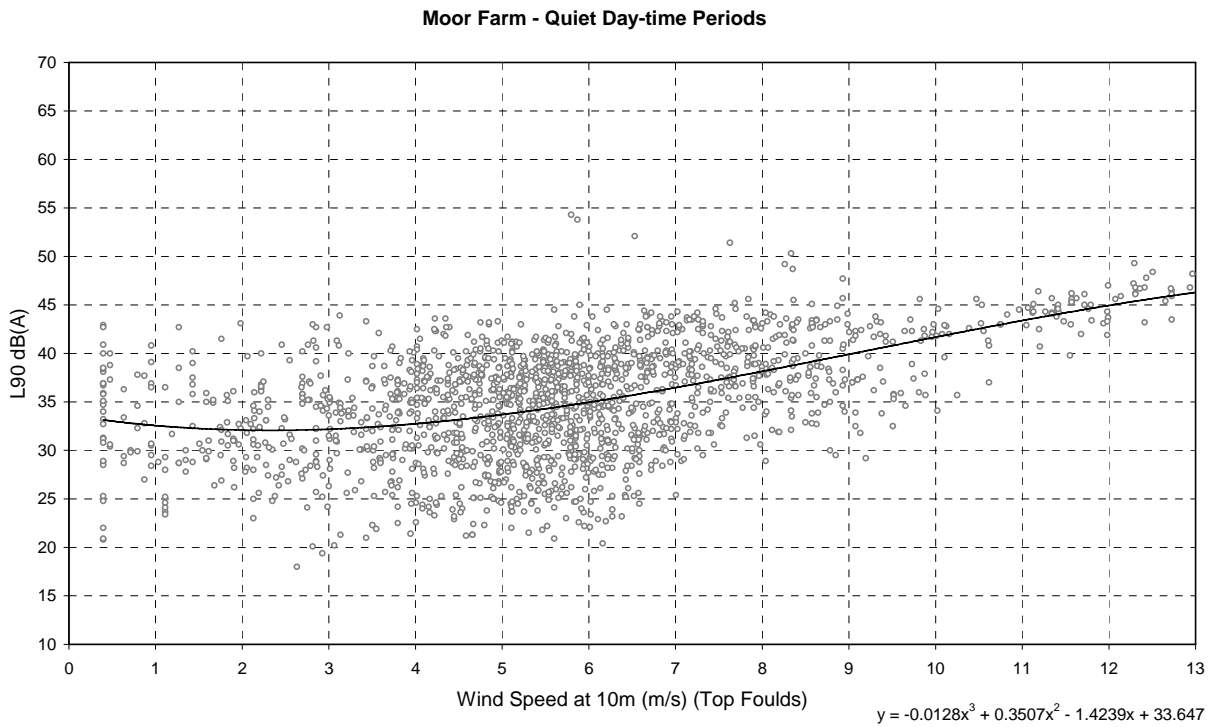


Figure A4.15 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 08 Moor Farm during quiet day-time periods.

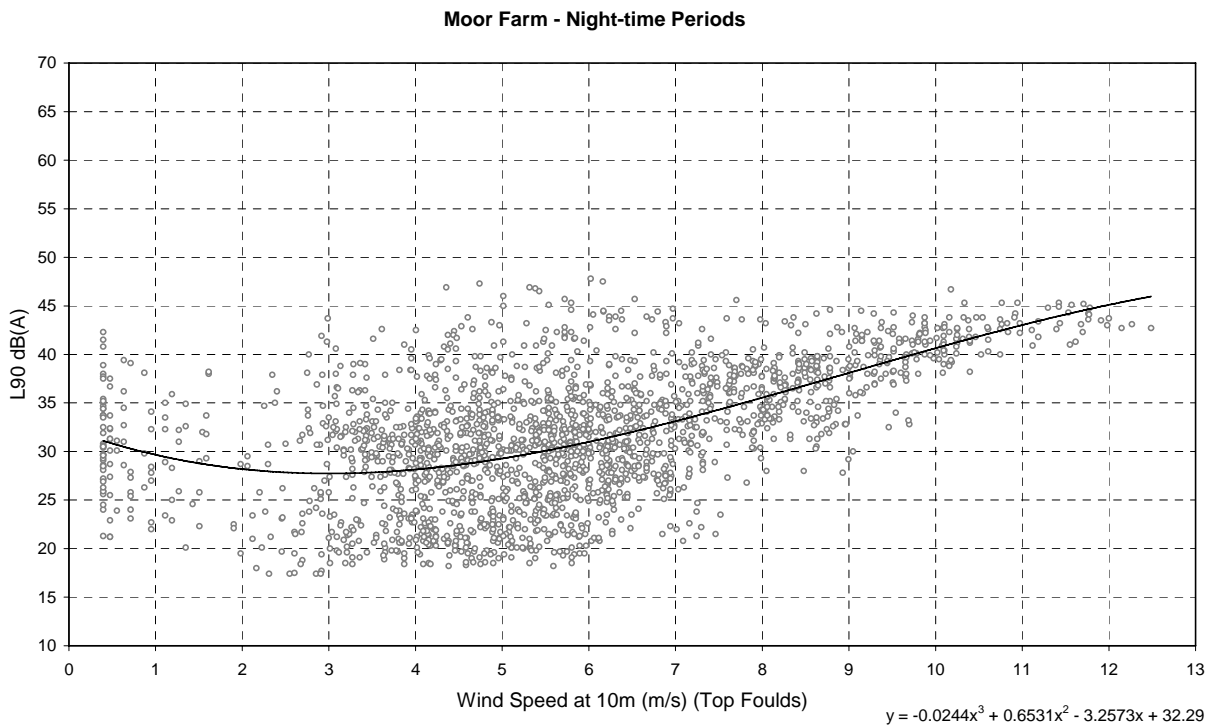


Figure A4.16 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 08 Moor Farm during night-time periods.

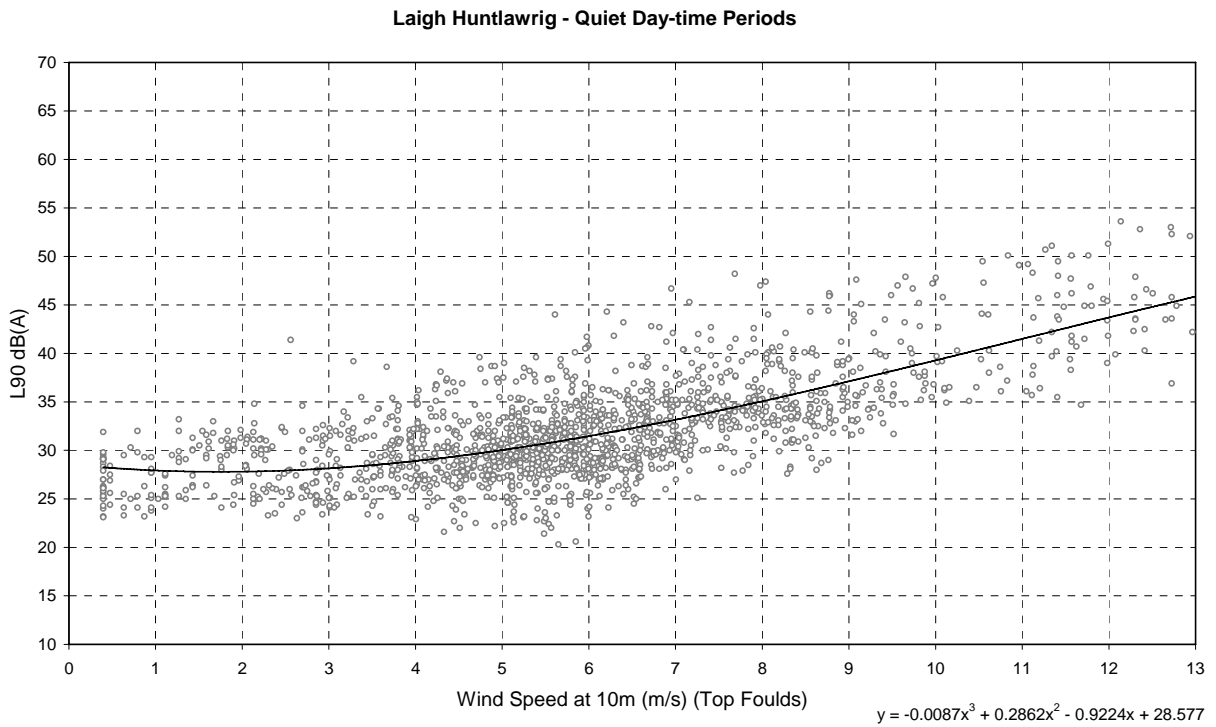


Figure A4.17 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 09 Laigh Huntlawrig during quiet day-time periods.

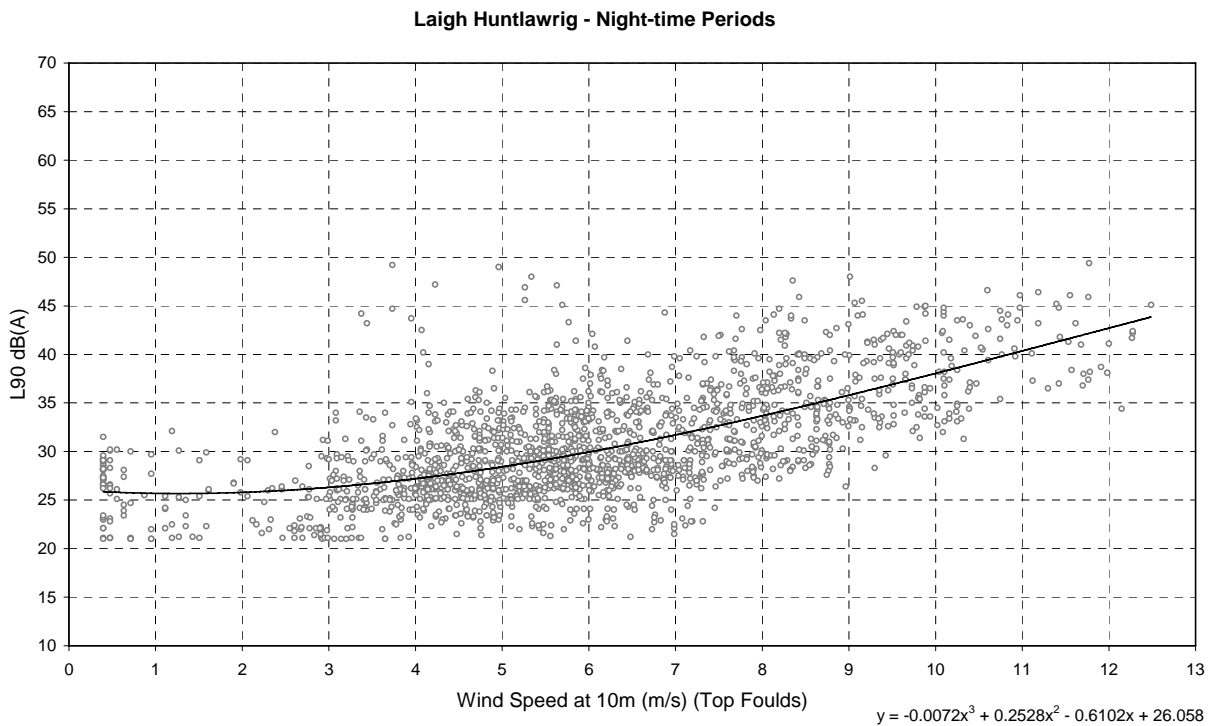


Figure A4.18 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 09 Laigh Huntlawrig during night-time periods.

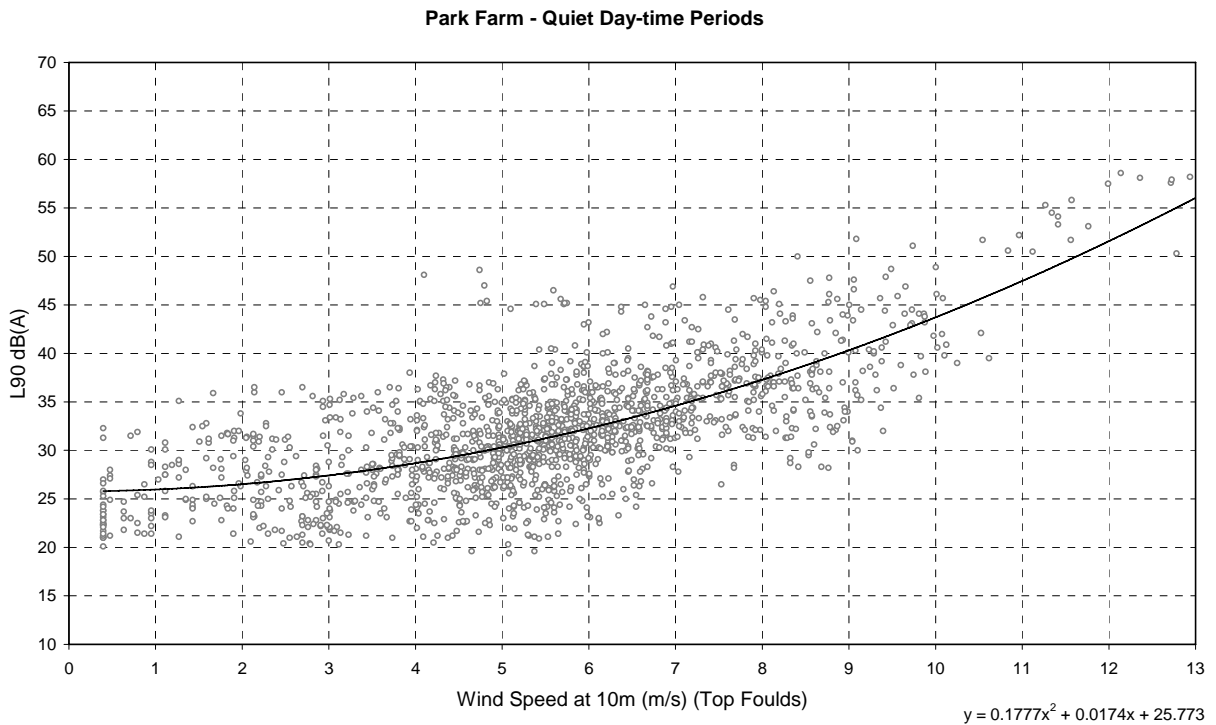


Figure A4.19 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 10 Park Farm during quiet day-time periods.

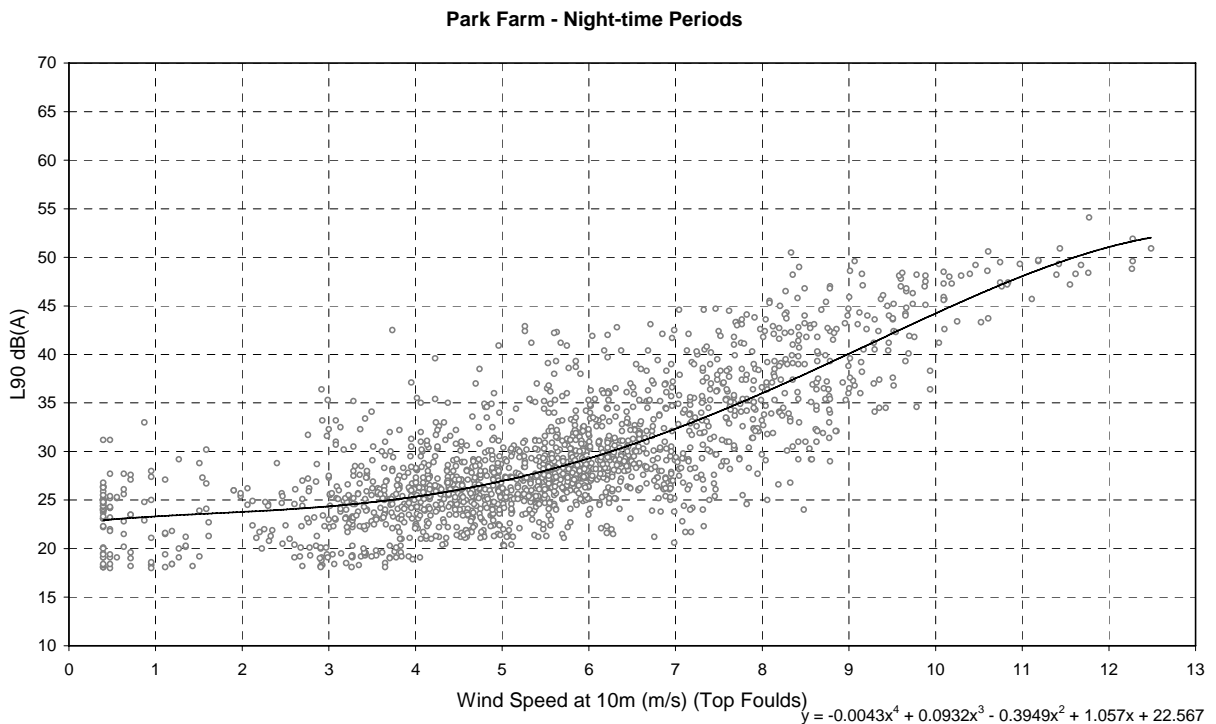


Figure A4.20 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 10 Park Farm during night-time periods.

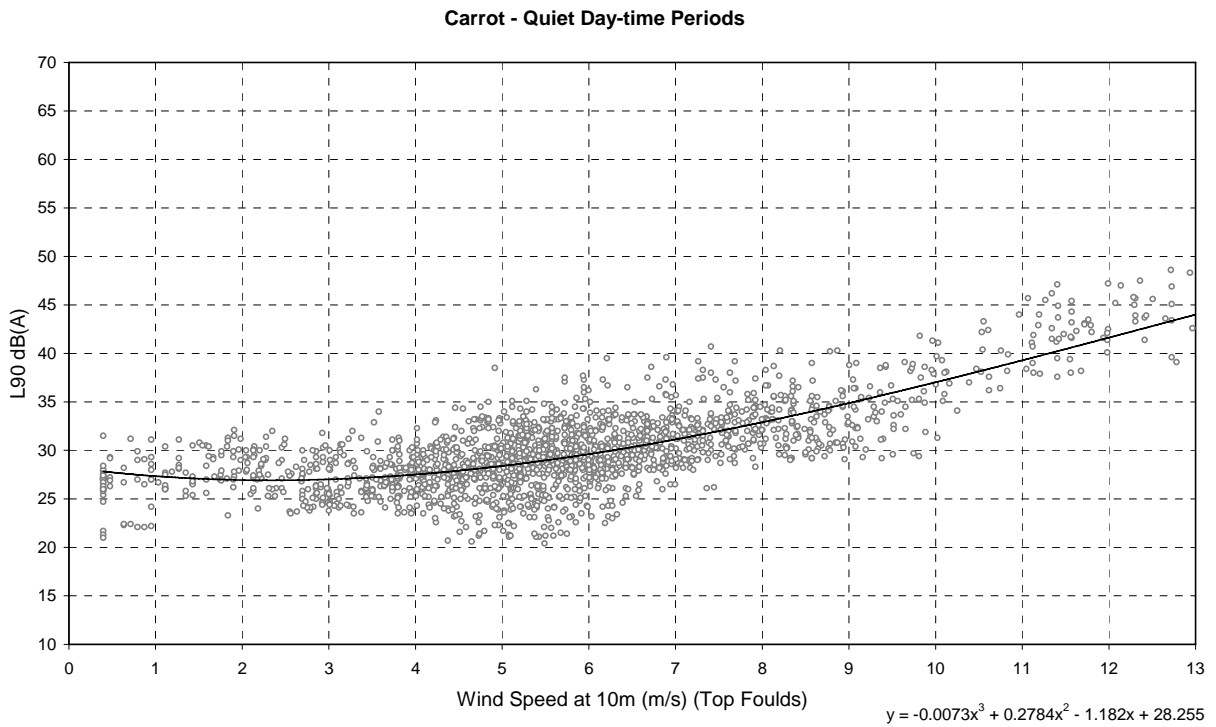


Figure A4.21 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 11 Carrot during quiet day-time periods.

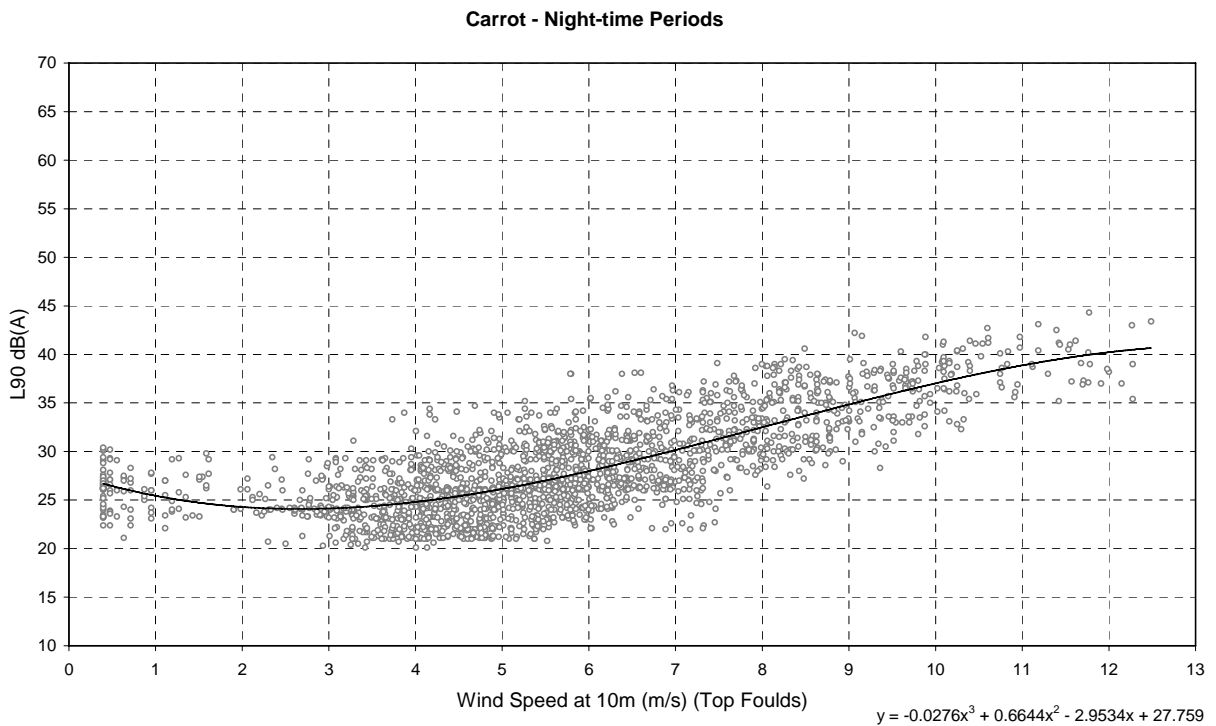


Figure A4.22 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 11 Carrot during night-time periods.

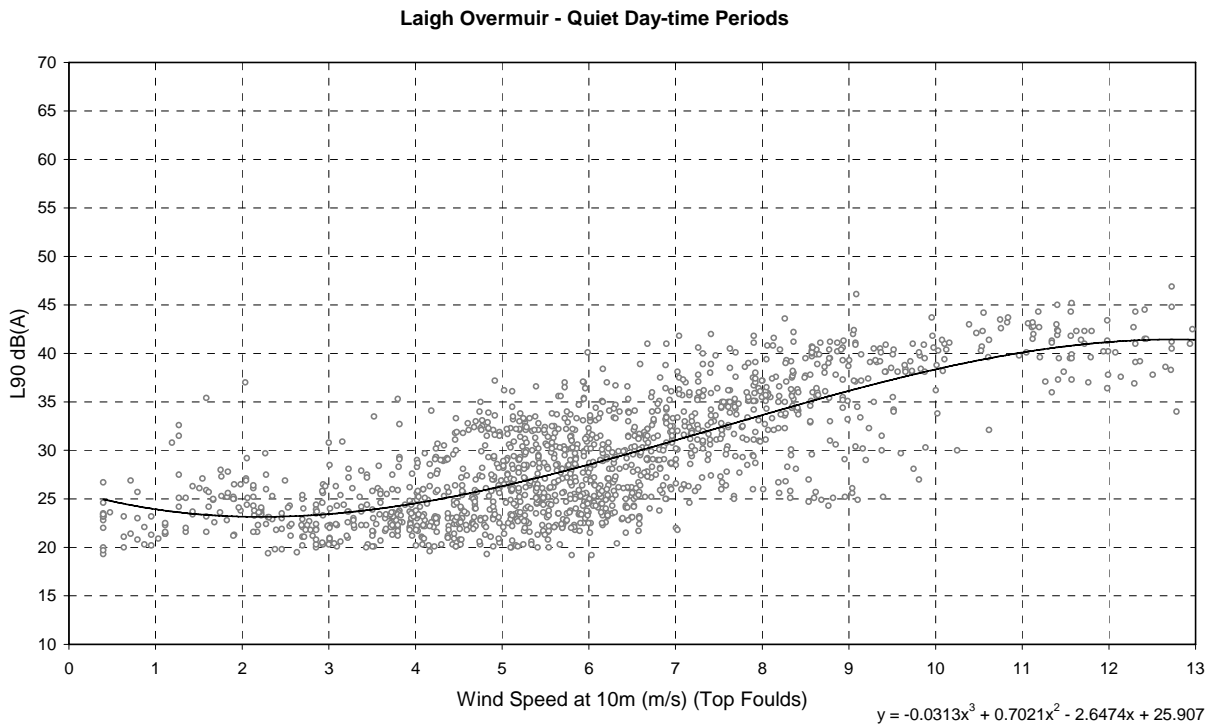


Figure A4.23 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 12 Laigh Overmuir during quiet day-time periods.

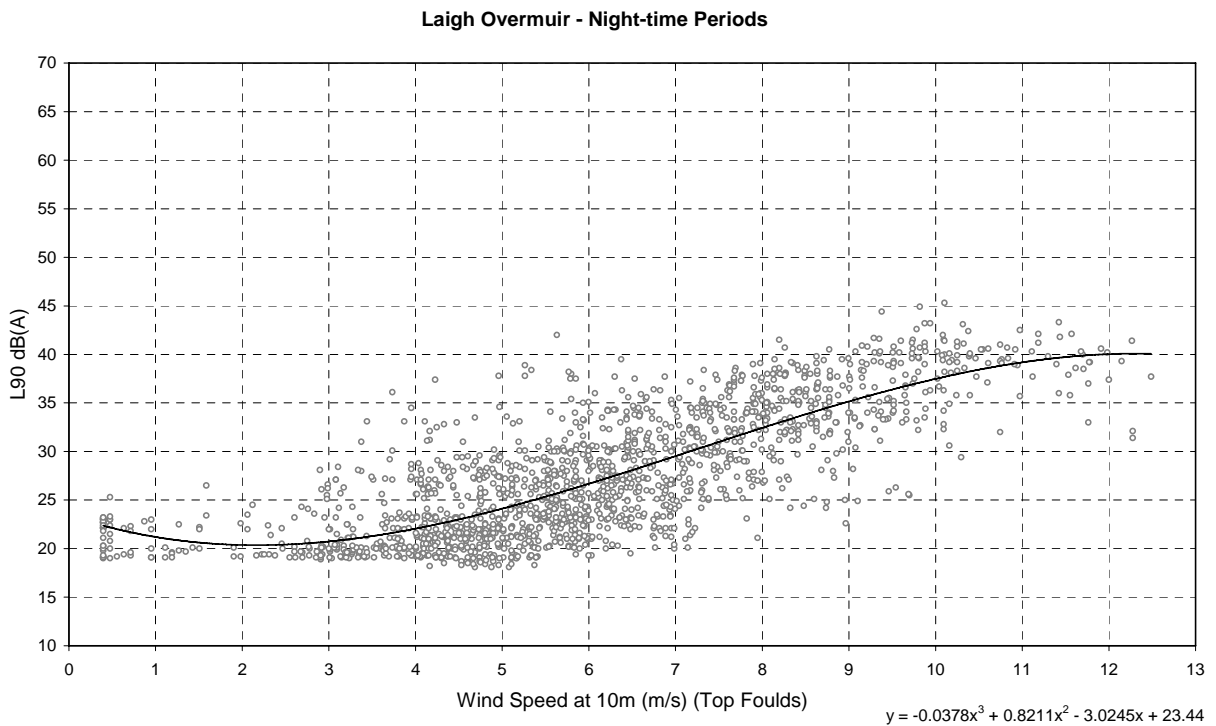


Figure A4.24 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 12 Laigh Overmuir during night-time periods.

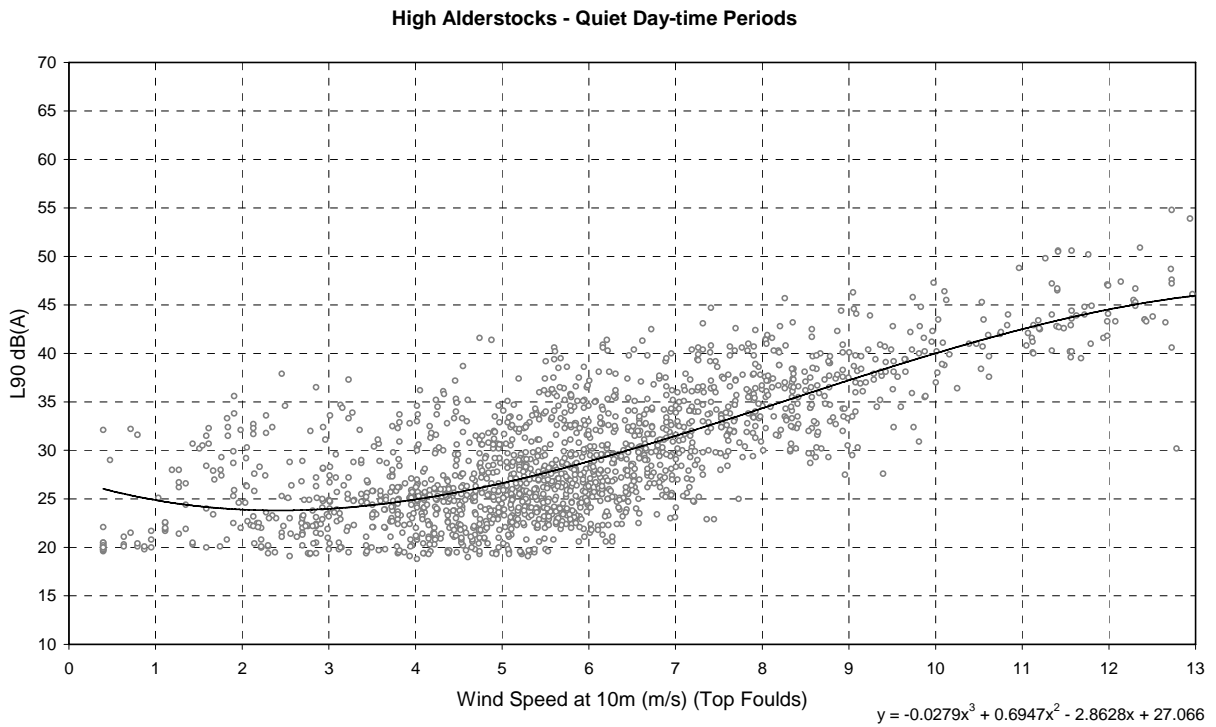


Figure A4.25 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 13 High Alderstocks during quiet day-time periods.

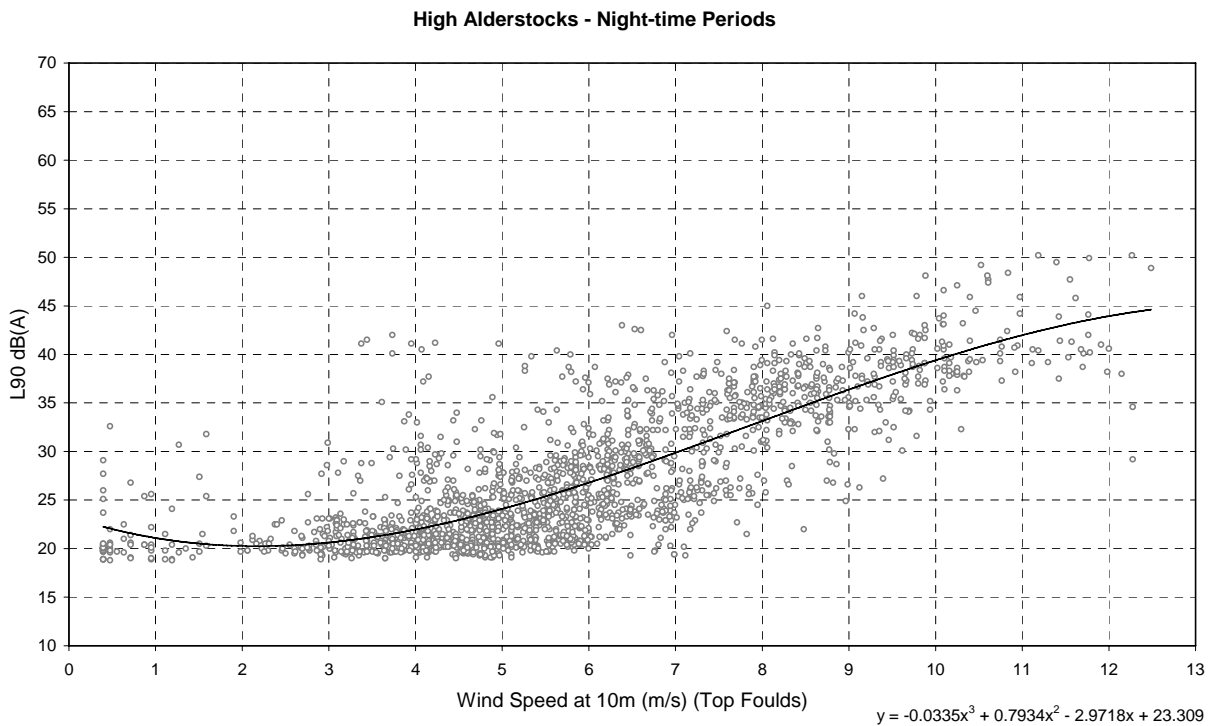


Figure A4.26 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 13 High Alderstocks during night-time periods.

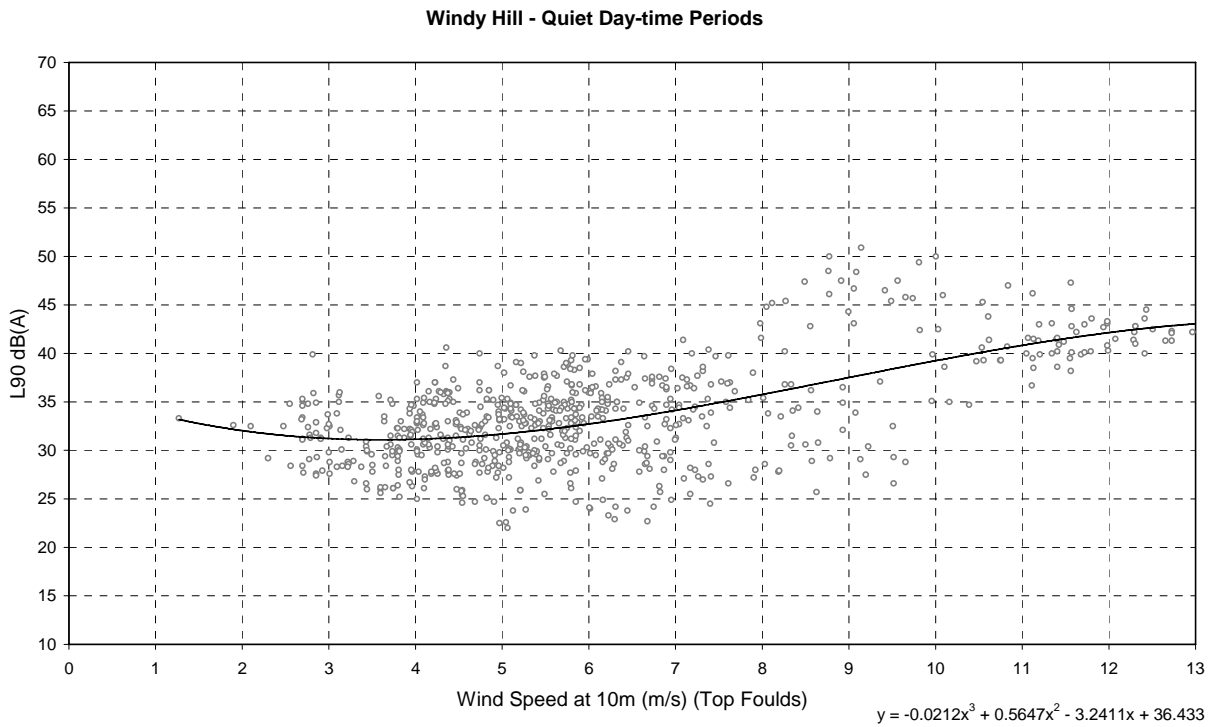


Figure A4.27 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 14 Windy Hill during quiet day-time periods.

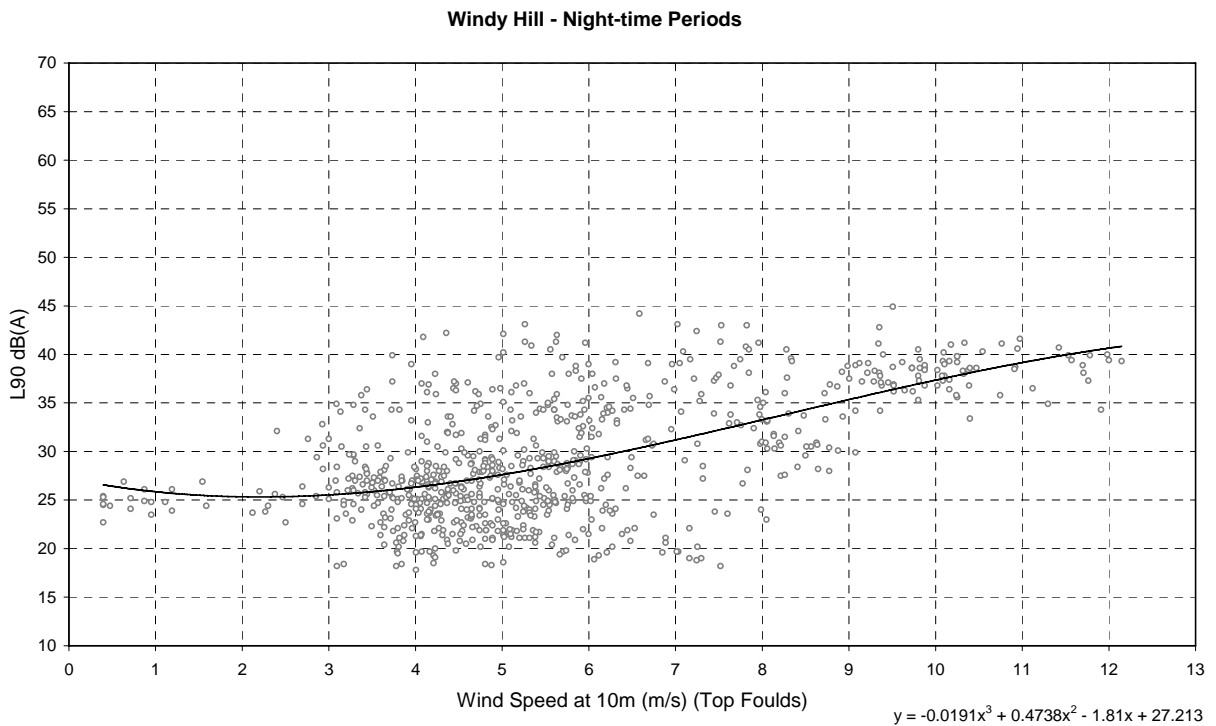


Figure A4.28 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 14 Windy Hill during night-time periods.

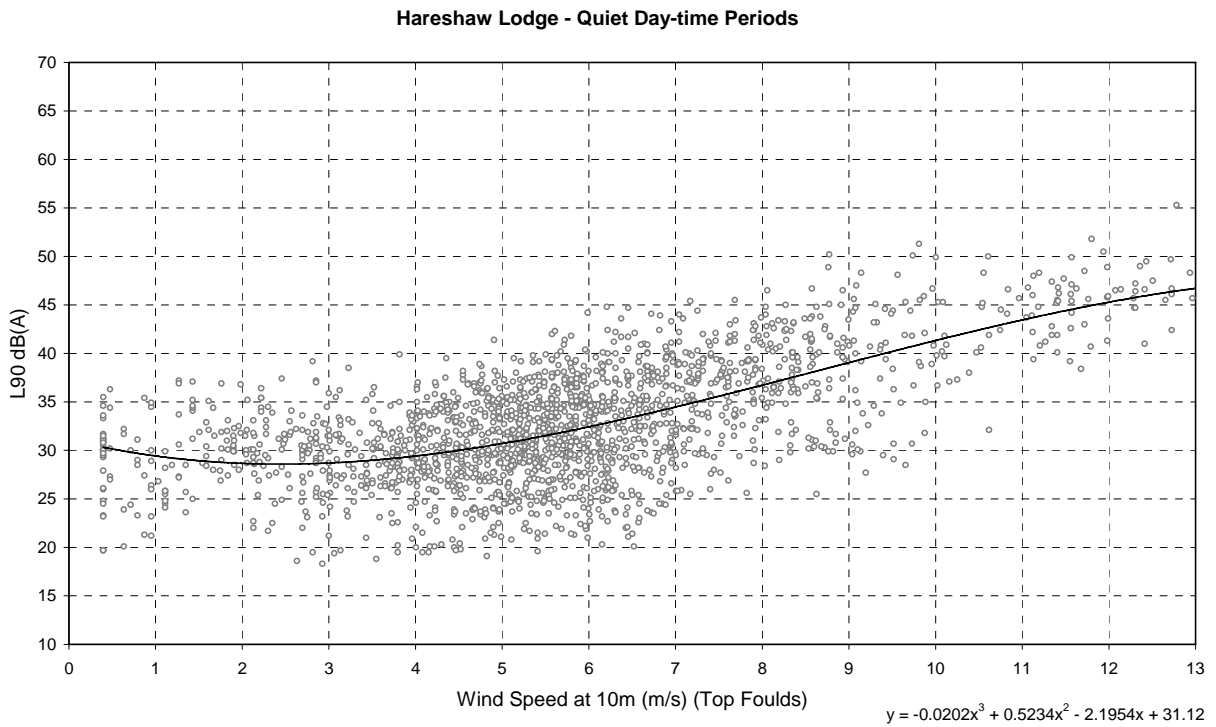


Figure A4.29 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 15 Hareshaw Lodge during quiet day-time periods.

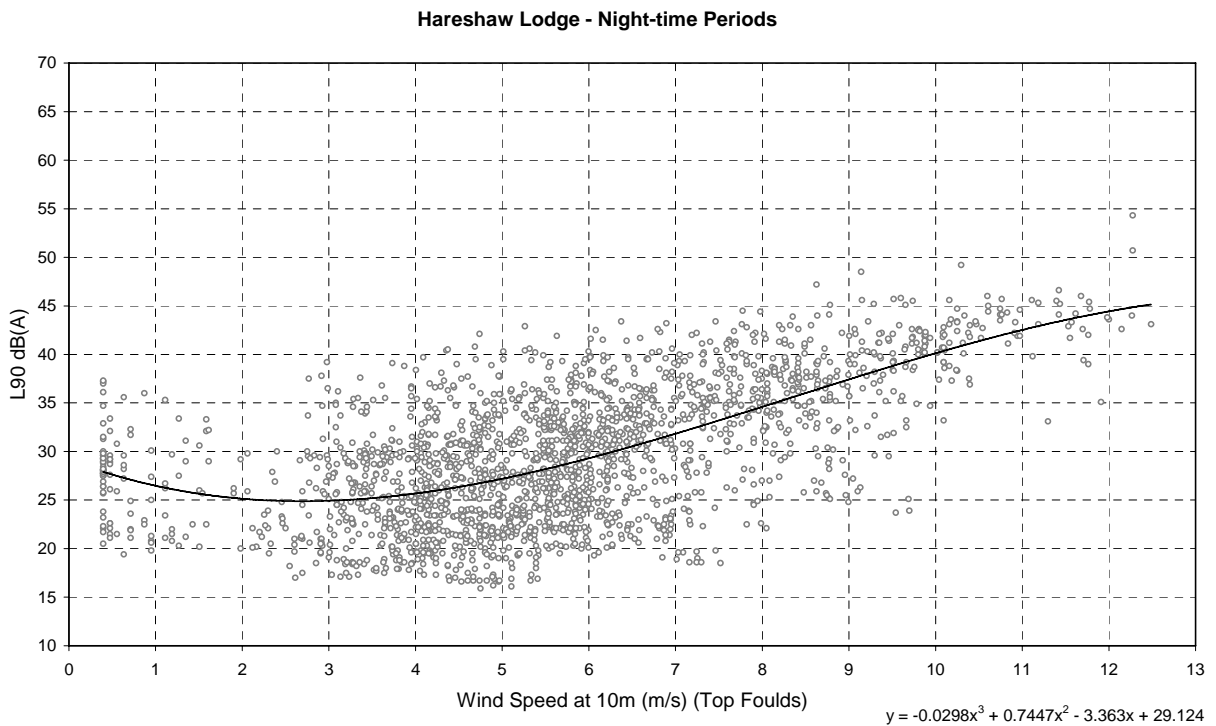


Figure A4.30 Chart of background noise levels against wind speeds (open grey circles) and the best fit curve (thin black line) to this data for 15 Hareshaw Lodge during night-time periods.

Approach

The Wind Farm site at Whitelee has a 40 m high met mast located on Topfoulds Hill at grid coordinates 253523E 648306N with instrumentation at various heights as follows:-

- 40 m Wind speed
- 30 m Wind direction
- 30 m Wind speed
- 20 m Wind Speed
- 20 m Wind direction

Wind speeds are needed at 10m height for correlation with measured noise data as specified in ETSU-R-97. ETSU-R-97 specifies that where measurements are not made using a 10m met mast, measurements at other heights may be used to provide 10m height wind speeds by calculation. The process described here was used to calculate 10m wind speeds from measured data from the mast.

Wind direction data were taken from the 30m height wind vane as that data is likely to better represent the wind direction that would be found at the proposed hub height than data from the 20 m height wind vane.

Methodology

ETSU-R-97 specifies that where measurements are not made using a 10 m met mast, measurements at other heights may be used to provide 10 m height wind speeds by calculation. Equation 1 is given in ETSU-R-97 for this purpose.

$$U_1 = U_2 \cdot \frac{\ln\left(\frac{H_2}{z}\right)}{\ln\left(\frac{H_1}{z}\right)} \tag{1}$$

Where:-

- H_1 The height of the measured wind speed
- H_2 The height of the wind speed to be calculated (10 m)
- U_1 The wind speed to be calculated
- U_2 The measured wind speed
- z The roughness length

Equation 1 is the same as that given in IEC61400-11⁴ for calculating 10 m wind speeds related to hub height wind speeds when providing source noise emission data for wind turbines. ETSU-R-97 suggests that the roughness length may be calculated from wind speed measurements at two heights. Equation 1 may therefore be rearranged to yield values of the roughness z :-

$$z = \left(\frac{H_2 \left[\frac{U_1}{U_2} \right]}{H_1} \right)^{\left[\frac{1}{\left[\frac{U_1}{U_2} \right] - 1} \right]} \tag{2}$$

Where:-

- H_1 The height of the upper wind speed measurement
- H_2 The height of the lower wind speed measurement
- U_1 The measured wind speed at the upper anemometer
- U_2 The measured wind speed at the lower anemometer
- z The roughness length (m)

Data from the met mast was available for the survey period from 13/02/2006 to 09/04/2006. These data were used to perform a calculation of the roughness length found between the highest two wind speed



measurements of 30 m and 40 m for every ten minute period. Equation 2 will only be valid where values of the 40 m wind speed are greater than the 30 m wind speed. Where this was not the case (i.e. wind speeds were the same at both heights or lower at greater height) the roughness length was assumed to be zero. The roughness lengths so calculated for every ten minute period were then used to calculate the hub height wind speed from that at 40 m using equation 1.

Equation 1 was then used to calculate a 10 m height wind speed from the hub height wind speed every ten minutes assuming the roughness length of 0.05 m. This is the reference roughness assumed in IEC 61400-11 when reporting turbine sound power levels.

Conclusions

By using this method, measured background noise levels were correlated with 10 m wind speeds calculated from wind speeds at hub height. The method used to calculate 10 m wind speeds from those close to hub height is the same as that used when deriving noise emission data for the turbines. Because the same method has been used, direct comparison of background noise levels and predicted turbine noise immission levels may be undertaken.