



Pepper Mill Barn
Old Salisbury Lane
Romsey
SO51 0GD

T: 01794 515999
F: 01794 515100
E: info@24acoustics.co.uk

**PROPOSED SOLAR FARM AT BROOK BARN FARM
LITTLEHAMPTON**

NOISE IMPACT ASSESSMENT

Technical Report: R5617-1 Rev 0

Date: 27th February 2015

For: Anesco Ltd
Easter Park
Benyon Road
Reading
RG7 2PQ

24 Acoustics Document Control Sheet

Project Title: Proposed Solar Farm at Brook Barn Farm, Littlehampton
Noise Impact Assessment

Report Ref: R5617-1 Rev 0

Date: 27th February 2015

	Name	Position	Signature	Date
Prepared by	David Coles BEng PhD MIOA	Consultant		
Approved by	Stephen Gosling BEng (Hons) MIOA	Principal Consultant		
For and on behalf of 24 Acoustics Ltd				

Document Status and Approval Schedule

Revision	Description	Prepared By	Approved By
0	Approved for Issue	David Coles	Stephen Gosling

DISCLAIMER

This report was completed by 24 Acoustics Ltd on the basis of a defined programme of work and terms and conditions agreed with the Client. The report has been prepared with all reasonable skill, care and diligence within the terms of the Contract with the Client and taking into account the project objectives, the agreed scope of works, prevailing site conditions and the degree of manpower and resources allocated to the project.

24 Acoustics Ltd accepts no responsibility whatsoever, following the issue of the report, for any matters arising outside the agreed scope of the works.

This report is issued in confidence to the Client and 24 Acoustics Ltd has no responsibility of whatsoever nature to third parties to whom this report or any part thereof is made known. Any such party relies upon the report at their own risk.

Unless specifically assigned or transferred within the terms of the agreement, 24 Acoustics Ltd retains all copyright and other intellectual property rights, on and over the report and its contents.

© 24 Acoustics Ltd 2015

EXECUTIVE SUMMARY

Anesco Ltd is applying for planning permission for the development of a solar farm at Brook Barn Farm in Littlehampton, West Sussex. 24 Acoustics Ltd has been instructed by Anesco Ltd to undertake an assessment of the likely noise impact of the operation of the solar farm to accompany the planning application.

The assessment has been undertaken following background noise surveys at nearby noise-sensitive receptors to the proposed solar farm and acoustic modelling of the noise emission from the solar farm to predict operational noise levels from power conversion equipment at the closest residential properties.

A comparison of the predicted noise levels has been made with the background noise levels in accordance with BS 4142:2014.

The assessment indicates that the noise arising from the proposed solar farm will be acceptable.

CONTENTS	Page
1.0 INTRODUCTION	5
2.0 SITE DESCRIPTION AND PROPOSED DEVELOPMENT	5
3.0 STANDARDS AND GUIDANCE	6
4.0 BACKGROUND NOISE SURVEY	7
5.0 CALCULATIONS AND ASSESSMENT	10
6.0 CONCLUSIONS	13
REFERENCES	14
FIGURES	15
APPENDIX A – ACOUSTIC TERMINOLOGY	18

1.0 INTRODUCTION

- 1.1 Anesco Ltd is applying for planning permission for the development of a solar farm at Brook Barn Farm in Littlehampton, West Sussex. 24 Acoustics Ltd has been instructed by Anesco Ltd to undertake an assessment of the noise arising from the operation of the solar farm to accompany the planning application.
- 1.2 The assessment has been undertaken following background noise surveys at receptors close to the proposed solar farm and acoustic modelling of the noise emission from the solar farm to predict operational noise levels at nearby residential properties.
- 1.3 All sound pressure levels quoted in this report are in dB relative to 20 μ Pa. All sound power levels are quoted in dB relative to 10e-12 Watts. A glossary of the acoustic terminology used in this report is provided in Appendix A.

2.0 SITE DESCRIPTION AND PROPOSED DEVELOPMENT

- 2.1 Brook Barn Farm is located in Littlehampton, approximately 10 km west of Worthing. The surrounding area comprises rural farmland with residential properties to the north-east, south-east and south-west of the site. Two plant nurseries are also situated to the east of the site. The Chichester to Worthing railway line runs along the southern boundary of the development site.
- 2.2 The proposed development comprises solar panels and ancillary equipment with a maximum generating capacity of 3.5 MW on a site approximately 13 acres in size. Although the solar panels do not produce any noise, the associated power inverters and transformers create noise and are the subject of this noise assessment.
- 2.3 It should be noted that the noise emission of the plant is variable, depending upon the power output of the solar panels. This noise impact assessment has been based upon the noise output of the plant at 100% duty.
- 2.4 The nearest residential properties to the site and associated plant are detailed as follows:

No	Name/ Address	OSGB36 Grid Reference	Distance from Plant
1	Brook Barn Farm	TQ 01624 03980	248 m
2	Brook Barn House	TQ 01589 03998	270 m
3	Brook Barn Cottages	TQ 01585 03955	295 m
4	Glen Villa	TQ 02140 04186	256 m
5	Torri House	TQ 02254 04174	361 m
6	33 Old Mead Road	TQ 02213 04188	326 m
7	24 Linnet Close	TQ 02063 03933	213 m

Table 1: Receptor Locations (Distances are to Closest Item of Power Conversion Plant)

2.5 Figure 1 provides an aerial image of the site and receptor locations.

3.0 STANDARDS AND GUIDANCE

National Planning Policy

- 3.1 Guidance on planning and noise in England is given in the National Planning Policy Framework (NPPF) [Reference 1]. This document is intended to replace specific guidance contained within planning policy guidance and statement documents which were in force prior to publication. This document therefore supersedes PPG 24 [Reference 2] which previously provided guidance on noise relating to planning and new development and PPS 22 [Reference 3] which provided guidance on renewable energy.
- 3.2 For this site, it is considered that the appropriate standard for use in assessing the noise impact is British Standard 4142:2014 [Reference 4].

British Standard 4142

- 3.3 BS 4142:2014 has recently been published and replaces BS 4142:1997. The standard provides a method for rating the effects of industrial and commercial sound on residential areas.
- 3.4 The standard advocates a comparison between the representative measured L_{A90} background noise (sound) level and L_{Aeq} (sound) noise level from the source being considered. For rating purposes if the noise source is tonal, intermittent or otherwise distinctive in character, a rating correction should be applied.
- 3.5 The standard states that a difference between the rating level and the background level of around +10 dBA is an indication of a significant adverse impact, depending on the context and a difference of around +5 dBA is likely to be an indication of an adverse impact, also depending on the context. Where the rating level does not exceed the background noise (sound) level, this is an indication of the specific sound source having a low impact (depending upon the context).

4.0 BACKGROUND NOISE SURVEY

Methodology

- 4.1 A background noise survey was undertaken between 18th and 24th February 2015 at the following key locations (as shown in Figure 1):

Location 1 – Brook Barn House, at OS coordinates TQ 01586 04000;

Location 2 – Adjacent to Glenvilla Nursery, at OS coordinates TQ 02067 04170.

- 4.2 The following instrumentation was used during the surveys:

- Rion NL31 precision grade Class 1 accuracy sound level meter;
- Rion NL32 precision grade Class 1 accuracy sound level meter;
- Brüel and Kjær Type 4231 precision acoustic calibrator.

- 4.3 The instrumentation was configured to measure continuously and store overall A-weighted statistical parameters including L_{Aeq} , L_{Amax} and L_{A90} (all measured on fast response) in 5 minute intervals. Measurements were made in accordance with BS 7445: 1991 'Description and measurement of environmental noise Part 2 - Acquisition of data pertinent to land use' [Reference 5].
- 4.4 The sound level meters were equipped with environmental microphones and windshields. The microphones were installed approximately 1.5 metres above local ground level under free-field conditions. The instrumentation was powered by external batteries and stored in weatherproof cases. The calibration of the instrumentation was checked before and on completion of the measurements and no significant drift was found. The calibration of all 24 Acoustics' equipment is traceable to National Standards.
- 4.5 Weather conditions at the start and end of the survey period were dry with mild winds. Analysis of local weather stations indicates that rainfall was experienced during the daytime on 19th, 20th, 22nd and 23rd February 2015. Wind may have affected measured background noise levels on 19th, 22nd, 23rd and 24th February 2015. Periods affected by adverse weather conditions have been removed from the analysis.

Results

- 4.6 The measured noise levels are shown graphically in Figures 2 and 3 and summarised below in Tables 3 and 4. Results have been presented between 05:00 and 21:00 as this represents the time period during which the solar farm could produce power on the longest day of the year.

Period	Sound Pressure Level (dB)			
	Night-time 05:00 - 07:00		Daytime 07:00 - 21:00	
	Average LA90,5min	Typical LA90,5min	Average LA90,1hr	Typical LA90,1hr
Wednesday 18/2/2015	--	--	29.6*	28.5*
Thursday 19/2/2015	30.2	27.3	37.7	35.6
Friday 20/2/2015	37.4	34.9	39.6	37.5
Saturday 21/2/2015	33.4	29.6	36.6	34.6
Sunday 22/2/2015	27.6	22.6	38.8	34.8
Monday 23/2/2015	30.7	27.9	37.0	34.7
Tuesday 24/2/2015	35.6	32.4	38.4*	36.5*
Overall	31	28	37	35

Table 3: Results at Location 1, Brook Barn Farm (*denotes incomplete measurement period)

Period	Sound Pressure Level (dB)			
	Night-time 05:00 - 07:00		Daytime 07:00 - 21:00	
	Average LA90,5min	Typical LA90,5min	Average LA90,1hr	Typical LA90,1hr
Wednesday 18/2/2015	--	--	42.3	40.9
Thursday 19/2/2015	41.4	38.6	47.1	46.2
Friday 20/2/2015	38.9	36.6	38.5	37.0
Saturday 21/2/2015	34.6	32.2	37.1	35.2
Sunday 22/2/2015	33.1	29.7	47.2	44.7
Monday 23/2/2015	39.1	36.4	45.5	43.6
Tuesday 24/2/2015	41.3	38.2	44.7	42.8
Overall	38	35	37	35

Table 4: Results at Location 2, Glenvilla Nursery (*denotes incomplete measurement period)

- 4.7 BS 4142 requires a representative background noise level to be used for the assessment period under consideration. The standard does not provide a specific means of determining a representative background sound level therefore 24 Acoustics considers the use of the typical (average minus one standard deviation) background noise level as a representative value.
- 4.8 Noise levels of 28 dB L_{A90} for Brook Barn Farm and 35 dB L_{A90} for Glenvilla Nursery have been used in this assessment (representing the quietest period during which the solar farm may be operating). These values have been applied also to surrounding properties as appropriate.

5.0 CALCULATIONS AND ASSESSMENT

- 5.1 The dominant sources of noise from the solar farm are the power inverters and transformers. There are two transformers proposed for the scheme. The proposed development comprises 100 small scale inverters rather than relatively few large inverters (which would require fan cooling). This significantly reduces the noise output from the solar farm.
- 5.2 The sound power level of the transformers is stated in a manufacturer's datasheet as 67 dBA. The manufacturer's datasheet for the inverters states a noise level of 50 dBA at 1 m, which corresponds to a sound power level of 64 dBA (calculated using the conformal surface method, considered worst-case).
- 5.3 Given the distances involved in the propagation calculations, both the transformers and inverters have been modelled as point sources, at heights of 1.8 m and 1.5 m respectively.
- 5.4 The predicted noise levels have been calculated using IMMI 2011-1 noise mapping software. The propagation methodology of ISO 9613 [Reference 6] has been used which takes into account the effects of geometric divergence, acoustic screening/reflection and atmospheric and ground absorption.
- 5.5 The calculations have assumed an ambient temperature of 10°C and relative humidity of 70%. Downwind propagation conditions have been assumed throughout. A ground absorption factor of $G=0.75$ (where 0 is hard ground and 1 is soft ground) has been used. Noise predictions have been made at a height of 1.5 m.

- 5.6 The solar panel arrays have been incorporated into the model, with the reflection coefficients of glass being used for the panels (as shown below in Table 5).

Reflection Coefficient per Octave Band (Hz)							
63	125	250	500	1k	2k	4k	8k
0.82	0.82	0.94	0.96	0.97	0.97	0.97	0.97

Table 5: Reflection Coefficients Used For the Solar Panel Arrays

- 5.7 The results of the acoustic model are shown graphically in Figure 4 as a noise contour map and are described below in Table 6.

Receptor Name	Predicted Sound Pressure Level (dB L _{Aeq})
Brook Barn Farm	19.5
Brook Barn House	19.3
Brook Barn Cottages	18.2
Glen Villa	20.9
Torri House	18.2
33 Old Mead Road	19.0
24 Linnet Close	18.5

Table 6: Results of Noise Propagation Calculations

Assessment

- 5.8 Solar farms are typically capable of producing power between the hours of 05:00 and 21:00. It should be noted that the predicted noise levels from the plant units are based on 100% duty, whilst the typical background noise levels reflect the quietest times of the day when the solar farm will create less noise. As a result, this is considered a worst-case assessment.
- 5.9 The predicted noise levels from the solar farm have been assessed in accordance with BS 4142 with the results of the assessment shown below in Table 7.

	Background Noise Level (dB LA90)	Noise Rating Level (dB LAeq)	Rating over Background (dB)
Brook Barn Farm	28	19	-9
Brook Barn House	28	19	-9
Brook Barn Cottages	28	18	-10
Glen Villa	35	21	-14
Torri House	35	18	-17
33 Old Mead Road	35	19	-16
24 Linnet Close	35	18	-17

Table 7: BS 4142 Noise Impact Assessment

- 5.10 Table 7 shows that the BS 4142 rating levels for noise from the solar farm at all receptors are significantly below the measured background noise level. It is important to note that this is a worst-case assessment and based on a comparison of predicted noise levels at maximum duty against background noise levels at the quietest times of the day. In reality, these are unlikely to coincide.
- 5.11 Given the outcome of this assessment, it is considered that the noise arising from the solar farm should not cause significant noise impact to the nearby residents.

Tonality

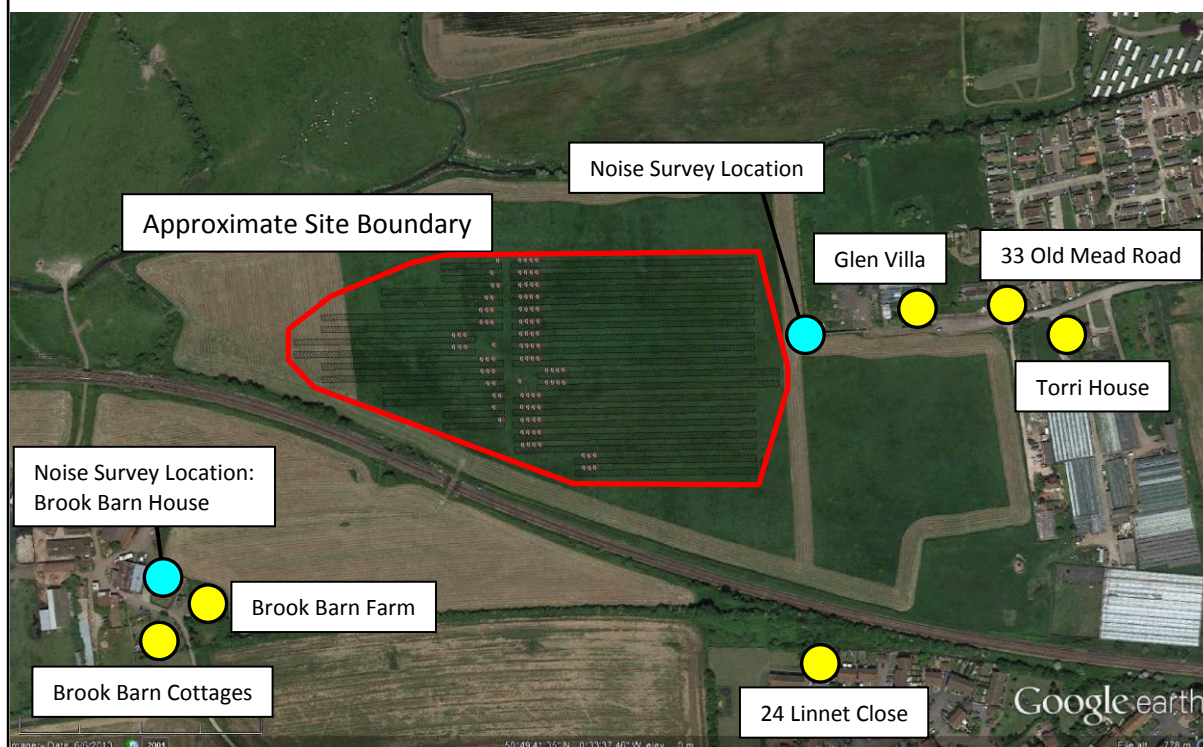
- 5.12 Octave band data have not been provided by the manufacturer and it is therefore not possible to undertake a full tonal assessment. However, even if a tone at 100 Hz (the most likely frequency at which a tone would be present for this type of plant) was 10 dB above the overall A-weighted level (representing a very strong tone), the level of the tone would be around the threshold of audibility and well below background levels at that frequency. It is therefore considered that tonality should not be an issue at this site.

6.0 CONCLUSIONS

- 6.1 Anesco Ltd is applying for planning permission for the development of a solar farm at Brook Barn Farm in Littlehampton, West Sussex. 24 Acoustics Ltd has been instructed by Anesco Ltd to undertake an assessment of the likely noise impact of the operation of the solar farm to accompany the planning application.
- 6.2 The assessment has been undertaken following background noise surveys at nearby noise-sensitive receptors to the proposed solar farm and acoustic modelling of the noise emission from the solar farm to predict operational noise levels from power conversion equipment at the closest residential properties.
- 6.3 A comparison of the predicted noise levels has been made with the background noise levels in accordance with BS 4142:2014.
- 6.4 The assessment indicates that the noise arising from the proposed solar farm will be acceptable.

REFERENCES

1. National Planning Policy Framework, Department for Communities and Local Government, 2012.
2. Planning Policy Guidance 24, Planning and Noise, Department of the Environment, 1994.
3. Planning Policy Statement 22, Renewable Power, Office of the Deputy Prime Minister, 2004.
4. British Standards Institution. British Standard 4142: 'Method for Rating Industrial Noise and Commercial Sound', 2014.
5. British Standards Institution. British Standard 7445: 'Description and measurement of environmental noise Part 2 - Acquisition of data pertinent to land use', 1991.
6. International Standards Organisation. ISO 9613, Acoustics - Attenuation of Sound During Propagation Outdoors, 1993.



Project:
Brook Barn Farm Solar Farm

Description:
Proposed Solar Farm, Receptor and Background Noise Survey Locations

DWG No: Figure 1

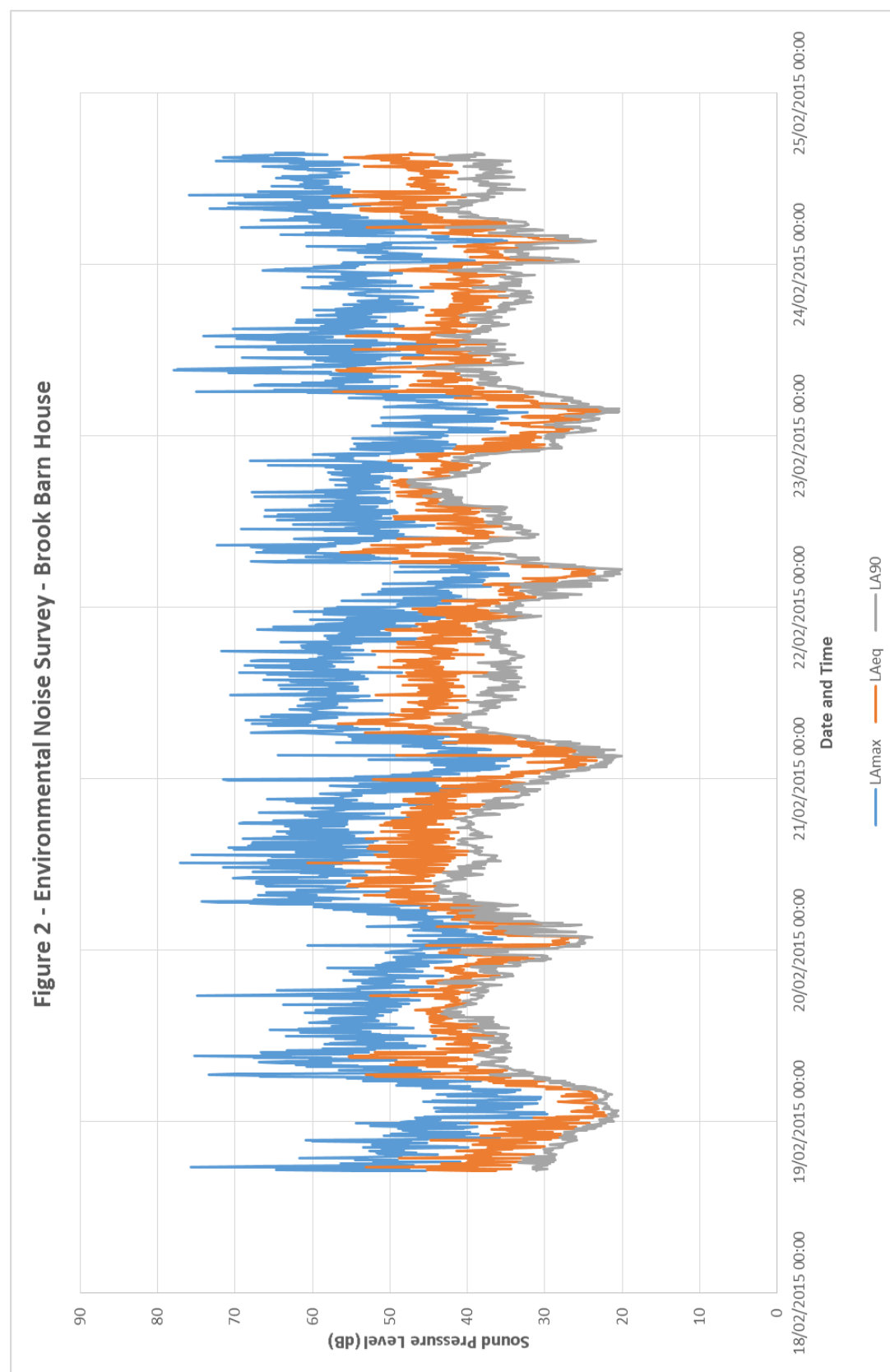
Scale: N.T.S.

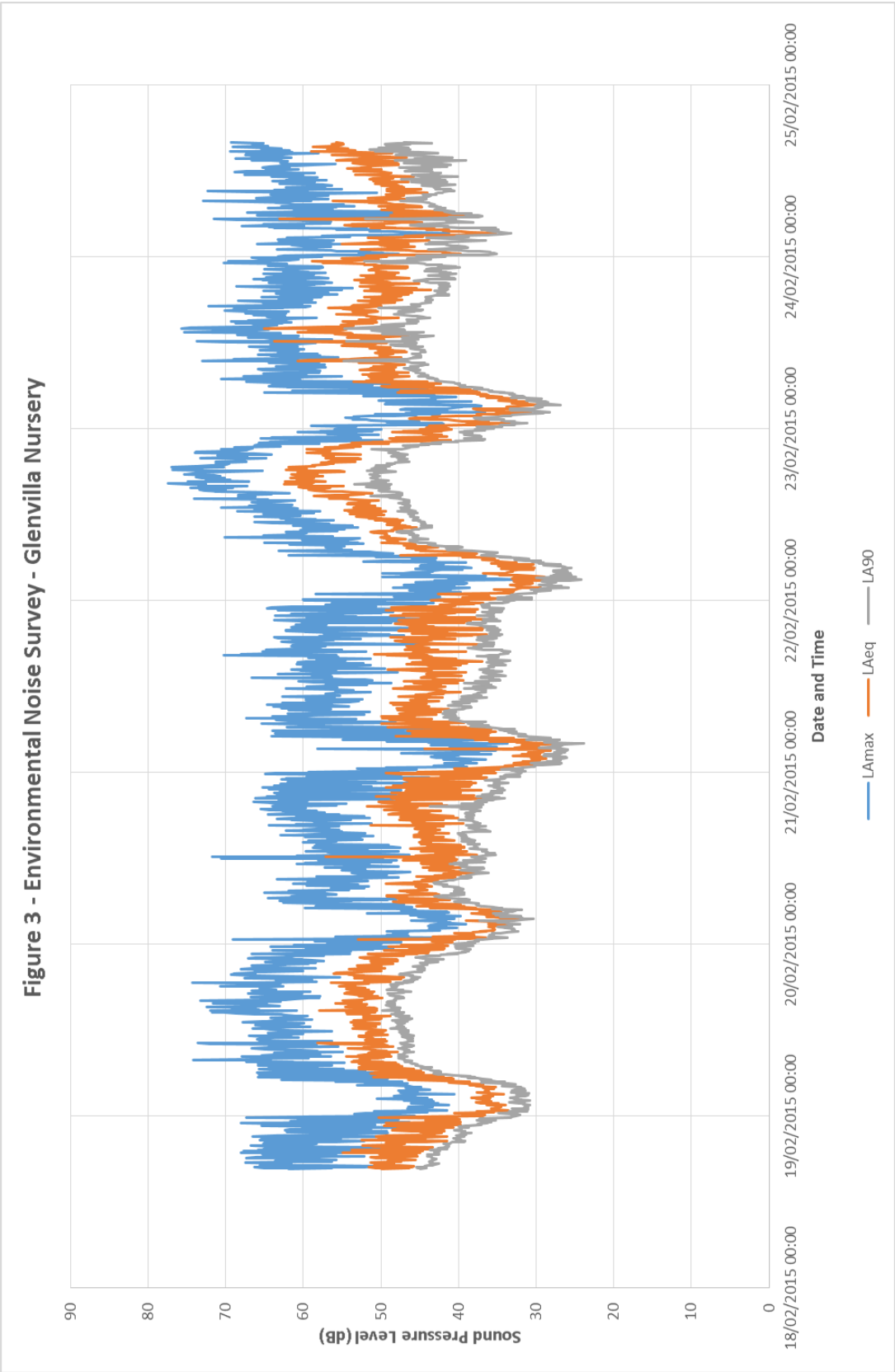
Rev: A

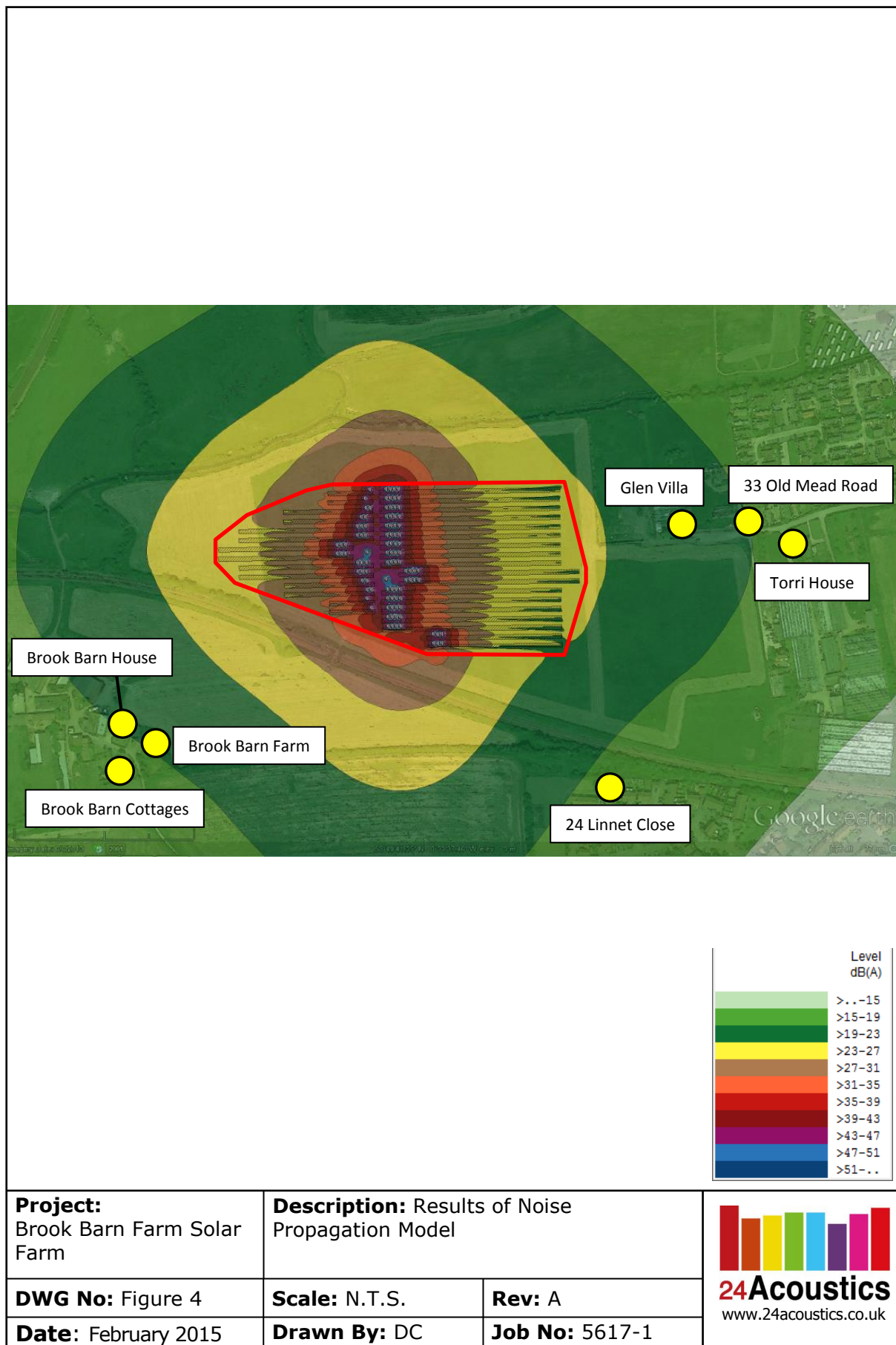
Date: February 2015

Drawn By: DC

Job No: 5617-1







APPENDIX A – ACOUSTIC TERMINOLOGY

Noise is defined as unwanted sound. The range of audible sound is from 0 to 140 dB. The frequency response of the ear is usually taken to be around 18 Hz (number of oscillations per second) to 18000 Hz. The ear does not respond equally to different frequencies at the same level.

It is more sensitive in the mid-frequency range than the lower and higher frequencies and because of this, the low and high frequency components of a sound are reduced in importance by applying a weighting (filtering) circuit to the noise measuring instrument. The weighting which is most widely used and which correlates best with subjective response to noise is the dBA weighting. This is an internationally accepted standard for noise measurements.

For variable sources, such as traffic, a difference of 3 dBA is just distinguishable. In addition, a doubling of traffic flow will increase the overall noise by 3 dBA. The 'loudness' of a noise is a purely subjective parameter, but it is generally accepted that an increase/ decrease of 10 dBA corresponds to a doubling/ halving in perceived loudness.

External noise levels are rarely steady, but rise and fall according to activities within an area. In attempt to produce a figure that relates this variable noise level to subjective response, a number of noise indices have been developed. These include:

i) The L_{Amax} noise level

This is the maximum noise level recorded over the measurement period.

ii) The L_{Aeq} noise level

This is "equivalent continuous A-weighted sound pressure level, in decibels" and is defined in British Standard BS 7445 [1] as the "value of the A-weighted sound pressure level of a continuous, steady sound that, within a specified time interval, T, has the same mean square sound pressure as a sound under consideration whose level varies with time".

It is a unit commonly used to describe construction noise and noise from industrial premises and is the most suitable unit for the description of other forms of environmental noise. In more straightforward terms, it is a measure of energy within the varying noise.

iii) The L_{A10} noise level

This is the noise level that is exceeded for 10% of the measurement period and gives an indication of the noisier levels. It is a unit that has been used over many years for the measurement and assessment of road traffic noise.

iv) The L_{A90} noise level

This is the noise level that is exceeded for 90% of the measurement period and gives an indication of the noise level during the quieter periods. It is often referred to as the background noise level and is used in the assessment of disturbance from industrial noise.