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For **Welland Waste Management Limited**
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Pebble Hall Farm, Theddingworth
Noise Assessment

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The Author

Dr Paul Cockcroft BEng PhD CEng MIMMM FIOA (Senior Partner) has been practising in mining engineering and acoustics since 1983. He joined WBM in 1989, became an Associate in 1991, a Partner in 1997 and Senior Partner in 2004. He has concentrated on environmental noise and has been involved in work for mineral operators, waste disposal companies, planning authorities and developers at over 500 mineral, waste disposal, housing, commercial development and other sites as well as measurement and noise prediction work for road and rail schemes. Dr Cockcroft has considerable experience of planning appeal work.

Walker Beak Mason

Walker Beak Mason (WBM) is an established independent acoustic consultancy specialising in architectural & building acoustics and environmental noise. WBM is a member of the Association of Noise Consultants and is also an Associate Assessor Member of the Institute of Environmental Management & Assessment. The Consultants are Members or Fellows of the Institute of Acoustics.

Contents

1 Introduction

Welland Waste Management Limited (WWM) currently operates a site at Pebble Hall Farm, near Theddingworth in Northamptonshire. The planning history, current operations and proposed development are described in detail in the Planning Statement prepared by GP Planning and are not reproduced in this report.

In summary, food waste is to be delivered to the site by heavy goods vehicles (HGVs) during daytime periods only, with almost all of the operations and processes to take place inside buildings. For processes that are continuous, potential impact at weekends and in particular at night will need to be considered.

The closest dwelling to the development site is Pebble Hall Farm, which is occupied by relatives of the site owner / applicant. Other dwellings in the area are at separation distances of about 600 to 1500 metres, namely on the northern side of the A4304 Theddingworth Road, on the eastern side of Husbands Bosworth, Hothorpe Hall and nearby dwellings south of Theddingworth.

This report sets out the findings of noise surveys conducted in April 2013 of the existing noise climate at positions representative of the closest noise sensitive properties to the site, for daytime, evening and night-time periods.

The report sets out the calculated noise levels arising from the proposed operations and compares the calculated site noise levels with the measured background noise levels to assess the potential impact of the operations in terms of likelihood of complaints about noise for daytime and night-time.

The impact of road traffic noise from site HGVs entering and leaving the site on the access road is also examined for the dwelling at Pebble Hall Farm.

To aid comprehension, a glossary of acoustic terms is presented in **Appendix A**.

2 Assessment Methodology

The various relevant noise guidance documents considered for this assessment are detailed below.

2.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF) was published in March 2012 with immediate effect and sets out the Government's planning policies for England. At the heart of the National Planning Policy Framework is a presumption in favour of sustainable development.

The NPPF revoked and replaced a number of Planning Policy Statements (PPS), Planning Policy Guidance (PPG) and other guidance documents, including Planning Policy Guidance 24: Planning and Noise).

With regard to noise there are various aims, including that noise from a new development should avoid giving rise to significant adverse impacts on health and quality of life, and that other adverse impacts should be mitigated and reduced to a minimum including through the use of conditions.

Section 11 of the NPPF (Conserving and enhancing the natural environment) refers specifically to noise in the following paragraphs:

"*109. The planning system should contribute to and enhance the natural and local environment by…preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability...*"

"*123. Planning policies and decisions should aim to:*

- *avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*

- *recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established (subject to the provisions of the Environmental Protection Act 1990 and other relevant law); and*
- *identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.*"

2.2 Environment Agency Horizontal Guidance for Noise

From examination of the Environment Agency website and discussion with a relevant noise officer from the Environment Agency on 26 April 2013, it is apparent that Part 1 – "Regulation and Permitting" is no longer supplied as part of the Horizontal Guidance for Noise. Part 2 – "Noise Assessment and Control" is included on the Environment Agency website. At the bottom of page 57 in Part 2 (Version 3 June 2004) it is stated "*The potential noise impacts of new or modified plants should be considered both in terms of BS4142: 1997, PPG24 and the World Health Organisation guidelines*". As indicated above, NPPF revoked and replaced PPG 24 Planning and Noise.

2.3 British Standard 4142

British Standard (BS) 4142:1997 "Method for Rating industrial noise affecting mixed residential and industrial areas" describes a method of determining the level of a noise of an industrial nature, together with procedures for assessing whether or not the noise in question is likely to give rise to complaints from persons living in the vicinity.

The noise level of the industrial source (specific noise source, $L_{Aeq,\ T}$) is corrected for any distinguishable features at the receptor location that could attract attention. The correction is +5 dB, and the corrected specific noise level is known as the rating level ($L_{Ar,T}$). The acoustic feature correction applies if the noise at the receptor location contains a distinguishable, discrete or continuous note (such as a whine, hiss, screech or hum), contains distinct impulses (bangs, clicks, clatters or thumps) or is irregular enough to attract attention.

The measured L_{Aeq} noise level at the residences in the absence of any specific noise level is known as the residual noise level. The $L_{A90,\,T}$ level (i.e. the level exceeded 90% of the time) corresponding to the residual noise level is known as the background noise level.

The likelihood of complaints is assessed by subtracting the background noise level from the rating level; the greater the difference, the greater the likelihood of complaints.

A difference of around +10 dB or more (rating level greater than background noise level) indicates that complaints are likely. A difference of around +5 dB is of marginal significance. A difference of -10 dB (rating level below background noise level) is a positive indication that complaints are unlikely.

There are limitations to the application of BS 4142. Within the Scope of the standard it is stated:

"*The method is not suitable for assessing the noise measured inside buildings or when the background and rating noise levels are both very low.*

NOTE: For the purposes of this standard, background noise levels below about 30 dB and rating levels below about 35 dB are considered to be very low."

2.4 World Health Organisation

Guidelines for Community Noise 1999

The World Health Organisation (WHO) "*Guidelines for Community Noise*" 1999 provides guidance on community noise based on knowledge of the health impacts of community noise and also provides guidance on the protection of people from the harmful effects of noise in non-industrial environments. Some of the relevant guideline values according to specific environments and critical health effects are tabulated below.

Specific environment	**Critical health effect**	**L_{Aeq} (dB)**	**Time base (hours)**	**$L_{Amax,fast}$ (dB)**
Outdoor living area	Serious annoyance, daytime and evening	55	16	-

Outdoor living area	Moderate annoyance, daytime and evening	50	16	-
Dwellings, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, night-time	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

According to the WHO guidelines, the time base for $L_{Aeq,T}$ values is 16 hours for daytime (including evening) and 8 hours for night-time.

The effects of noise in dwellings are usually sleep disturbance, annoyance and speech interference. For bedrooms the critical effect is sleep disturbance. The WHO indoor guideline values for bedrooms are 30 dB $L_{Aeq,T}$ for continuous noise. If the noise is not continuous, maximum noise levels should be used to indicate the probability of noise-induced awakenings with 45 dB $L_{Amax,f}$ as the relevant criterion. The WHO guidelines state that "*For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB LAmax more than 10-15 times per night…*"

At night-time, external noise levels outside the façades of bedrooms should not exceed 45 dB $L_{Aeq,T}$ and 60 dB $L_{Amax,f}$ and so that people may sleep with bedroom windows open, assuming a noise reduction of 15 dB from outside to inside with the window open.

To protect the majority of people from being seriously annoyed during the daytime, the outside noise level from steady, continuous noise should not exceed 55 dB $L_{Aeq,T}$ on balconies, terraces and in outdoor living rooms. To protect the majority of people from being moderately annoyed during the daytime, the outside noise level should not exceed 50 dB $L_{Aeq,T}$.

It is important to note that these are health based guidelines rather than levels set out in current Government legislation.

Night Noise Guidelines for Europe 2009

The World Health Organization "Night Noise Guidelines for Europe" 2009 document provides guidelines that are neither standards nor legally binding criteria. The guidelines may be considered as an extension to, as well as an update of, the previous WHO "Guidelines for Community Noise" 1999.

This document proposes that an $L_{night,outside}$ of 40 dB should be the target of the night noise guideline (NNG) to protect the public. The $L_{night,outside}$ indicator is defined in Environmental Noise Directive 2002/49/EC and is the year average at the most exposed facade. It is the long-term A-weighted average sound level (L_{Aeq}) determined over all the night periods of a year, where night is eight hours in duration (usually 23.00 to 07.00 hours) and a year is a relevant year as regard the emission of sound and an average year for meteorological conditions. The $L_{night,outside}$ is determined at a receiver height of 4 metres above local ground and is taken to be a free field level even though it would be assessed near the most affected façade of a dwelling.

The Night Noise Guidelines also reports that effects on sleep quality can occur at a threshold levels of 42 dB $L_{Amax,inside}$ (internal level) although biological effects such as EEG awakening and changing sleep structure can occur at lower noise levels.

3 Site Description

The proposed development site is situated about 500 metres south of the A4304 Theddingworth Road. The closest dwelling to the development site is Pebble Hall Farm, which is occupied by relatives of the site owner / applicant, near to the junction of the site access road and the A4304. The dwelling at Pebble Hall Farm is about 40 metres from the site access road.

Other dwellings in the area are at separation distances of about 600 to 1500 metres to the proposed development site, namely Dene Lodge and Woodside Farm on the northern side of Theddingworth Road, Bosworth Hall on the eastern side of Husbands Bosworth, Hothorpe Hall and nearby dwellings south of Theddingworth.

4 Measurement Methodology

4.1 Measurement Description

A site location plan including the baseline noise survey measurement locations is included in this report as **Appendix B**.

The noise measurements were carried out in accordance with the Measurement Practice in BS 4142: 1997 for instrumentation and calibration.

The locations at which baseline measurements have been made were chosen as the representative of the residential dwellings and areas closest to the proposed development site.

Baseline noise surveys were conducted during four visits at four locations representative of the nearest noise sensitive properties. A total of sixteen sample measurements were taken over the course of the attended surveys in April 2013. In addition, a sound level meter was installed for a week at Pebble Hall Farm for largely unattended baseline noise monitoring.

Food waste is to be delivered to the site by heavy goods vehicles (HGVs) during daytime periods only, 07:00 to 17:00, with almost all of the operations and processes to take place inside buildings.

The sample measurements were undertaken between about 16:00 and 17:30 on Friday 19 April 2013; between about 22:00 and 23:30 on Monday 22 April 2013; between about 09:30 and 11:00 on Friday 26 April 2013; between about 01:30 and 03:00 on Saturday 27 April 2013. The meter at Pebble Hall Farm was installed at about 15:30 on Friday 19 April 2013 and collected at about 11:00 on Friday 26 April 2013.

The measurements were taken at a microphone height of approximately 1.4 metres above local ground level away from reflecting surfaces other than the ground, with a wind shield used throughout each measurement. The sample measurements were of 15 minute duration. The start times of the measurements are shown along with the results.

The parameters reported are the statistical indices $L_{A10,T}$ and the Background Noise Level, $L_{A90,T}$ as well as the Equivalent Continuous Noise Level, $L_{Aeq,T}$. An explanation of the noise units presented is given in **Appendix A**.

The instrumentation used for the measurements and calibration details are shown in **Appendix C.** The attended survey results are presented in **Appendix D**. The results from the unattended survey are presented in **Appendix E**.

4.2 Results

The detailed results from the attended surveys are presented in **Appendix D**.

A summary of the background noise levels from the attended survey results is presented in the following table.

Position	**dB $L_{A90,15min}$**	**dB $L_{A90,15min}$**	**dB $L_{A90,15min}$**	**dB $L_{A90,15min}$**
	Morning	Afternoon	Evening	Night
1 Husbands Bosworth	44	40	31	22
2 West of Woodside Farm	47	53	29	27
3. Pebble Hall Farm	42	48	30	18
4. Hothorpe Road	41	37	35	20

The noise climate was affected by road traffic, aircraft movements, birdsong, animal calls, distant agricultural activity and wind movement in trees at times

The results from the unattended survey at Pebble Hall Farm are presented in **Appendix E**. The background noise levels at the quietest part of the night-time period were in the range 18 to 23 dB $L_{A90,\ 1\ hour,\ free\ field}$ at this location.

5 Calculated Site Noise Levels

The potential impact of site noise levels at the nearest noise sensitive properties to the operations can be assessed by the calculation of site noise levels due to the activities taking place on site and comparison with the measured baseline noise environment.

The noise levels likely to arise at dwellings depend on the sound power levels of the plant as much as on the distance to the properties and the effects of intervening ground and buildings. Proper allowance can be made for these variables to calculate site noise levels.

The Equivalent Continuous Noise Level, $L_{Aeq,\ T,}$ is the preferred unit for assessing noise sources. It is the value of a continuous level that would have equivalent energy to the continuously varying noise over the specified period "T". This unit is recommended internationally for the description of environmental noise and is in general use. It is the chosen unit of BS 5228 for Construction and Open site noise and BS 7445 for the Description and Measurement of Environmental Noise.

5.1 Noise Sources and Sound Power Levels

The noise levels of the proposed operations have been supplied by WWM to WBM, generally in the form of noise levels at a separation distance of 1 m. These noise levels have been used to determine Sound Power Levels for plant items, allowing noise levels inside the various buildings to be calculated. With assumptions about sound insulation properties of the building walls and roofs, the noise level breakout from each building can be determined. The apparent Sound Power Levels for the walls and roofs of the buildings, as well as noise from exhausts for one of the buildings and the “genset” units, have been determined.

The calculations in this report are based on BS5228: 2009: Part 1 Noise. Further details of the calculation methods are set out in **Appendix F** to this report. A sample site noise calculation sheet for the nearest dwelling is included in **Appendix F**, showing the noise sources and sound power levels.

5.2 Site Operation Activities

In order to calculate the noise levels for the proposed development site, the contribution from each significant specific noise source has been evaluated separately and then combined together to give the overall noise level.

The activities that will take place on the site are as summarised below and set out on the sample calculation sheet along with on-time percentages for the daytime assessment period of 1-hour or night-time period of 5-minutes.

- Lorry movements along site access road;
- Four engines "gensets" outside the buildings;
- Stack exhausts for each of the four engines;
- Reception building walls, roof and open door (daytime);
- Reception building exhaust;
- Digester building walls, roof and open door (daytime);
- Slurry tanker outside buildings (daytime).

For the purposes of the calculations, the receiver height has been tested at 1.5 metres for the receiver locations (daytime) and 4.0 metres (night-time).

The site noise calculations include barrier attenuation attributable to the building between the "gensets" and the dwellings at Pebble Hall Farm, Woodside Farm and Hothorpe Hall. No allowance has been made in the calculations for the effects of any barrier attenuation due to bunding or landforms between the site and the noise sensitive receptors so as not to over-estimate the attenuation.

5.3 Calculated Site Noise Levels

The nearest residential properties for which site noise calculations have been made are Pebble Hall Farm, Woodside Farm, Bosworth Hall, Hothorpe Hall.

The calculated site noise levels, for night-time and daytime periods, are set out in the table below with conventional, insulated cladding for walls and roof of the reception building and digester building and without barrier attenuation for the “gensets”. The daytime site noise levels include HGV movements on the site access road, open doors to buildings and the operation outside buildings of a slurry tanker.

Without Building as Barrier for “gensets” Receiver Location	**Calculated Daytime Site Noise Levels dB $L_{Aeq, 1\ hour, free\ field}$**	**Calculated Night-time Site Noise Levels dB $L_{Aeq, 5\ minutes, free\ field}$**
Bosworth Hall	34	25
Woodside Farm	45	34
Pebble Hall Farm	55	36
Hothorpe Hall	39	30

Note: Pebble Hall Farm is occupied by relatives of site owner and applicant

The calculated site noise levels, for night-time and daytime periods, are set out in the table below with conventional, insulated cladding for walls and roof of the reception building and digester building and with barrier attenuation for the “gensets”. The daytime site noise levels include HGV movements on the site access road, open doors to buildings and the operation outside buildings of a slurry tanker.

With Building as Barrier for “gensets” Receiver Location	**Calculated Daytime Site Noise Levels dB $L_{Aeq, 1\ hour, free\ field}$**	**Calculated Night-time Site Noise Levels dB $L_{Aeq, 5\ minutes, free\ field}$**
Bosworth Hall	34	25
Woodside Farm	44	29
Pebble Hall Farm	55	30
Hothorpe Hall	39	25

Note: Pebble Hall Farm is occupied by relatives of site owner and applicant

The calculated night-time site noise levels are about 5 dB $L_{Aeq, 5\ minutes, free\ field}$ lower with barrier attenuation attributable to the adjacent building, other than for Bosworth Hall which is to the west and not shielded by the building.

6 Comparison with Background Noise Levels

The assessment method in BS 4142: 1997 compares the site noise level with the background noise level, to determine the likelihood of complaints.

The following table compares the calculated daytime site noise levels from the proposed development site and associated activities to the measured daytime background noise levels, with the building as a barrier for the "gensets" other than for Bosworth Hall.

Comparison for Morning / Afternoon Periods

With Mitigation for Engines Building **Receiver Location**	**Calculated Site Noise Levels** **dB $L_{Aeq,1\ hour}$**	**Measured Background Noise Levels** **dB $L_{A90,15\ minutes}$**	**Differences** **dB $L_{Aeq,\ T}$ – dB $L_{A90,\ T}$**
Bosworth Hall	34	44 / 40	-10 / -6
Woodside Farm	44	47 / 53	-3 / -9
Pebble Hall Farm	55	42 / 48	+ 13 / +7
Hothorpe Hall	39	41 / 37	-2 / +2

Note: Pebble Hall Farm is occupied by relatives of site owner and applicant

For Bosworth Hall and Woodside Farm the calculated daytime site noise levels below the measured background noise levels for morning and afternoon periods.

For Pebble Hall Farm, the calculated daytime site noise levels are 13 and 7 dB(A) above the measured background noise levels for morning and afternoon periods.

For Hothorpe Hall, the calculated daytime site noise levels are within 2 dB(A) of the measured background noise levels for morning and afternoon periods.

For the daytime period the calculated site noise levels, other than for Pebble Hall Farm, are below 45 dB $L_{Aeq,\ 1\ hour,\ free\ field}$ and are at or below the average daytime background noise levels. For Pebble Hall Farm, the calculated site noise level for daytime is dominated by HGV movements on the access road.

The following table compares the calculated night-time site noise levels from the proposed development site and associated activities to the measured evening and night-time background noise levels, with the building as a barrier for the “gensets” other than for Bosworth Hall.

Comparison for Evening / Night-time Periods

With Mitigation for Engines Building **Receiver Location**	**Calculated Site Noise Levels** **dB $L_{Aeq,\ 5\ minutes}$**	**Measured Background Noise Levels** **dB $L_{A90,15\ minutes}$**	**Differences** **dB $L_{Aeq,\ T}$ – dB $L_{A90,\ T}$**
Bosworth Hall	25	31 / 22	-6 / +3
Woodside Farm	29	29 / 27	0 / +2
Pebble Hall Farm	30	30 / 18	0 / +12
Hothorpe Hall	25	35 / 20	-10 / + 5

Note: Pebble Hall Farm is occupied by relatives of site owner and applicant

For Bosworth Hall, the calculated night-time site noise level is 6 dB(A) below the measured background noise level for the evening period and 3 dB(A) above the measured background noise level for the night-time period.

For Woodside Farm, the calculated night-time site noise level is equal to the measured background noise level for the evening period and 2 dB(A) above the measured background noise levels for the night-time period.

For Pebble Hall Farm, the calculated night-time site noise level is equal to the measured background noise level for the evening period and 12 dB(A) above the measured background noise level for the night-time period.

For Hothorpe Hall, the calculated night-time site noise level is 10 dB(A) below the measured background noise level for the evening period and 5 dB(A) above the measured background noise level for the night-time period.

A difference of around +10 dB or more (rating level greater than background noise level) indicates that complaints are likely. A difference of around +5 dB is of marginal significance. A difference of -10 dB (rating level below background noise level) is a positive indication that complaints are unlikely.

There are limitations to the application of BS 4142. Within the Scope of the standard it is stated: "*The method is not suitable for assessing the noise measured inside buildings or when the background and rating noise levels are both very low.*

NOTE: For the purposes of this standard, background noise levels below about 30 dB and rating levels below about 35 dB are considered to be very low."

For the night-time period, background noise levels are below 30 dB $L_{A90, T}$ and the site noise levels are below 35 dB $L_{Aeq, T}$ and accordingly are considered to be very low and therefore outside the scope of BS 4142.

7 Vehicle Movements on Site Access Road

The dwelling at Pebble Hall Farm is about 40 metres from the site access road and about 50 metres to the edge of the A4304 Theddingworth Road.

Food waste is to be delivered to the site by heavy goods vehicles (HGVs) during daytime periods only, 07:00 to 17:00, with almost all of the operations and processes to take place inside buildings.

The noise climate at Pebble Hall Farm during the period 07:00 to 17:00 is and will continue to be dominated by road traffic noise on the A4304 Theddingworth Road.

Individual HGV movements on the site access road may well be audible at Pebble Hall Farm but the maximum noise levels would be similar to those arising from the passage of other HGVs on the A4304 Theddingworth Road.

8 Summary and Conclusions

Welland Waste Management Limited (WWM) currently operates a site at Pebble Hall Farm, near Theddingworth in Northamptonshire. The planning history, current operations and proposed development are described in detail in the Planning Statement prepared by GP Planning and are not reproduced in this report.

In summary, food waste is to be delivered to the site by heavy goods vehicles (HGVs) during daytime periods only, with almost all of the operations and processes to take place inside buildings. For processes that are continuous, potential impact at weekends and in particular at night will need to be considered.

The closest dwelling to the development site is Pebble Hall Farm, which is occupied by relatives of the site owner / applicant. Other dwellings in the area are at separation distances of about 600 to 1500 metres, namely on the northern side of the A4304 Theddingworth Road, on the eastern side of Husbands Bosworth, Hothorpe Hall and nearby dwellings south of Theddingworth.

Baseline noise surveys were conducted during four visits at four locations representative of the nearest noise sensitive properties. A total of sixteen sample measurements were taken over the course of the attended surveys in April 2013. In addition, a sound level meter was installed for a week at Pebble Hall Farm for largely unattended baseline noise monitoring.

Food waste is to be delivered to the site by heavy goods vehicles (HGVs) during daytime periods only, 07:00 to 17:00, with almost all of the operations and processes to take place inside buildings.

The sample measurements were undertaken between about 16:00 and 17:30 on Friday 19 April 2013; between about 22:00 and 23:30 on Monday 22 April 2013; between about 09:30 and 11:00 on Friday 26 April 2013; between about 01:30 and 03:00 on Saturday 27 April 2013. The meter at Pebble Hall Farm was installed at about 15:30 on Friday 19 April 2013 and collected at about 11:00 on Friday 26 April 2013.

In order to calculate the noise levels for the proposed development site, the contribution from each significant specific noise source has been evaluated separately and then combined together to give the overall noise level.

The nearest residential properties for which site noise calculations have been made are Pebble Hall Farm, Woodside Farm, Bosworth Hall, Hothorpe Hall.

The calculated daytime site noise levels from the proposed development site and associated activities are compared to the measured background noise levels for morning, afternoon, evening and night-time periods, with the building as a barrier for the “gensets” other than for Bosworth Hall.

For the daytime period the calculated site noise levels, other than for Pebble Hall Farm, are below 45 dB $L_{Aeq,\ 1\ hour,\ free\ field}$ and are at or below the average daytime background noise levels. For Pebble Hall Farm, the calculated site noise level for daytime is dominated by HGV movements on the access road.

The assessment method in BS 4142: 1997 compares the site noise level with the background noise level, to determine the likelihood of complaints.

For Bosworth Hall, the calculated night-time site noise level is 6 dB(A) below the measured background noise level for the evening period and 3 dB(A) above the measured background noise level for the night-time period.

For Woodside Farm, the calculated night-time site noise level is equal to the measured background noise level for the evening period and 2 dB(A) above the measured background noise levels for the night-time period.

For Pebble Hall Farm, the calculated night-time site noise level is equal to the measured background noise level for the evening period and 12 dB(A) above the measured background noise level for the night-time period.

For Hothorpe Hall, the calculated night-time site noise level is 10 dB(A) below the measured background noise level for the evening period and 5 dB(A) above the measured background noise level for the night-time period.

A difference of around +10 dB or more (rating level greater than background noise level) indicates that complaints are likely. A difference of around +5 dB is of marginal significance. A difference of -10 dB (rating level below background noise level) is a positive indication that complaints are unlikely.

There are limitations to the application of BS 4142. Within the Scope of the standard it is stated: “*The method is not suitable for assessing the noise measured inside buildings or when the background and rating noise levels are both very low.*

NOTE: For the purposes of this standard, background noise levels below about 30 dB and rating levels below about 35 dB are considered to be very low."

For the night-time period, background noise levels are below 30 dB $L_{A90, T}$ and the site noise levels are below 35 dB $L_{Aeq, T}$ and accordingly are considered to be very low and therefore outside the scope of BS 4142.

The noise climate at Pebble Hall Farm during the period 07:00 to 17:00 is and will continue to be dominated by road traffic noise on the A4304 Theddingworth Road.

Individual HGV movements on the site access road may well be audible at Pebble Hall Farm but the maximum noise levels would be similar to those arising from the passage of other HGVs on the A4304 Theddingworth Road.

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Senior Partner

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Appendix A – Glossary of Acoustic Terms

The following section describes some of the parameters that are used to quantify noise.

Decibels dB

Noise levels are measured in decibels. The decibel is the logarithmic ratio of the sound pressure to a reference pressure ($2x10^{-5}$ Pascals). The decibel scale gives a reasonable approximation to the human perception of relative loudness. In terms of human hearing, audible sounds range from the threshold of hearing (0 dB) to the threshold of pain (140 dB).

A-weighted Decibels dB(A)

The 'A'-weighting filter emulates human hearing response for low levels of sound. The filter network is incorporated electronically into sound level meters. Sound pressure levels measured using an 'A'-weighting filter have units of dB(A) which is a single figure value to represent the overall noise level for the entire frequency range.

A change of 3 dB(A) is the smallest change in noise level that is perceptible under normal listening conditions. A change of 10 dB(A) corresponds to a doubling or halving of loudness of the sound. The background noise level in a quiet bedroom may be around 20 –30 dB(A); normal speech conversation around 60 dB(A) at 1 m; noise from a very busy road around 70-80 dB(A) at 10m; the level near a pneumatic drill around 100 dB(A).

Façade Noise Level

Façade noise measurements are those undertaken near to reflective surfaces such as walls, usually at a distance of 1m from the surface. Façade noise levels at 1m from a reflective surface are normally around 3 dB greater than those obtained under freefield conditions.

Freefield Noise Level

Freefield noise measurements are those undertaken away from any reflective surfaces other than the ground

Frequency Hz

The frequency of a noise is the number of pressure variations per second, and relates to the "pitch" of the sound. Hertz (Hz) is the unit of frequency and is the same as cycles per second. Normal, healthy human hearing can detect sounds from around 20 Hz to 20 kHz.

Octave and Third-Octave Bands

Two frequencies are said to be an octave apart if the frequency of one is twice the frequency of the other. The octave bandwidth increases as the centre frequency increases. Each bandwidth is 70% of the band centre frequency.

Two frequencies are said to be a third-octave apart if the frequency of one is 1.26 times the other. The third octave bandwidth is 23% of the band centre frequency.

There are recognised octave band and third octave band centre frequencies. The octave or third-octave band sound pressure level is determined from the energy of the sound which falls within the boundaries of that particular octave of third octave band.

Appendix A (continued)

Equivalent Continuous Sound Pressure Level $L_{Aeq,T}$

The 'A'-weighted equivalent continuous sound pressure level $L_{Aeq,T}$, is a notional steady level which has the same acoustic energy as the actual fluctuating noise over the same time period T. The $L_{Aeq,T}$ unit is dominated by higher noise levels, for example, the $L_{Aeq,T}$ average of two equal time periods at, for example, 70 dB(A) and 50 dB(A) is not 60 dB(A) but 67 dB(A).

The $L_{Aeq,}$ is the chosen unit of BS 7445-1:2003 "Description and Measurement of Environmental noise".

Maximum Sound Pressure Level L_{Amax}

The L_{Amax} value describes the overall maximum 'A'-weighted sound pressure level over the measurement interval. Maximum levels are measured with either a fast or slow time weighted, denoted as $L_{Amax,f}$ or $L_{Amax,s}$ respectively.

Sound Exposure Level L_{AE} or SEL

The sound exposure level is a notional level which contains the same acoustic energy in 1 second as a varying 'A'-weighted noise level over a given period of time. It is normally used to quantify short duration noise events such as aircraft flyover or train passes.

Statistical Parameters L_N

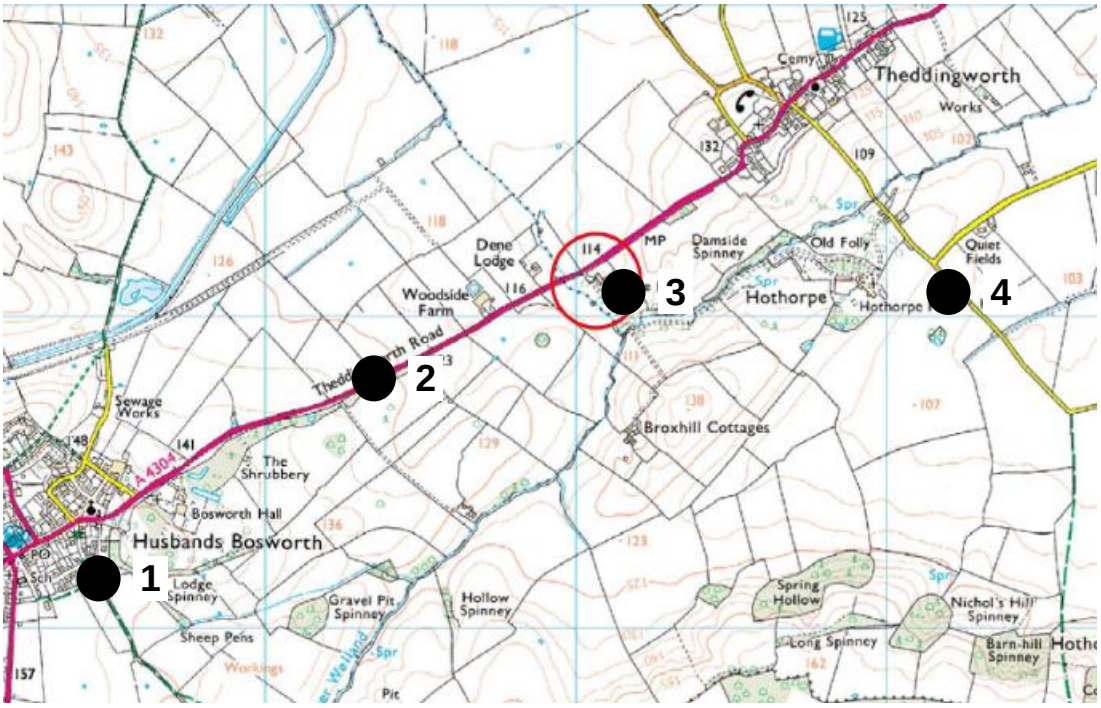
In order to cover the time variability aspects, noise can be analysed into various statistical parameters, i.e. the sound level which is exceeded for N% of the time. The most commonly used are the $L_{A01,T}$, $L_{A10,T}$ and the $L_{A90,T}$.

$L_{A01,T}$ is the 'A'-weighted level exceeded for 1% of the time interval T and is often used to gives an indication of the upper maximum level of a fluctuating noise signal.

$L_{A10,T}$ is the 'A'-weighted level exceeded for 10% of the time interval T and is often used to describe road traffic noise. It gives an indication of the upper level of a fluctuating noise signal. For high volumes of continuous traffic, the $L_{A10,T}$ unit is typically 2–3 dB(A) above the $L_{Aeq,T}$ value over the same period.

$L_{A90,T}$ is the 'A'-weighted level exceeded for 90% of the time interval T, and is often used to describe the underlying background noise level. It is defined in British Standard 4142 as the background noise unit and is used for establishing the reference against which industrial noises are assessed.

Appendix B – Site Location Plan and Measurement Positions



Location	Description
1 Husbands Bosworth	Southern end of Butts Lane, by public footpath sign
2 West of Woodside Farm	Field entrance on northern side of Theddingworth Road
3. Pebble Hall Farm	In rear garden, to south of stables / outbuildings
4. Hothorpe Road	Field entrance, south of junction to “Quiet Fields”

Appendix C – Survey Details

Date and Location of Surveys

Friday 19.04.13, Monday 22.04.13, Friday 26.04.13, Saturday 27.04.13

In the vicinity of Pebble Hall Farm, Northamptonshire

Surveys carried out by

Ms Rachel Canham (19/22/26.04.13) and Dr Richard Lyons (27.04.13)

Instrumentation used (Serial Number)

Survey Date	Sound Level Meter	Calibrator
Install Meter 19.04.13 to 26.04.13	Norsonic 116 (21628)	B&K 4230 (584690)
Friday 19.04.13	Norsonic 140 (1403137)	Norsonic 1251 (31993)
Monday 22.04.13	Norsonic 140 (1403137)	Norsonic 1251 (31993)
Friday 26.04.13	Norsonic 140 (1403136)	Norsonic 1251 (31992)
Saturday 27.04.13	Norsonic 140 (1403138)	Norsonic 1251 (31991)

Field Calibration

The sensitivity of the meter was verified on site immediately before and after the survey. The measured calibration levels were as follows:

Survey Date	Start Cal	End Cal
Install Meter 19.04.13 to 26.04.13	94.0 dB(A)	
Friday 19.04.13	113.9 dB(A)	113.8 dB(A)
Monday 22.04.13	113.9 dB(A)	113.9 dB(A)
Friday 26.04.13	113.8 dB(A)	113.7 dB(A)
Saturday 27.04.13	113.7 dB(A)	113.9 dB(A)

Monthly Calibration

The meter and calibrator are tested monthly against a Laboratory Standard Bruel and Kjaer Pistonphone, type 4220 (serial number 375806) and a Norsonic Calibrator, type 1253 (serial number 22906) with UKAS approved laboratory certificate of calibration.

Install Meter

The install meter was set to store hourly results on the hour, which are presented in tabular and graphical format in **Appendix E**.

Appendix D – Survey Results

Friday 19.04.13

Occasional showers during set up of install meter, stopped raining for sample measurements. Reasonably light winds (N), overcast becoming less cloudy during survey, around 9 degrees C.

Results dB (T = 15 minutes)

Location	Start time	$L_{Aeq, T}$	$L_{AF(max)}$	$L_{A10, T}$	$L_{A90, T}$	Comments
4 - Hothorpe Road	15:55	50	75	46	37	Stopped raining but roads damp. Distant road traffic, birdsong, distant aircraft, sheep in nearby fields, occasional bangs from direction of the site. Two passing vehicles on adjacent road, two vehicles on nearby junction.
1 - Butts Lane Husbands Bosworth	16:19	50	71	52	40	Weather dry but roads still damp. Noise due to birdsong, distant road traffic, sheep in adjacent field, light aircraft in distance and overhead, occasional dog barks, two vehicles turning.
2 - West of Woodside Farm	16:42	74	88	80	53	Noise dominated by road traffic on Theddingworth Road, also birdsong, distant aircraft, farm vehicle activity in nearby fields.
3 - Pebble Hall Farm	17:02	60	68	63	48	Noise due to road traffic on Theddingworth Road, birdsong, distant bangs, aircraft.

Appendix D (continued)

Monday 22.04.13

Overcast, dry, 10-12 degrees C, light SW breeze in most locations apart from Hothorpe Road where wind speeds ~ 5 m/s,

Results dB (T = 15 minutes)

Location	Start time	$L_{Aeq, T}$	$L_{AF(max)}$	$L_{A10, T}$	$L_{A90, T}$	Comments
3 - Pebble Hall Farm	22:09	49	67	51	30	Noise due to distant road traffic, occasional vehicles on Theddingworth Road, distant aircraft, rustling leaves / wind in trees, distant bleating from sheep in fields
4 - Hothorpe Road	22:33	46	70	49	35	Quite breezy at this location, ~ 5 m/s. Noise due to rustling leaves/ wind in trees/ wind noise, very distant road traffic noise, distant animal/bird calls
2 - West of Woodside Farm	22:58	60	84	50	29	Noise due to intermittent / occasional vehicles on Theddingworth Road, distant church bells, wind in trees/ rustling foliage, distant aircraft, noise from livestock in fields
1 - Butts Lane Husbands Bosworth	23:20	44	67	45	31	Noise due to road traffic on A5199, lots of bleating from sheep and lambs in adjacent field, distant aircraft, some wind noise / rustling leaves

Appendix D (continued)

Friday 26.04.13

Cloudy, mainly dry with occasional light showers/hail, 8 degrees C, westerly breeze, 2-3 m/s

Results dB (T = 15 minutes)

Location	Start time	$L_{Aeq, T}$	$L_{AF(max)}$	$L_{A10, T}$	$L_{A90, T}$	Comments
1 - Butts Lane Husbands Bosworth	09:22	48	71	51	44	Noise due to birdsong, distant traffic, local activity from adjacent houses, sheep in field, cock crowing, rustling leaves
2 - West of Woodside Farm	09:44	73	87	78	47	Noise due to road traffic, birdsong, distant farming activity, distant aircraft, rustling leaves
4 - Hothorpe Road	10:14	45	63	47	41	Brief rain shower during sample. Noise due to distant road traffic, distant aircraft, birdsong, sheep in field, distant reversing beepers, distant bangs (bird scarers?), bangs/clanks from Hothorpe Hall
3 - Pebble Hall Farm	10:41	57	69	62	42	Brief rain / hail shower at end of sample. Noise due to road traffic, birdsong, sheep in field, distant bangs, distant aircraft

Appendix D (continued)

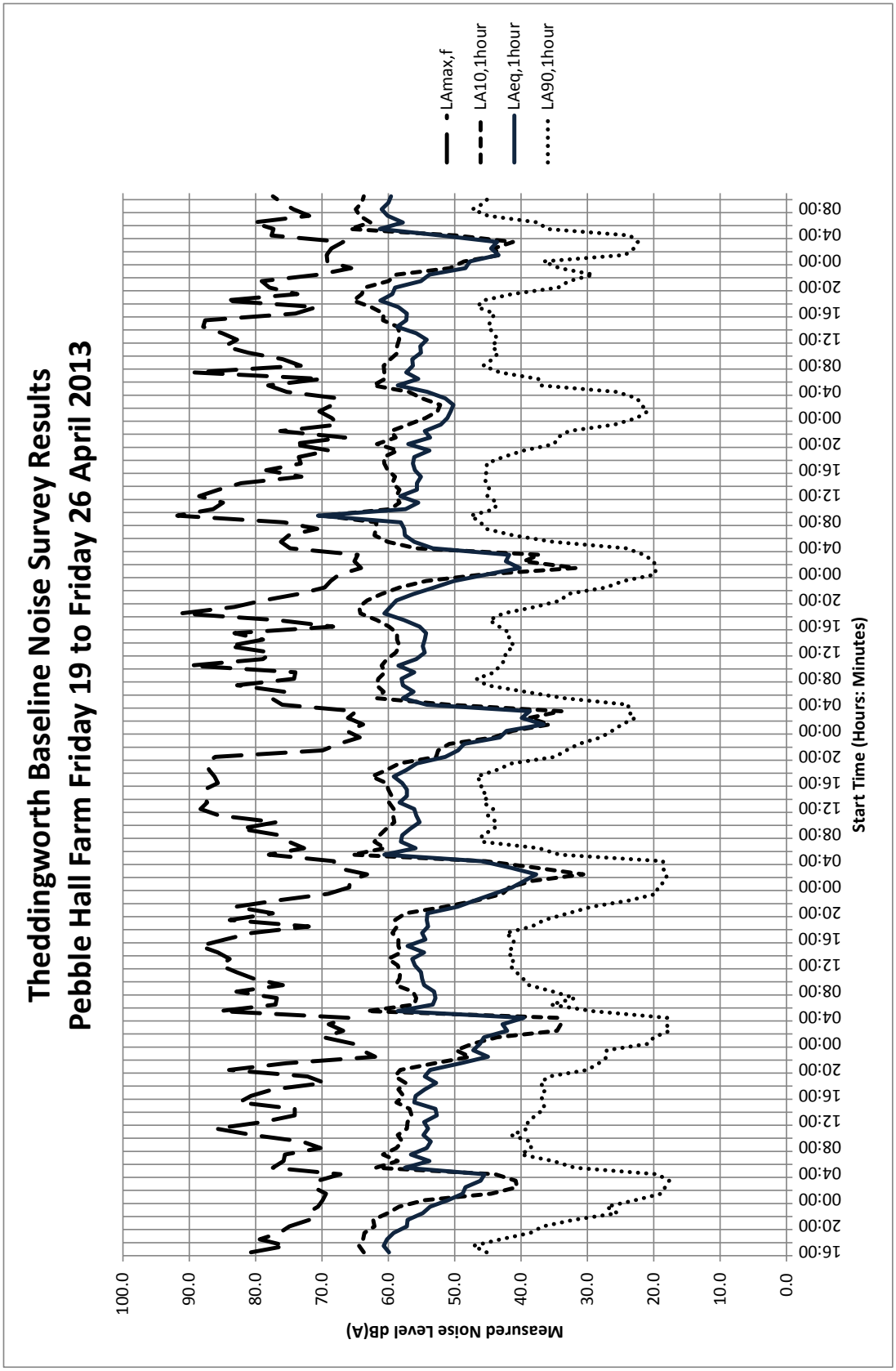
Saturday 27.04.13

Dry, partial cloud, 2-3 degrees C, winds initially calm <1m/s and 3-4m/s mid-survey

Results dB (T = 15 minutes)

Location	Start time	$L_{Aeq, T}$	$L_{AF(max)}$	$L_{A10, T}$	$L_{A90, T}$	Comments
4 - Hothorpe Road	01:31	29	46	33	20	Distant occasional vehicles on Theddingworth Road;distant sheep bleeting; dog barking in distance; owl hoots; distant aircraft movement; dull thuds from ENE.
3 - Pebble Hall Farm	01:58	46	66	47	18	Owl hoots; distant sheep bleats; distant road traffic, intermittent vehicles on Theddingworth Road; fox baying; occasional birdcalls; distant church bell chimes; dull thud in distance.
2 - West of Woodside Farm	02:23	56	82	40	27	Breeze in trees; owl hoots; birdcalls; distant RT; occasional vehicles on Theddingworth Road; distant aircraft movement.
1 - Butts Lane Husbands Bosworth	02:46	30	46	33	22	Distant road traffic on Theddingworth Road and to West; breeze in trees; distant sheep bleats; owl hoots; church bell chimes; birdsong

Appendix E – Unattended Noise Survey Results



Appendix E (continued)

Start time	$L_{Aeq, T}$	$L_{AF(max)}$	$L_{A10, T}$	$L_{A90, T}$
16:00	60	81	64	45
17:00	61	75	64	47
18:00	60	79	64	43
19:00	59	76	64	39
20:00	57	75	62	37
21:00	57	72	62	32
22:00	55	72	60	26
23:00	54	71	58	27
00:00	51	70	55	23
01:00	49	69	45	19
02:00	48	71	41	18
03:00	46	71	41	18
04:00	46	67	44	20
05:00	58	77	62	32
06:00	54	76	59	35
07:00	57	76	61	40
08:00	54	70	59	39
09:00	54	73	58	39
10:00	55	80	59	42
11:00	54	86	57	39
12:00	55	79	57	39
13:00	53	74	57	38
14:00	53	74	57	37
15:00	56	83	59	37
16:00	56	81	58	37
17:00	55	77	59	36
18:00	53	70	57	37
19:00	55	72	59	36
20:00	54	84	58	30
21:00	49	75	53	28
22:00	45	62	48	27
23:00	47	64	50	27
00:00	46	65	47	21
01:00	46	70	44	20
02:00	42	67	35	18
03:00	43	69	34	18
04:00	40	66	35	18
05:00	59	85	63	29
06:00	53	77	56	36
07:00	53	77	56	32
08:00	53	83	56	35

Start time	$L_{Aeq, T}$	$L_{AF(max)}$	$L_{A10, T}$	$L_{A90, T}$
09:00	55	76	59	39
10:00	55	80	58	40
11:00	55	83	58	41
12:00	56	85	59	42
13:00	56	84	60	41
14:00	55	86	58	42
15:00	57	88	59	41
16:00	54	85	59	41
17:00	55	81	59	42
18:00	54	72	59	38
19:00	54	84	59	37
20:00	54	77	57	33
21:00	50	83	52	29
22:00	47	77	47	24
23:00	44	69	43	20
00:00	41	66	42	19
01:00	40	66	38	18
02:00	38	63	31	18
03:00	42	68	38	19
04:00	46	68	45	19
05:00	61	78	65	34
06:00	56	73	61	37
07:00	58	75	62	46
08:00	58	76	61	46
09:00	57	82	60	44
10:00	55	77	59	44
11:00	56	86	59	45
12:00	56	88	59	44
13:00	58	87	60	46
14:00	57	88	60	45
15:00	57	88	60	46
16:00	58	86	60	46
17:00	59	86	63	47
18:00	57	87	60	44
19:00	56	88	58	41
20:00	51	86	53	35
21:00	50	70	53	33
22:00	49	68	51	31
23:00	43	64	44	28
00:00	42	66	41	26
01:00	37	64	36	25
02:00	40	66	39	23

Start time	$L_{Aeq, T}$	$L_{AF(max)}$	$L_{A10, T}$	$L_{A90, T}$
03:00	39	65	34	24
04:00	54	76	51	24
05:00	58	78	62	33
06:00	56	76	61	39
07:00	58	83	62	45
08:00	58	74	62	47
09:00	56	74	61	44
10:00	59	90	61	43
11:00	56	79	60	42
12:00	55	78	59	42
13:00	55	84	58	41
14:00	55	79	59	42
15:00	54	83	59	42
16:00	55	68	60	43
17:00	58	77	62	45
18:00	61	91	64	43
19:00	60	83	64	38
20:00	59	79	63	34
21:00	56	74	61	33
22:00	53	70	58	27
23:00	50	69	54	25
00:00	45	67	46	20
01:00	40	64	32	20
02:00	42	65	40	20
03:00	42	65	37	22
04:00	53	75	56	24
05:00	56	76	60	35
06:00	58	75	62	41
07:00	58	71	62	45
08:00	58	76	62	46
09:00	71	92	70	48
10:00	57	86	60	44
11:00	56	85	58	44
12:00	58	89	59	45
13:00	56	86	58	45
14:00	56	82	59	45
15:00	55	73	59	46
16:00	56	78	60	45
17:00	56	73	61	45
18:00	56	74	61	43
19:00	54	69	59	40
20:00	57	75	62	35

Start time	$L_{Aeq, T}$	$L_{AF(max)}$	$L_{A10, T}$	$L_{A90, T}$
21:00	54	67	59	35
22:00	55	76	60	33
23:00	52	68	57	26
00:00	51	69	54	23
01:00	51	70	53	21
02:00	50	68	52	22
03:00	51	68	55	23
04:00	54	75	57	26
05:00	59	78	62	37
06:00	56	70	61	37
07:00	57	89	61	43
08:00	56	73	61	46
09:00	56	76	60	44
10:00	55	81	59	43
11:00	55	85	59	44
12:00	54	83	58	44
13:00	56	85	58	44
14:00	59	88	59	45
15:00	57	88	61	45
16:00	57	74	61	44
17:00	59	71	63	47
18:00	61	85	65	46
19:00	59	74	64	41
20:00	59	78	64	34
21:00	55	79	60	33
22:00	54	71	59	29
23:00	48	66	51	34
00:00	48	69	49	37
01:00	43	69	43	24
02:00	45	69	44	23
03:00	44	67	41	22
04:00	52	78	50	24
05:00	61	77	66	36
06:00	58	80	63	37
07:00	60	72	64	45
08:00	61	74	65	47
09:00	60	76	64	46
10:00	60	77	64	45

Appendix F – Noise Calculation Method and Calculation Sheet

Specific noise levels are predicted or measured in terms of the Equivalent Continuous Noise Level, $L_{Aeq,T}$ over a given reference time interval, T. In the Technical Guidance document to the NPPF the time interval for daytime, evening and night the reference time interval is 1 hour. In BS 4142: 1997 the reference time interval for daytime is 1 hour and for night-time is 5 minutes, although the periods for daytime and night-time are not defined.

The calculation method for any plant which is relatively fixed in location is that set out in BS 5228: 2009 Part 1, Annex F, and is the "Method for activity L_{Aeq}" described in section F.2.2 or the "Method for plant sound power level" described in section F.2.3.

The calculation method for site mobile plant such as lorries is that set out in BS5228: 2009: Part 1, Annex F, and is the "Method for mobile plant using a regular well defined route (e. g. haul roads)" described in section F. 2. 5.

Ground Absorption has been assumed as 90% soft ground between the proposed development site and the receiver locations.

The method of assessing screening is that attributed to Maekawa as used in BS 5228: 2009 and various other Government published documents. This method uses the calculated path difference and octave band noise data for each noise source over the frequency range stated in BS 5228: 2009.

The effects of ground absorption are not used in the calculations if screening has been assessed and offers a higher attenuation.

The nearest distances to the respective dwellings, from the various items of plant, have been used in an acoustic model for the site to calculate the reasonable worst case $L_{Aeq,T}$ site noise levels.

A summary site noise calculation sheet for one of the receiver locations is included below.

	WELLAND WASTE MANAGEMENT	**4169**	**24-May-13**	PWC			Wind Correction :	2	dB(A)						
							Receiver Height :	4.0	m						
	PEBBLE HALL FARM THEDDINGWORTH	**FOOD WASTE PROCESSING & ELECTRICITY GENERATION**					Building / Barrier Height :	5	m						
		Comments on Sound Power Levels &		Activity	Power LWA		Capacity	Source		2 way flow	Speed			BS5228	
Ref	Plant Item	Attenuation assumed for buildings		LAeq @ 10 m	or LWA / m	On-time %	Tonnes	Height		Q per hour	V kph	Plant Set back(m)		method	
1	CHP genset in ISO container (1) fans / louvre	70 dB(A) at 1 m	manufacturer guarantee	66	94	100		2				0	m back	1	Activity
2	CHP genset in ISO container (2) fans / louvre	70 dB(A) at 1 m	manufacturer guarantee	66	94	100		2				0	m back	1	Activity
3	CHP genset in ISO container (3) fans / louvre	70 dB(A) at 1 m	manufacturer guarantee	66	94	100		2				0	m back	1	Activity
4	CHP genset in ISO container (4) fans / louvre	70 dB(A) at 1 m	manufacturer guarantee	66	94	100		2				0	m back	1	Activity
5	Stack exhaust (one for each of four sets)	70 dB(A) at 1 m	manufacturer guarantee	59	87	100		10				0	m back	1	Activity
6	Reception building walls	108 dB LWA	-25 dB for building	55	83	100		6				0	m back	1	Activity
7	Reception building roof	108 dB LWA	-25 dB for building	55	83	100		9				0	m back	1	Activity
8	Reception building exhaust	70 dB(A) at 1 m		53	81	100		10				0	m back	1	Activity
9	Reception building door	Daytime only	-10 dB for open door	70	98	100		2				0	m back	1	Activity
10	Digester building walls	108 dB LWA	-25 dB for building	55	83	100		6				0	m back	1	Activity
11	Digester building roof	108 dB LWA	-25 dB for building	55	83	100		9				0	m back	1	Activity
12	Digester building door	Daytime only	-10 dB for open door	70	98	100		2				0	m back	1	Activity
13	Slurry tanker	Daytime only	Outside buildings	78	106	100		3				0	m back	1	Activity
14	HGV movements	Daytime only		76	104	100		2		12	15	0	m back	4	Haul Road
15	Source 15 (spare Plant Item)			-1027	-999	100		2				0	m back	1	Activity
	Location No.	**1**	**Pebble Hall Farm**												
	Receiver Height	4.0	m AOD												
	Site Noise Level for Items 1 to 14	**55**	**dB LAeq, 1 hour, free field**		Daytime (Receiver Height 1.5 m)										
	Site Noise Level for Items 1 to 8, 10 & 11	**30**	**dB LAeq, 5 minutes, free field**		Night-time (Receiver Height 4.0 m)										

Ref	**Plant Item**	Plan	Working	Ground	Working	Source	Angle	Range	Barrier	Barrier	Path	Barrier	Soft	Ground	Resultant
		Distance	Distance	Height	Height/depth	Height	Degrees	Metres	-Receiver	Height	Diff.	Atten.	Ground %	Atten.	LAeq
1	**CHP genset in ISO container (1) fans / louvre**	500	500	0.0	0.0	2.0	0	0	480	5.0	0.221	15.1	90.0	4.9	18.9
2	**CHP genset in ISO container (2) fans / louvre**	500	500	0.0	0.0	2.0	0	0	480	5.0	0.221	15.1	90.0	4.9	18.9
3	**CHP genset in ISO container (3) fans / louvre**	500	500	0.0	0.0	2.0	0	0	480	5.0	0.221	15.1	90.0	4.9	18.9
4	**CHP genset in ISO container (4) fans / louvre**	500	500	0.0	0.0	2.0	0	0	480	5.0	0.221	15.1	90.0	4.9	18.9
5	**Stack exhaust (one for each of four sets)**	500	500	0.0	0.0	10.0	0	0	480	5.0	-0.581	0.0	90.0	2.2	24.8
6	**Reception building walls**	500	500	0.0	0.0	6.0	0	0	0	0.0	-1.000	0.0	90.0	4.0	19.0
7	**Reception building roof**	500	500	0.0	0.0	9.0	0	0	0	0.0	-1.000	0.0	90.0	2.7	20.3
8	**Reception building exhaust**	500	500	0.0	0.0	10.0	0	0	0	0.0	-1.000	0.0	90.0	2.2	18.8
9	Reception building door	500	500	0.0	0.0	2.0	0	0	0	0.0	-1.000	0.0	90.0	4.9	33.1
10	**Digester building walls**	500	500	0.0	0.0	6.0	0	0	0	0.0	-1.000	0.0	90.0	4.0	19.0
11	**Digester building roof**	500	500	0.0	0.0	9.0	0	0	0	0.0	-1.000	0.0	90.0	2.7	20.3
12	Digester building door	500	500	0.0	0.0	2.0	0	0	0	0.0	-1.000	0.0	90.0	4.9	33.1
13	Slurry tanker	500	500	0.0	0.0	3.0	0	0	0	0.0	-1.000	0.0	90.0	4.9	41.1
14	HGV movements	40	40	0.0	0.0	2.0	130	0	0	0.0	-1.000	0.0	0.0	0.0	54.6
15	Source 15 (spare Plant Item)	10000	10000	0.0	0.0	2.0	0	0	0	0.0	-1.000	0.0	0.0	0.0	-1085.0