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TECHNICAL REPORT

NEW POULTRY BREEDING SHEDS

BEDINGFIELD HALL FARMS

Noise Impact Assessment

Adrian James Acoustics Document Control Sheet

Report prepared for:	BHF Poultry Ltd Bedingfield Hall Bedingfield Eye Suffolk IP23 7LJ
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QA Control

Rev	Date	Author	Checked by	Approved by
-	08 February 2021	Gary Percival MIOA	Andy Thompson MIOA	Andy Thompson MIOA

Revision History

Rev	Details

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1 INTRODUCTION

1.1 Background

We have been appointed by BHF Poultry Ltd to assess the potential impact of noise from mechanical plant equipment which has been installed to serve three new poultry breeding sheds on land to the south of Hall Road, Bedingfield, Eye IP23 7LJ.

The development was granted planning permission by Babergh Mid Suffolk Council (BMSC) in August 2019 (reference DC/19/04108) subject to conditions. Condition 8 relates to noise from fixed plant and from construction of the development, stating:

> *"Before the first operation of any plant or machinery within the site a full acoustic assessment of the plant and machinery to be used in associated with the development shall be carried out by a competent person in accordance with the current version of BS4142 and the findings and recommendations of the assessment shall be submitted to and approved in writing by the local planning authority. The assessment shall identify the noise intrusive works necessary for the construction of the development. The recommendations of the assessment shall be implemented in full."*

The sheds have already been constructed with works on site nearing completion, and we understand that no complaints regarding construction noise have been received.

This report therefore documents an assessment of mechanical plant noise only, with the main aim of satisfying the requirements of and ultimately discharging Condition 8.

1.2 Statement of technical competency

This report is prepared by Gary Percival. I am an Associate with 12 years' experience in acoustics consultancy and am a full member of the UK Institute of Acoustics (MIOA).

My educational qualifications include a first-class BSc honours degree in audio and music technology from Anglia Ruskin University (2009), the Institute of Acoustics (IOA) Diploma in Acoustics & Noise Control (2012) and most recently a master's degree in Architectural and Environmental Acoustics from London South Bank University (2019).

I have carried out hundreds of noise impact assessments over my consultancy career, and thus have the technical competency to carry out this assessment appropriately.

1.3 Structure of this report

The structure of this report is as follows:

- Section 2 sets out the relevant assessment methodology;
- Section 3 describes the development site and development;
- Section 4 sets out the methodology and findings of our sound measurements;
- Section 5 presents the results of the BS 4142 assessment; and
- Section 6 sets out our conclusions.
- An explanation of technical terms used in this report is given in Appendix A.
- Technical data for the mechanical plant are provided in Appendix B.
- Appendix C sets out the sound measurement systems and calibration details.

1.4 Source information

The report is based on the following design information provided by BHF Poultry Ltd.

Drawn By	Drawing No	Revision	Title
Brown & Co	09-003-05	A	Site Location Plan [Proposal]
C. E. Davidson Ltd	SCOTT-LAY1	2	Site Layout

Table 1 – Details of drawings and design information used to inform assessment

2 ASSESSMENT METHODOLOGY

2.1 BS 4142:2014+A1:2019

2.1.1 Introduction

British Standard 4142:2014+A1:2019 *'Methods for rating and assessing industrial and commercial sound'* (BS 4142) describes appropriate technical methodology for the rating and assessment of sound of an industrial and/or commercial nature.

Sound of an industrial and/or commercial nature includes industrial and manufacturing processes, fixed mechanical and electrical plant installations, the unloading of goods and materials at industrial and/or commercial premises and sound from mobile plant that is an inherent part of the overall sound from industrial and/or commercial premises.

BS 4142 is applicable for the purposes of:

- Investigating complaints;
- Assessing sound from proposed, new, modified, or additional source(s) of sound from an industrial and/or commercial nature; and
- Assessing sound at proposed new dwellings or premises used for residential purposes.

BS 4142 is not intended to be applied to the rating and/or assessment of sound from recreational activities (including motorsport), music and other forms of entertainment, shooting grounds, construction/demolition, domestic animals, people, public address systems and any other sources falling within the scope of other standards/guidance.

2.1.2 Summary of BS 4142 assessment methodology

The BS 4142 assessment methodology can be summarised as follows:

1. Determine the background sound level (dB $L_{A90,T}$) at the nearest noise sensitive receptor(s) of interest.
2. Determine the specific sound level of the source under assessment (dB $L_{Aeq,T}$) (T = 1 hour for day or 15 minutes at night) at the receptor location(s).
3. Apply a rating level acoustic feature correction if the sound source has tonal, impulsive, intermittent or other characteristics which attract attention.
4. Compare the rating level (dB $L_{Ar,Tr}$) with the background sound level; typically, the greater this difference, the greater the magnitude of impact.

Differences of around +10dB are likely to be an indication of significant adverse impact, depending upon the context; a difference of +5dB is likely to be an indication of adverse impact, depending upon the context. Where the rating level (dB $L_{Ar,Tr}$) does not exceed the background sound level ($L_{A90,T}$) at the nearest receptor of interest, the indication is that the specific sound source will have a low impact, depending upon the context.

Note: Adverse impacts include but are not limited to sleep disturbance. Not all adverse impacts will lead to complaints and not all complaints are proof of an adverse impact.

2.1.3 Acoustic features

Certain acoustic features (which include tonality impulsivity and/or intermittence) can also increase the significance of impact. Where such features are present a *"character correction"* should be added to the specific sound level to obtain the rating level.

The recommended BS 4142 character corrections are presented in Table 2.

Characteristic	Perceptibility		
	Just Perceptible	**Clearly Perceptible**	**Highly Perceptible**
Tonality	+2 dB	+4 dB	+6 dB
Impulsivity	+3 dB	+6 dB	+9 dB
Intermittency	0	+3 dB	+3 dB
Other	0	+3 dB	+3 dB

Table 2 – Summary of BS 4142:2014 character corrections

BS4142:2014 describes suitable subjective methods for assessing character features, plus additional objective (one-third octave and reference) methods for tonality.

2.1.4 Uncertainty

The BS 4142 methodology also requires that the level of uncertainty in the technical data and/or calculations is reported. Where uncertainty could affect the conclusion, reasonable, practicable steps should be taken to reduce uncertainty. If appropriate, the level and potential effects of any identified uncertainty should also be reported.

2.2 WHO Night Noise *Guidelines*

The Night Noise Guidelines (NNGL) for Europe were published by the WHO in 2007, to complement the Guidelines for Community Noise (1999) and reflect the advances in research on the effects of night-time noise exposure. The NNGL found that below 30dB(A) $L_{night\ outside}$ there are no observed effects on sleep and that there is no evidence that the biological effects observed at levels below 40dB(A) $L_{night\ outside}$ are harmful to health. At levels above 55dB(A) $L_{night\ outside}$ adverse health effects occur frequently and there is limited evidence that the cardio-vascular system is coming under stress.

3 DESCRIPTION OF SITE AND DEVELOPMENT

3.1 Description of site

The permitted development is located on land to the south of Hall Road, approximately 1km to the south-east of the village of Bedingfield.

The surrounding area is mostly agricultural in nature with several farms operating in the vicinity. The development site itself is surrounded by arable fields.

Approximately 400m to the south-east of the three poultry sheds are a further two poultry sheds which were recently constructed (BMSC reference DC/18/01310) and which are also used for the breeding of poultry. These sheds are currently operational.

The site is in a rural area and there are relatively few residential or other noise-sensitive properties nearby. The nearest noise-sensitive receptors are as follows:

1. 2 detached properties 500m to the north-west
2. A large, detached residence 400m to the north-east (Flemings Hall)
3. 3 terraced cottages 550m to the east
4. Poultry farm manager's residence 490m to the south-east
5. Detached property on Eye Road 630m to the south
6. 2 detached properties 670m to the south-west

There are other residential properties in the area, but these are at greater distance from the site and/or are shielded by intervening buildings. If the noise impact at these worst-case receptors is acceptable, this is also likely to be the case at other receptors.

The site and noise-sensitive receptors described above are shown in Figure 1.

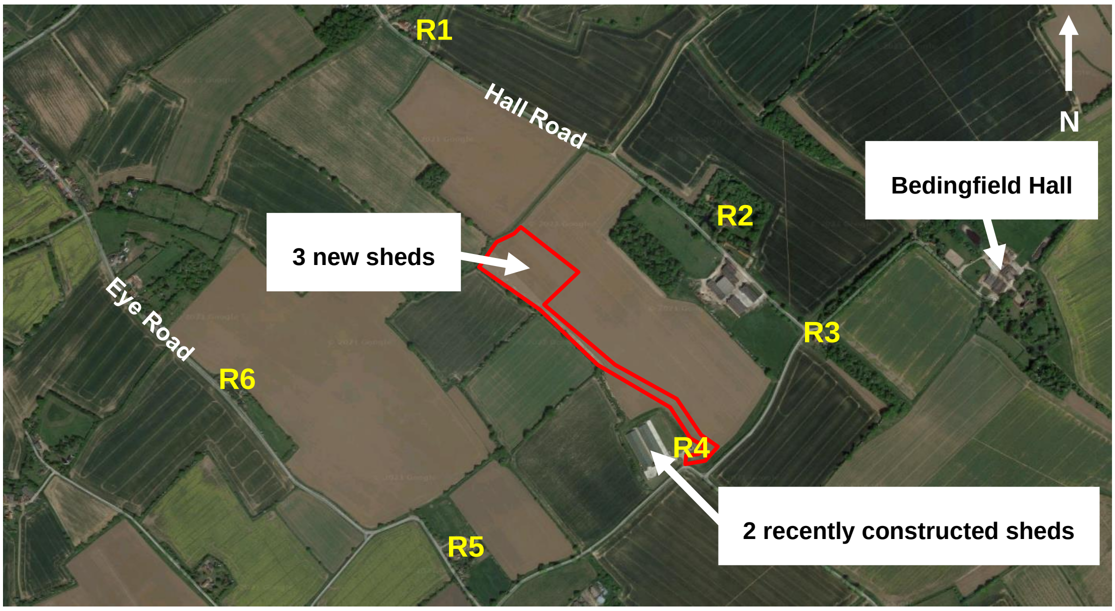


Figure 1 – Annotated aerial photograph/plan of site and surroundings © Google 2020

3.2 Description of development

The new poultry sheds will be used for rearing of great grandparent breeding birds which are housed in lower stocking numbers than most typical poultry breeder farms. The site will not be stocked to full capacity due to the breeding quality of the birds and only two of the three sheds would ever be in use at any one time.

Each of the three sheds will be served by two main types of noise-generating plant:

- 10 exhaust air chimney fans spaced evenly along the roof pitch
- 1 large (1380x1380mm) cooling fan on the south-east gable end

The location of these fans is indicated in Figure 2.

Technical details for the plant (including sound power and sound pressure levels) were provided by the supplier (Big Dutchman). Data sheets are presented in Appendix B.

In comparison to many other typical poultry sites, the site has a much lower stocking density and the associated movements onsite will be minimal in comparison. On many large commercial broiler sites the machinery and associated plant can produce higher levels of noise due to the volume and so in this sense the site can be considered much quieter than many typical poultry farms.

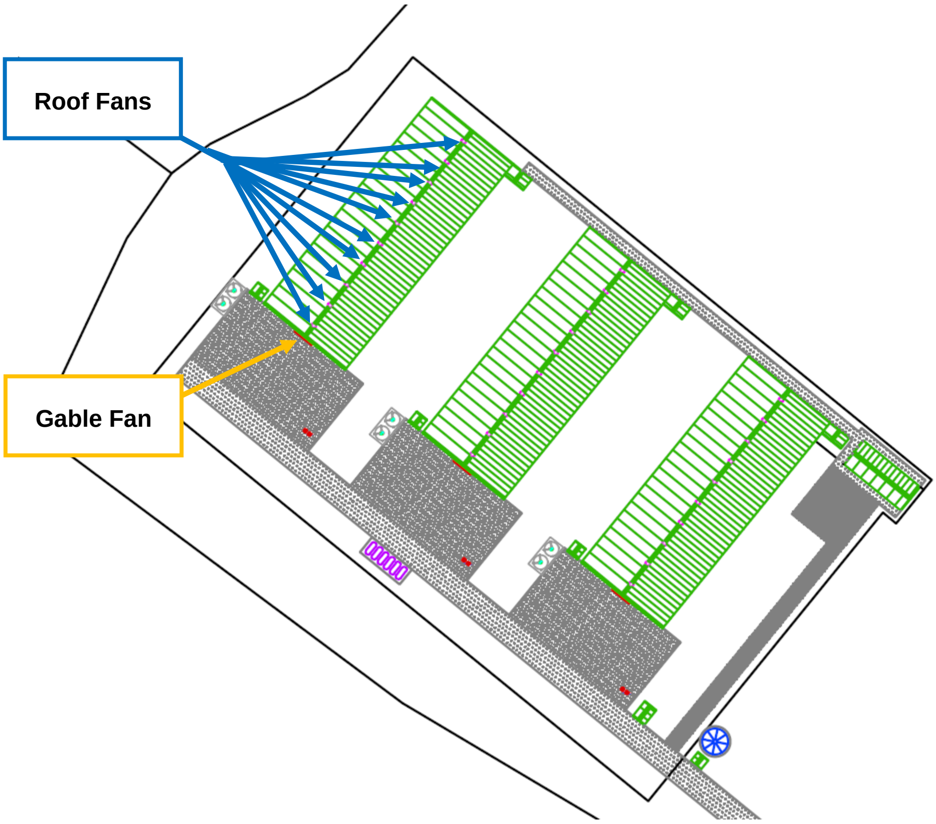


Figure 2 – Annotated site layout with location of roof and gable fans indicated

As described above, the birds will be kept in lower density groups than at most typical poultry farms, and as a result it will be easier to regulate the temperature in the sheds.

Under typical seasonal conditions, up to 6 of the 10 chimney fans on each shed would operate at one time. The remaining 4 chimney fans and gable fans would only ever be used during unusually warm temperatures (well above 30°C). According to the farm operator this is only likely to occur for a few days each year, at the very most.

4 SOUND MEASUREMENTS

4.1 Introduction

A survey was undertaken between approximately 13:00hrs and 15:00hrs on Monday 18 January, and then between 22:00hrs and midnight on Sunday 24 January 2020.

The attended survey had two aims:

- To quantify operational noise emissions from the commissioned fans; and
- To measure typical background levels representative of nearby receptors.

4.2 Sound measurement systems

4.2.1 Details of sound measurement systems

Details of the sound measurement systems used are presented in Appendix C.

4.2.2 Operational calibration test

The measurement systems were calibrated before and after use using the reference calibrator described in Appendix C. The results of the test are presented in Table 3.

Date	Instrument	Calibrator reference level (dB)	Level before (dB)	Level after (dB)	Calibration drift (+/- dB)
18 January	Norsonic 118	113.9	113.7	113.8	0.1
24 January			113.7	113.8	

Table 3 – Details of operational calibration test

4.3 Weather conditions

Weather during the survey was generally suitable for acoustic measurements, based on published weather data, anemometer measurements, and subjective observations.

On Monday 18 January 2021, the average temperature was around 5-6°C during the measurements, with average wind speeds up to 4-5 m/s and mostly cloudy skies.

On Sunday 24 January 2021, the average temperature was around 0-2°C during the measurements, with average wind speeds between 0-5 m/s and mostly cloudy skies. Wind speeds were highest during the first hour, although they did not generally exceed 5 m/s which is typically considered the limit for acoustic surveys. There was a brief blizzard between 22:45hrs and 23:00hrs, after which the wind dropped off to 0-2 m/s.

Atmospheric inversions can sometimes occur during very cold conditions, which can affect sound propagation at distances typically exceeding 1km. However, this is most likely to be present when there is also minimal/no wind and very little or no cloud cover. In this case there was no evidence of inversion effects during either survey period.

4.4 Operational fan measurements

Construction of the three sheds is almost complete, and all required ventilation plant is already installed and fully commissioned. Measurements were therefore undertaken to quantify noise emissions from the roof and gable fans running at fixed typical duty.

4.4.1 Measurement locations

Measurements were carried out at two locations:

- 3m from the gable end fan on one of the sheds.
- 25m from one of the chimney fans, clear line of sight.

In both locations the sound level meter was on a tripod 1.2m above the ground.

Photographs of the measurement positions are presented in Figure 3.

Figure 3 – Photographs of gable (left) and chimney (right) fan measurement positions

Measured sound levels at 3m from the gable fan were apparently dictated by that fan. However, at 25m from the nearest chimney fan the ambient sound was also affected by other local sources including distant traffic and wildlife.

We therefore took the measured 1/3 octave-band L_{90} sound levels as being most representative of the sound from each fan operating at a steady, consistent duty level. An additional measurement was also taken at 25m from the chimney fan to measure baseline sound levels with the fan switched of, which was then logarithmically subtracted from the first measurement to derive the specific sound levels.

4.4.2 *Measurement results*

The overall A-weighted sound level (dB $L_{AF90,T}$) for each fan is summarised in Table 4.

Source	A-weighted sound level (dB $L_{AF90,T}$)
Gable fan @ 3m	71
Chimney roof fan @ 25m[1]	36

Note 1 – ambient sound logarithmically excluded using baseline sound measurement

Table 4 – Summary of A-weighted sound emissions from each operational fan

The technical data supplied for the fans and presented in Appendix B are single figure sound power and sound pressure levels, and do not contain any spectral information.

We therefore also analysed the 1/3 octave-band spectral content of the measurements using the one-third octave method from Section 9.3.2 of BS 4142 to look for tonality. There was no evidence of distinct tonality within the 1/3 octave-band measurements (see Figure 4 below) or from our own subjective impressions of listening to the sound.

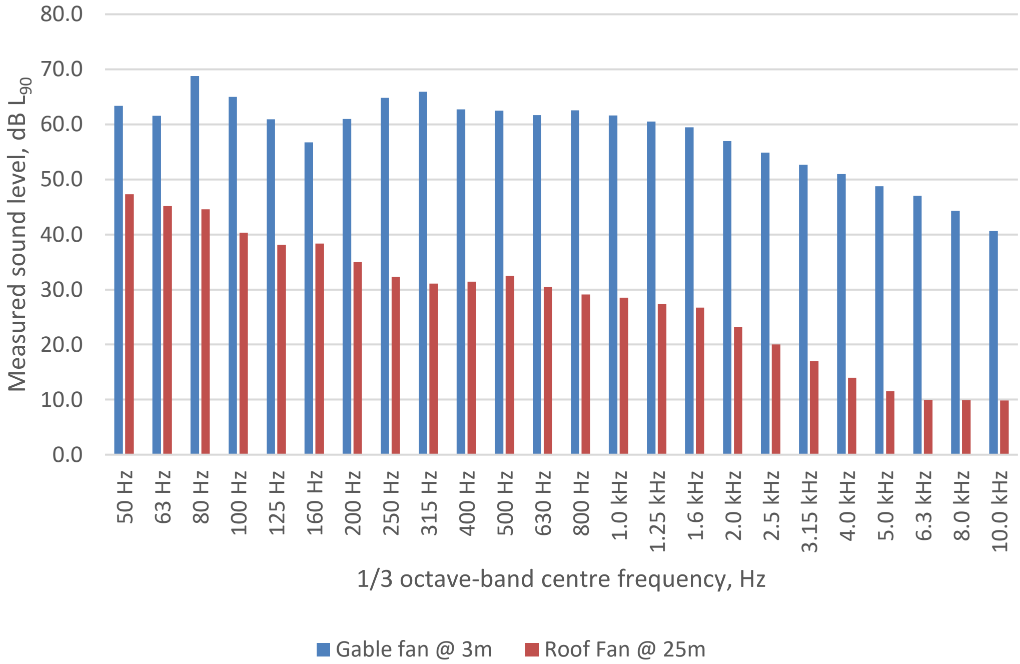


Figure 4 – 1/3 octave-band frequency content of gable and roof fan measurements

The measurement data for the fans operating in-situ at required fixed duty was used in combination with the technical data provided by the supplier to determine accurate specific sound levels for the fans as they will operate in practice. This process, the findings thereof, and the resulting modelling predictions, are discussed in Section 5.2.

4.5 Background sound measurements

4.5.1 Measurement locations

Measurements were carried out on both survey days to quantify the typical day and night-time background sound levels at the nearest noise-sensitive receptors identified in Figure 1. Where it was not possible to measure at the exact property (or group of properties), alternative measurement locations were identified which were considered representative of background sound levels at these properties.

The attended background sound measurement locations are shown in Figure 5.

Figure 5 – Aerial view with background sound measurement locations © Google 2020

4.5.2 Subjective impressions

This is a relatively quiet, rural area. The main ambient noise sources identified during the survey were occasional local traffic, distant traffic (during the daytime only), plus natural source (wind, birdsong, geese honking) and agricultural sources (bird scarers).

High level aircraft and, on a couple of occasions, military helicopters were also audible.

The site and surrounding area are very flat and open. As a result, wind blow across the open landscape and generates noise, even at relatively low wind speeds (<5 m/s). This was most noticeable in the first hour of the evening/night-time survey, when there was no local road traffic at all, and sound levels were higher due to wind blowing across the landscape, and through the trees and hedgerows which line the fields and roads.

Between 23:00hrs and midnight, only one distant vehicle was observed, and we were measuring no distinguishable source. This is likely to represent most of the night-time.

4.5.3 Measurement results

The measured sound levels are presented in Table 5.

Position	Date/Start Time	$L_{Aeq,15min}$	$L_{AFmax,15min}$	$L_{AFmin,15min}$	$L_{AF90,15min}$
M1	(2021/01/18 13:55hrs)	48	76	30	33
M3	(2021/01/18 14:25hrs)	48	68	31	33
M4	(2021/01/18 14:51hrs)	41	58	29	31
M2	(2021/01/24 22:18hrs)	41	63	29	34
M1	(2021/01/24 23:21hrs)	26	42	21	23
M4	(2021/01/24 23:46hrs)	24	44	18	20

Table 5 – Summary of background sound measurements

While the survey was undertaken for relatively short periods during both the day and night-time, there was so little happening during the periods selected that these are likely to be representative of the lowest typical background sound levels in the area.

This is particularly true at night, where it is unlikely that we would have measured much lower sound levels later in the night as there was so little happening, even at midnight.

5 BS 4142 ASSESSMENT

5.1 Background sound level

As described in Section 4.5, attended measurements were undertaken during January 2021 to quantify typical background sound levels during both the day and night-time.

The survey was undertaken during sample periods which are likely to represent the lowest typical background sound levels. Background sound levels lower than those measured could occur at other times, but we would consider these to be atypically low.

Indeed, BS 4142 specifically states that the representative background sound level used for assessment should not necessarily be the absolute lowest measured level, because this would result in an excessively onerous assessment for most of the time.

In any case, it is considered unlikely that typical background sound levels would ever be significantly lower than measured, because the measured levels are already low.

According to the Associated of Noise Consultants (ANC) Technical Note on BS 4142 (published March 2020):

> *"BS 4142 does not define 'low' in the context of background sound levels nor rating levels. The note to the Scope of the 1997 version of BS 4142 defined very low background sound levels as being less than about 30 dB L_{A90}, and low rating levels as being less than about 35 dB $L_{Ar,Tr}$."*

It is evident from the measurement results in Table 5 that night-time background sound levels are regularly, if not predominantly, below 30 dB L_{A90}. The implications of this are discussed in the assessment of impacts documented in Section 5.5 of this report.

The lowest typical background sound levels measured during the survey, which were therefore identified as a reasonable basis for assessment, are summarised in Table 6.

Period	Lowest typical background sound level, dB $L_{AF90,15min}$
Daytime (07:00hrs – 23:00hrs)	31
Night-time (23:00hrs – 07:00hrs)	20

Table 6 – Summary of representative background sound levels for assessment

5.2 Specific sound level

5.2.1 Input data

In this case, the technical data provided for the plant equipment comprises single figure sound power and sound pressure levels with no spectral information. However, we were able to measure sound emissions from a sample of already commissioned plant from which we were able to obtain frequency information and check whether the technical data provided was representative of the in-situ operational sound emissions.

In practice, the roof chimney fan measurements aligned closely with the technical data (within 1 dB once the measurement conditions are accounted for) while the sound level from the gable fan was calculated to be 7 dB lower than the data would indicate. From our discussions with the farm operator, we understand that this fan runs at much lower fixed duty than it is designed for, to reduce the sound emissions when in use.

5.2.2 Modelling predictions

To predict the overall, cumulative specific sound level (in accordance with BS 4142) at the nearest existing noise-sensitive properties, a predictive noise model implementing the calculation methodology from ISO 9613-2 was generated using CadnaA software.

The model predicts attenuation, reflection, diffraction, and absorption effects due to the surrounding topography, ground conditions, intervening obstacles (such as buildings). The model also assumes worst-case downwind sound propagation at all receptors.

The drawings summarised in Table 1 were used to generate accurate representations of the three new poultry sheds and associated infrastructure, and the various gable and roof fans were added, with input data derived as discussed in Section 5.2.1.

As described in Section 3.2, under typical environmental conditions up to six of the ten roof chimney fans would operate at one time. The other four (and the gable end fan) would only operate under atypical conditions (during abnormally warm temperatures). Furthermore, only two of the three poultry sheds would ever be in use at any one time.

We therefore predicted specific sound levels for the following possible scenarios:

Scenario	Conditions	Gable fans	Roof chimney fans
Typical 1	Normal environmental conditions, including during typically warm summer months	Not operating	6 fans, sheds 1 and 2 only
Typical 2			6 fans, sheds 2 and 3 only
Typical 3			6 fans, sheds 1 and 3 only
Worst-case 1	Atypically warm temperatures (up to 2-3 days per year as a worst-case)	Sheds 1 and 2 only	10 fans, sheds 1 and 2 only
Worst-case 2		Sheds 2 and 3 only	10 fans, sheds 2 and 3 only
Worst-case 3		Sheds 1 and 3 only	10 fans, sheds 1 and 3 only

Table 7 – Summary of specific sound level prediction (and assessment) scenarios

The predicted cumulative specific sound levels at each worst-case receptor and during each of the six prediction scenarios described above are summarised in Table 8 below.

Scenario	Predicted cumulative specific sound level, dB $L_{Aeq,T}$					
	R1	R2	R3	R4	R5	R6
Typical 1	20	22	16	18	15	18
Typical 2	18	23	19	21	15	18
Typical 3	20	23	18	20	15	18
Worst-case 1	23	25	19	28	22	26
Worst-case 2	20	26	21	28	22	25
Worst-case 3	23	25	21	29	22	25

Table 8 – Summary of predicted specific sound levels for each scenario

2D CadnaA sound propagation contours for each scenario are also presented below.

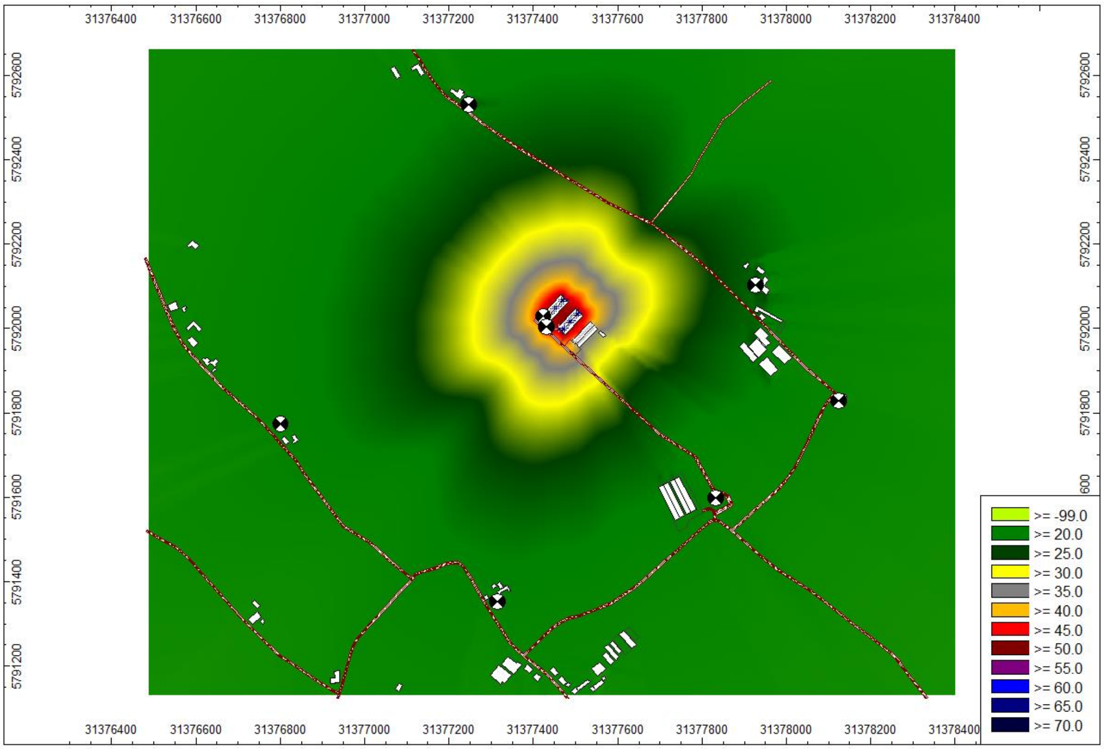


Figure 6 – CadnaA sound prediction contours – Scenario: Typical 1

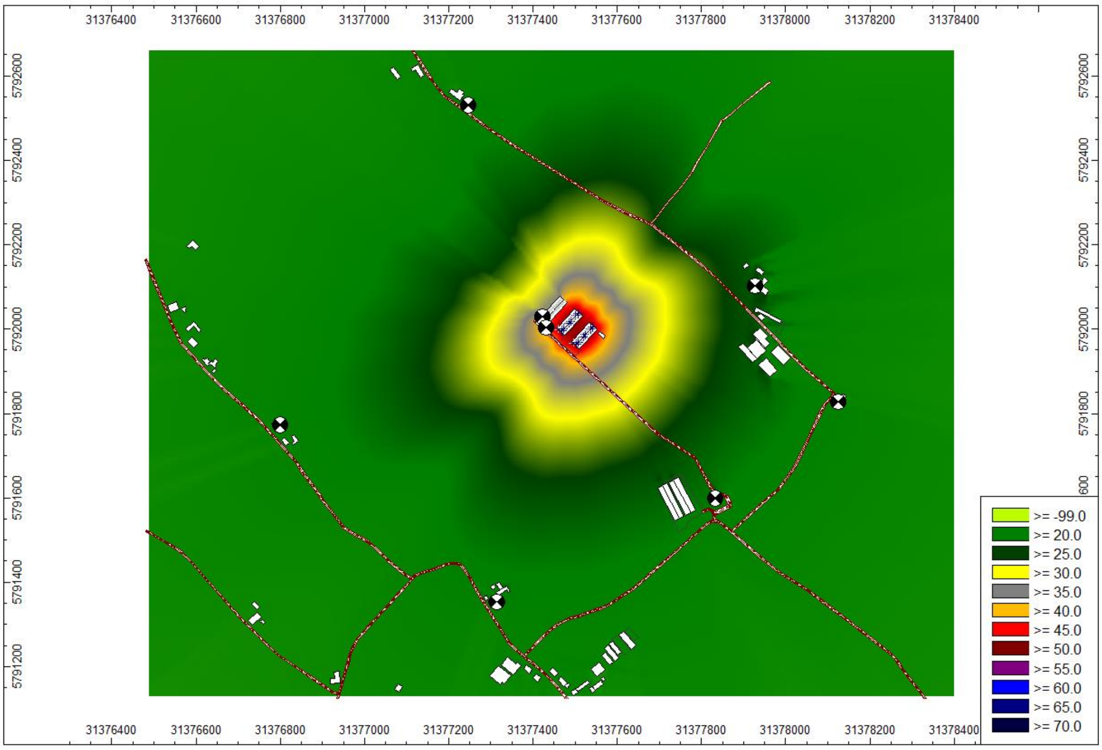


Figure 7 – CadnaA sound prediction contours – Scenario: Typical 2

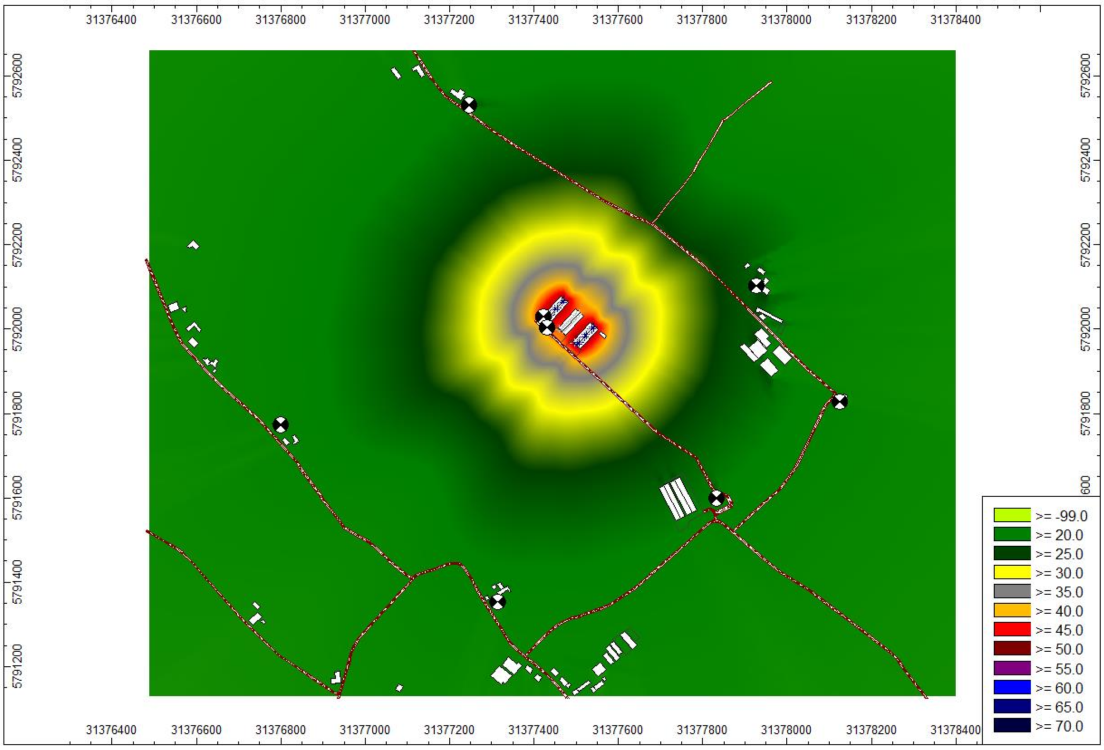


Figure 8 – CadnaA sound prediction contours – Scenario: Typical 3

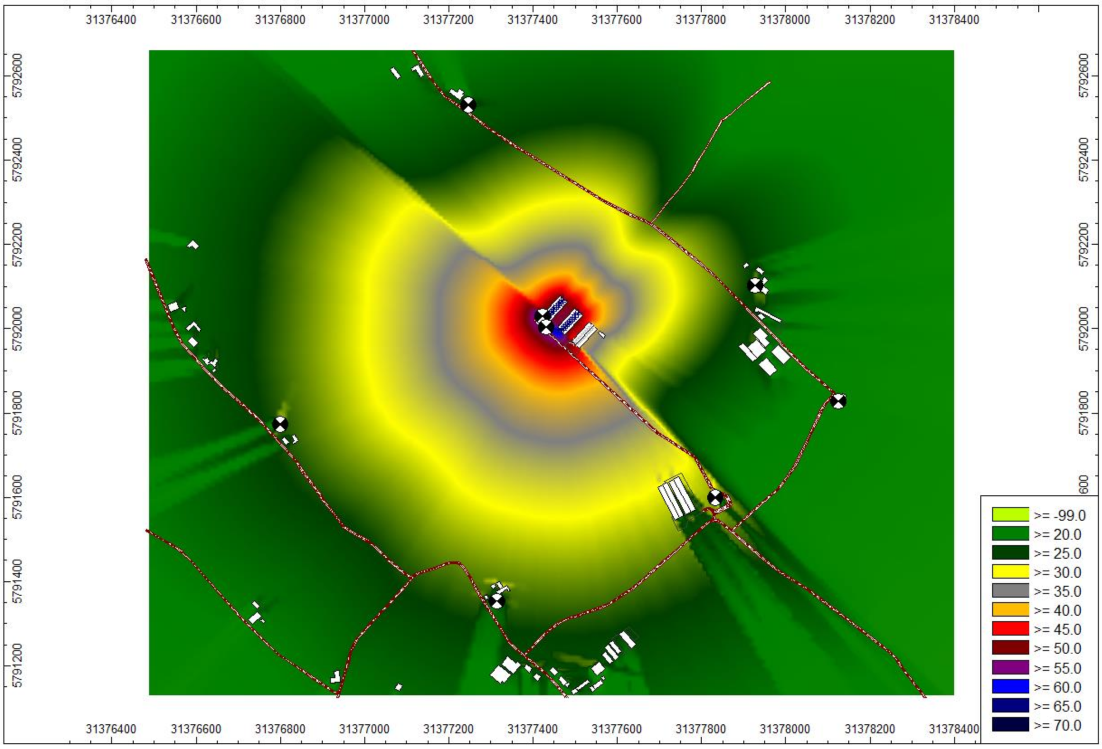


Figure 9 – CadnaA sound prediction contours – Scenario: Worst-case 1

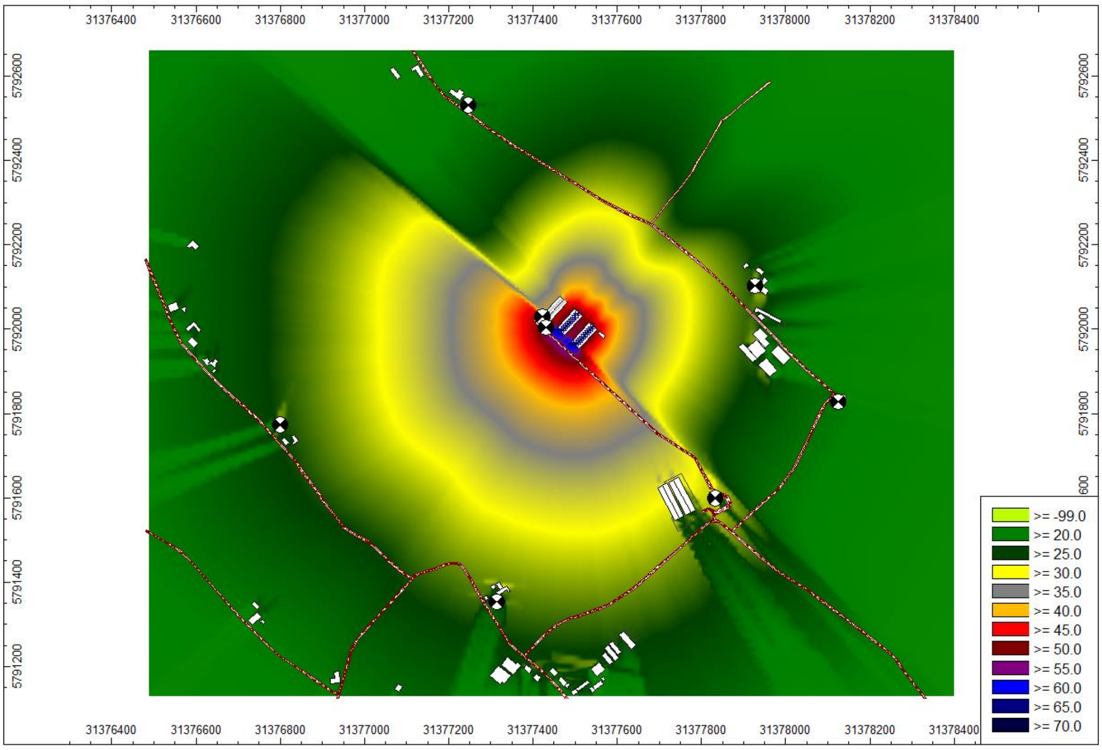


Figure 10 – CadnaA sound prediction contours – Scenario: Worst-case 2

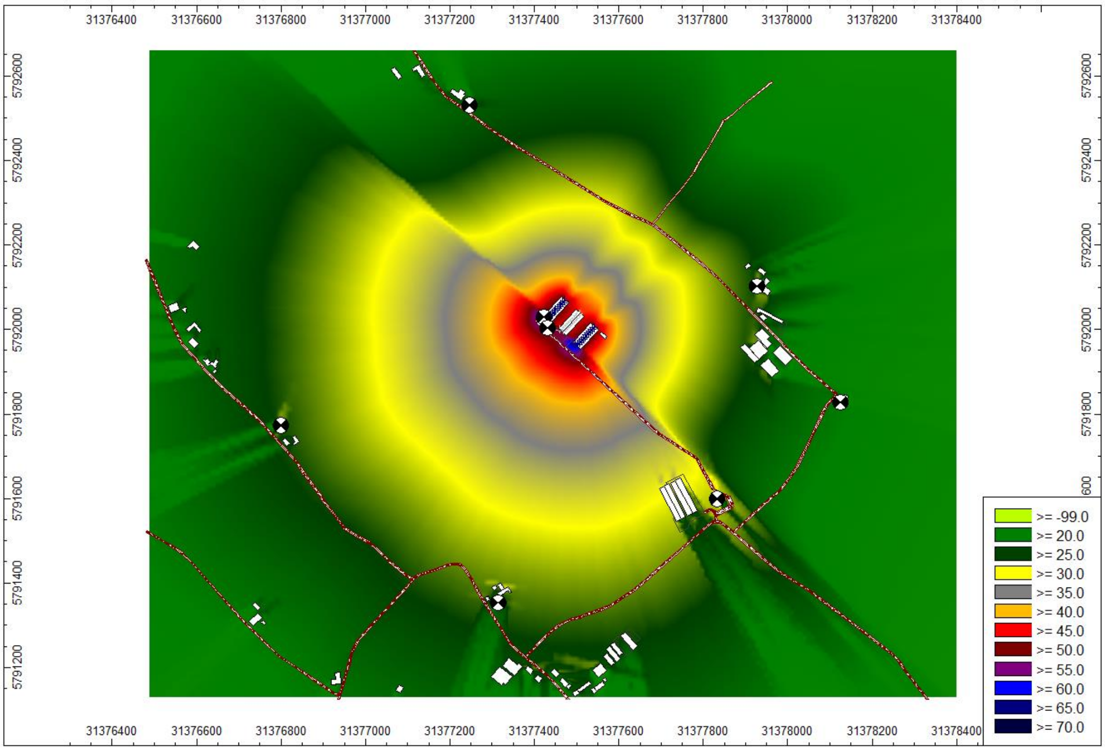


Figure 11 – CadnaA sound prediction contours – Scenario: Worst-case 3

5.3 Rating level

BS 4142 requires consideration of whether the specific sound exhibits characteristics which could make it more distinctive, including tonality, impulsivity, and intermittence.

In this case, specific sound levels from the fans at the location of off-site residences are unlikely to exhibit any such characteristics for the following reasons:

- As described in Section 4.4.2, analysis of the measurement data for the gable and roof fans showed that the sound did not exhibit any distinctive tonality.
- When in use, the fans will operate continuously at a steady fixed level of duty, meaning that the sound is unlikely to exhibit any impulsivity.
- Similarly, when required, the fans are unlikely to switch on and off regularly during any reference time interval (1 hour during the day, 15 minutes at night) and are therefore unlikely to exhibit any clearly intermittent characteristics.

Rating levels are therefore taken to be identical to the specific sound levels in Table 8.

5.4 Uncertainty

BS 4142 recommends that any significant uncertainties are reported, potential effects highlighted and, where practicable, reasonable steps taken to reduce the effects.

5.4.1 Uncertainty of measured values

The main area of measurement uncertainty in this case relates to the relatively limited sample times during which background sound measurements were undertaken.

However, for the reasons described in 4.5.3, the measurements are considered to be representative of the lowest typical background sound levels which are likely to occur, and are therefore a reasonable basis for assessment in accordance with BS 4142.

5.4.2 Uncertainty in calculations

The main area of uncertainty in calculations relates to the acoustic absorption provided by the land surrounding the site. The arable fields surrounding the site are currently ploughed and very soft from seasonal rainfall. During the summer when crops have grown to full height and/or the ground is harder due to drier conditions, it is possible that ground absorption could vary more than assumed. However, any variation is likely to be relatively minor and the absorption assumed should thus remain representative.

5.5 Assessment of impacts

The impact of the specific sound source can initially be estimated by subtracting the representative sound level from the rating level. Typically, the greater this difference, the greater the magnitude of impact (depending on the context).

The results of the BS 4142 assessment for the daytime and night-time are presented for each scenario and at each worst-case receptor in Table 9 and Table 10 respectively.

Scenario	Difference between background sound level and rating level, dB					
	R1	**R2**	**R3**	**R4**	**R5**	**R6**
Typical 1	-11	-9	-15	-13	-16	-13
Typical 2	-13	-8	-12	-10	-16	-13
Typical 3	-11	-8	-13	-11	-16	-13
Worst-case 1	-8	-6	-12	-3	-9	-5
Worst-case 2	-11	-5	-10	-3	-9	-6
Worst-case 3	-8	-6	-10	-2	-9	-6

Table 9 – Summary of predicted specific sound levels for each scenario (daytime)

Scenario	Difference between background sound level and rating level, dB					
	R1	**R2**	**R3**	**R4**	**R5**	**R6**
Typical 1	0	2	-4	-2	-5	-2
Typical 2	-2	3	-1	1	-5	-2
Typical 3	0	3	-2	0	-5	-2
Worst-case 1	3	5	-1	8	2	6
Worst-case 2	0	6	1	8	2	5
Worst-case 3	3	5	1	9	2	5

Table 10 – Summary of predicted specific sound levels for each scenario (night-time)

The above assessment indicates that rating levels during the day would be below the representative background sound level at all receptors and for all scenarios. According to BS 4142, this suggests that a low impact is likely, even during atypical and relatively rare periods when the additional roof chimney and gable fans would also be operating.

During the night, the rating levels at some receptors during typical operating scenarios would be between -5 dB below and + 3 dB above background. According to BS 4142, adverse impacts can start to occur if rating levels exceed +5 dB above background, which is not predicted to occur at any receptor during typical operation, even at night.

In the unlikely event that one of the worst-case operating scenarios occurs at night (which is particularly unlikely because even during rare, unseasonably warm periods the night-time period is likely to be cooler and additional fans might not be necessary) rating levels could be between -1 dB below and 9 dB above the prevailing background.

However, the only receptor where night-time rating levels could significantly exceed the threshold of adverse impact (i.e. by more than 1 dB) is Receptor 4, which is also the facility manager's residence. It is reasonable to assume that the manager would be less sensitive to this noise than other receptors with no personal connection to the facility, so we consider it unlikely that this receptor would be adversely affected.

In any case, BS 4142 requires consideration of context and this case the worst-case scenarios could occur so infrequently (a maximum of 2-3 days a year as a worst-case) that any impacts during these periods are likely to be more tolerable to local residents.

It should also be noted that *"significant adverse effects"*, which BS4142 indicates may happen with rating levels 10dB above the background, would be avoided in all cases.

5.5.1 Discussion of low background sound and rating levels

As per subclause 11(1) of BS 4142, where background sound and/or rating levels are *"low"* it may be more appropriate to carry out an assessment of absolute sound levels, rather than basing an assessment entirely on the difference between the two levels.

According to the Associated of Noise Consultants (ANC) Technical Note on BS 4142 (published March 2020):

> *"BS 4142 does not define 'low' in the context of background sound levels nor rating levels. The note to the Scope of the 1997 version of BS 4142 defined very low background sound levels as being less than about 30 dB L_{A90}, and low rating levels as being less than about 35 dB $L_{Ar,Tr}$."*

Two of the night-time background sound measurements were below 30 dB $L_{AF90,15\text{-}min}$. On this basis, and considering that all predicted rating levels are less than 35 dB $L_{Ar,Tr}$, it is appropriate to also assess the night-time specific sound levels in absolute terms.

In the absence of any specific guidance for assessing absolute sound levels from plant, the WHO *Night Noise Guidelines (NNGL) for Europe* are often used as an appropriate basis for the assessment of potential for night-time sleep disturbance in general terms.

The NNGL found that below 30dB(A) $L_{night\ outside}$ there are no observed effects on sleep and that there is no evidence that levels below 40dB(A) $L_{night\ outside}$ are harmful to health.

None of the predicted rating levels would exceed 30 dB $L_{Aeq,T}$, even during atypical worst-case conditions, so on this basis no observed effects on sleep are likely to occur.

This appears to reinforce the conclusions in Section 5.5; i.e. that even exceedances of the representative background sound level during the quietest night-time periods and under atypical, infrequent worst-case conditions would be unlikely to disturb sleep.

6 CONCLUSIONS

- An assessment of predicted cumulative noise emissions from mechanical plant serving three recently constructed poultry breeding sheds has been completed in accordance with BS 4142.
- The BS4142 assessment indicates that the rating levels at the nearest (worst-case) noise-sensitive receptors would result in a low impact during the day. This would generally also be the case at night, except for potentially a few days a year when additional fans might be required to operate and rating levels at one receptor could exceed the threshold of adverse impact by up to 3 dB. However, this property is occupied by the facility manager, who is likely to be less sensitive to the noise. The night-time impact at all other receptors is predicted to be low and/or acceptable.
- The worst-case scenarios would only ever occur during atypical hot conditions (well in excess of 30°C). It is much less likely that such temperatures would occur during the night than during the day, which also offsets potential impacts.
- The area surrounding the development is typically quiet and rural in nature. Where background sound and/or rating levels are *"low"* BS 4142 indicates that an assessment of absolute sound levels might be more appropriate. Night-time background sound levels are regularly *"low"* (according to ANC guidance) and we have therefore also assessed the predicted sound levels using the guidance in the WHO *Night Noise Guidelines (NNGL) for Europe*. This indicated that even exceedances of the background sound level during the quietest night-time periods and under worst-case conditions would be unlikely to disturb sleep.
- Considering the above, it is our view that the impact of plant noise generated by the development would be acceptable, and furthermore that for most of the time (i.e. during *'typical'* operating conditions) a *"low"* impact can be expected. The requirements of Condition 8 (for plant) are therefore considered to be met.

APPENDIX A TECHNICAL TERMS AND UNITS RELEVANT TO THIS REPORT

Acoustic environment - Sound from all sources as modified by the environment

Ambient sound level, LA = $L_{Aeq,T}$ - Totally encompassing sound, usually composed of many sources. Comprises the residual sound and specific sound when present.

Background sound level, $L_{A90,T}$ - A weighted SPL exceeded by the residual sound for 90% of the a given time interval, T and rounded to the nearest whole dB.

Measurement time interval, T_m - Total time over which measurements are taken. May be the sum of multiple non-contiguous, short-term intervals

Rating level, $L_{Ar,Tr}$ - Specific sound level plus adjustment for characteristic features

Reference time interval, T_r - Specified interval over which the specific sound level is determined, i.e. 1h during the day (0700-2300) and 15mins at night (2300-0700).

Residual sound level, L_r = $L_{Aeq,T}$ - Ambient sound remaining when specific sound source does not contribute

Specific sound level, L_s = $L_{Aeq,Tr}$ - Level produced by specific sound source over reference time interval, Tr. Can also be calculated and/or predicted.

Sound Pressure Level (L_p or SPL) - This is a function of the source and its surroundings and is a measure in decibels of the total instantaneous sound pressure at a point in space. The SPL can vary both in time and in frequency. Different measurement parameters are therefore required to describe the time variation and frequency content of a given sound. These are described below.

Frequency - This refers to the number of complete pressure fluctuations or cycles that occur in one second. Frequency is measured in Hertz (Hz). The rumble of thunder has a low frequency, while a whistle has a high frequency. The sensitivity of the ear varies over the frequency range and is most sensitive between 1KHz and 5KHz.

Octave and One-Third Octave Bands - The human ear is sensitive to sound over a frequency range of approximately 20 Hz to 20,000 Hz and is more sensitive to medium and high frequencies than to low frequencies. To define the frequency content of a sound, the spectrum is divided into frequency bands, the most common of which are octave bands. Each band is referred to by its centre frequency, and the centre frequency of each band is twice that of the band below it. Where it is necessary for a more detailed analysis octave bands may be divided into one-third octave bands.

‘**A’ Weighting** - The sensitivity of the human ear varies with frequency, some frequencies sound louder than others. The 'A'-weighting curve represents the non-linear frequency response of the human ear and is incorporated in an electronic filter used in sound level meters. Measurements using an 'A'-weighting filter makes the meter more sensitive to the middle range of frequencies, which approximates to the response of the ear and the subjective loudness of the sound. Sound level measurements using ‘A’-weighting will include the subscript A, e.g. dB(A).

Statistical Analysis - These figures are normally expressed as LN, where L is the sound pressure level in dB and N is the percentage of the measurement period. The LN figure represents the sound level that is exceeded for that percentage of the measurement period. L_{90} is commonly used to give an indication of the background level or the lowest level during the measurement period.

APPENDIX B TECHNICAL DATA SHEETS FOR MECHNICAL PLANT

Big Dutchman

Data sheet: Fan for exhaust air chimney

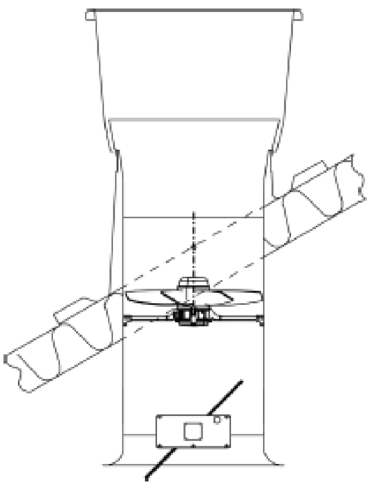
Code no	Description
60-47-7900	**Fan FF063-6ET(S) 1x230V 50/60Hz 2.5/3.3A f/tube**
valid for the following chimney types:	
60-39-0002	Exhaust air chimney CL600-2000 grey with fan 230/6
60-39-0012	Exhaust air chimney CL600-2000 black with fan 230/6
60-39-0014	Exhaust air chimney CL600-4000 black with fan 230/6

Parameter	Unit	Value	Comment
Nominal voltage	[V] / [Hz]	230 / 50	compatible with 60Hz
Allowable voltage	[V]	207 - 253	
Current consumption	[A]	2,5	3,3A at 60Hz
max. ambient temperature	[°C]	70	
Sound power level (L_WA)	[dB(A)]	78,4	30Pa
Sound pressure level (L_pA)	[dB(A)]	53,4	Distance 7m / 30Pa
Weight	[kg]	12	
Speed control	[-]	T, Triac, FU	
Protection class	[-]	IP54	
Certificate	[-]	CE, ErP2015	

Pressure	Air volume*	Air speed	Spec. capacity
[Pa]	[m³/h]	[m/s]	[W/1000m³]
0	-	-	-
10	12,709	10.6	-
20	12,245	10.3	-
30	11,711	9.8	-
40	10,809	9.0	-
50	9,847	8.2	-
60	7,200	6.0	-
80	-	-	-
100	-	-	-
120	-	-	-
140	-	-	-
160	-	-	-

Illustration

The fan capacity only applies to the shown kind of assembly!



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* Measured with fans of the accuracy class 3. Data based on the standard density of 1.2 kg/m³.

Edition: 02/2015 -GB

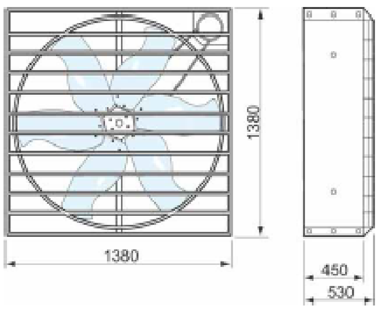
Data sheet: Wall fan

Code no	Description
60-25-3035	Fan EM50 1.50HP E13 SST 41930m³ 400-3-50 assembled max. 60Pa

Parameter	Unit	Value	Comment
Nominal voltage	[V] / [Hz]	400/50	
Allowable voltage	[V]	380 - 420	
Current consumption	[A]	3.0	
Max. ambient temperature	[°C]	50	
Sound power level (L_wA)	[dB(A)]	95.6	
Sound pressure level (L_pA)	[dB(A)]	76	Distance 2 m, 45° lateral
Weight	[kg]	94	
Speed control	[-]	-	
Protection class	[-]	IP55	
Certificate	[-]	CE, ERP 2013	

Pressure	Air volume	Air speed	Specific capacity
[Pa]	[m³/h]	[m/s]	[W/1000m³]
0	41,930	-	-
10	39,700	-	-
20	37,930	-	47.4
30	36,700	-	-
40	34,460	-	-
50	31,850	-	-
60	30,030	-	-
80	-	-	-
100	-	-	-
120	-	-	-
140	-	-	-
160	-	-	-

Illustration



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APPENDIX C MEASUREMENT SYSTEMS AND CALIBRATION

Job reference and title:	12880 – New Poultry Sheds, Bedingfield Hall Farms
Measurement location:	See Section 4 of this report
Measurement date(s):	Monday 18 and Sunday 24 January 2021.

Measuring equipment used:

Equipment description / serial number	Type number	Manufacturer	Date of calibration expiration	Calibration certificate number
Precision sound level meter serial no. 31634	118	Norsonic	12/11/2022	36278
Microphone serial no. 59932	1225	Norsonic	12/11/2022	36277
Microphone pre-amplifier serial no. 30583	1206	Norsonic	12/11/2022	36278
Microphone calibrator serial no. 31279	NOR-1251	Norsonic	12/11/2022	36276

Calibration level:	114.0 dB @ 1 kHz
Persons in charge of measurements:	Gary Percival, MIOA
Measurement parameters	1/3 Octave band $L_{eq,T}$
	1/3 Octave band and A-weighted $L_{F90,T}$