J003367/4940/2/TD

20th July 2021

ACOUSTIC
CONSULTANTS

Gradwells Farm, Great Eccleston, PR3 0YN
Residential Development
Ambient Noise & Building Envelope Assessment

architectural

environmental

occupational

industrial

noise control at source

project management

planning

legal services

expert witness

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CONTENTS

1.0 SUMMARY

At the request of CFM Consultants Ltd, PDA Ltd has carried out a noise impact assessment for the proposed residential development at Gradwells Farm, Copp Lane, Great Eccleston, PR3 0YN. Currently the proposed site consists of open farmland.

The suitability of the site for residential development in regards to noise has been assessed against the recommended design criteria of WHO Guidelines for Community Noise 1999 & BS 8233:2014.

Noise egress across site has been modelled based on results of a previous noise survey conducted in relation to the adjacent potential residential development to Copp Lane (planning application ref 19/00860/OULMAJ).

Internal and external ambient noise levels for the proposed residential properties have been calculated based on the results of the noise survey and estimated dimensions for the room volumes and external façade/window areas.

To achieve the WHO 1999 & BS 8233 design criteria regarding internal noise levels, suitable minimum noise insulation specifications have been derived for the windows and trickle ventilators of each residential property.

All external amenity gardens to the proposed residential properties are expected to achieve the recommended BS 8233, 50 and/or 55 dBA criteria.

All results are presented in this report.

PDA calculations for internal noise levels have been based on assumed construction details and room dimensions as described in Sections 5.2-5.3 of this report. CFM Consultants Ltd should check these construction details and inform PDA of any discrepancies as these could influence the conclusions of this report.

2.0 SITE DESCRIPTION

The proposed site for the development is located at Gradwells Farm, Copp Lane, Great Eccleston, PR3 0YN. Predominantly the proposed site consists of open farmland.

The north and west site boundary is shared with another proposed residential development, planning application ref 19/00860/OULMAJ). The Garstang Rd runs approximately 250m to the northern most boundary. Copp Lane is adjacent the southernmost boundary.

An overview of the proposed site is depicted in Figures 1&2 below:

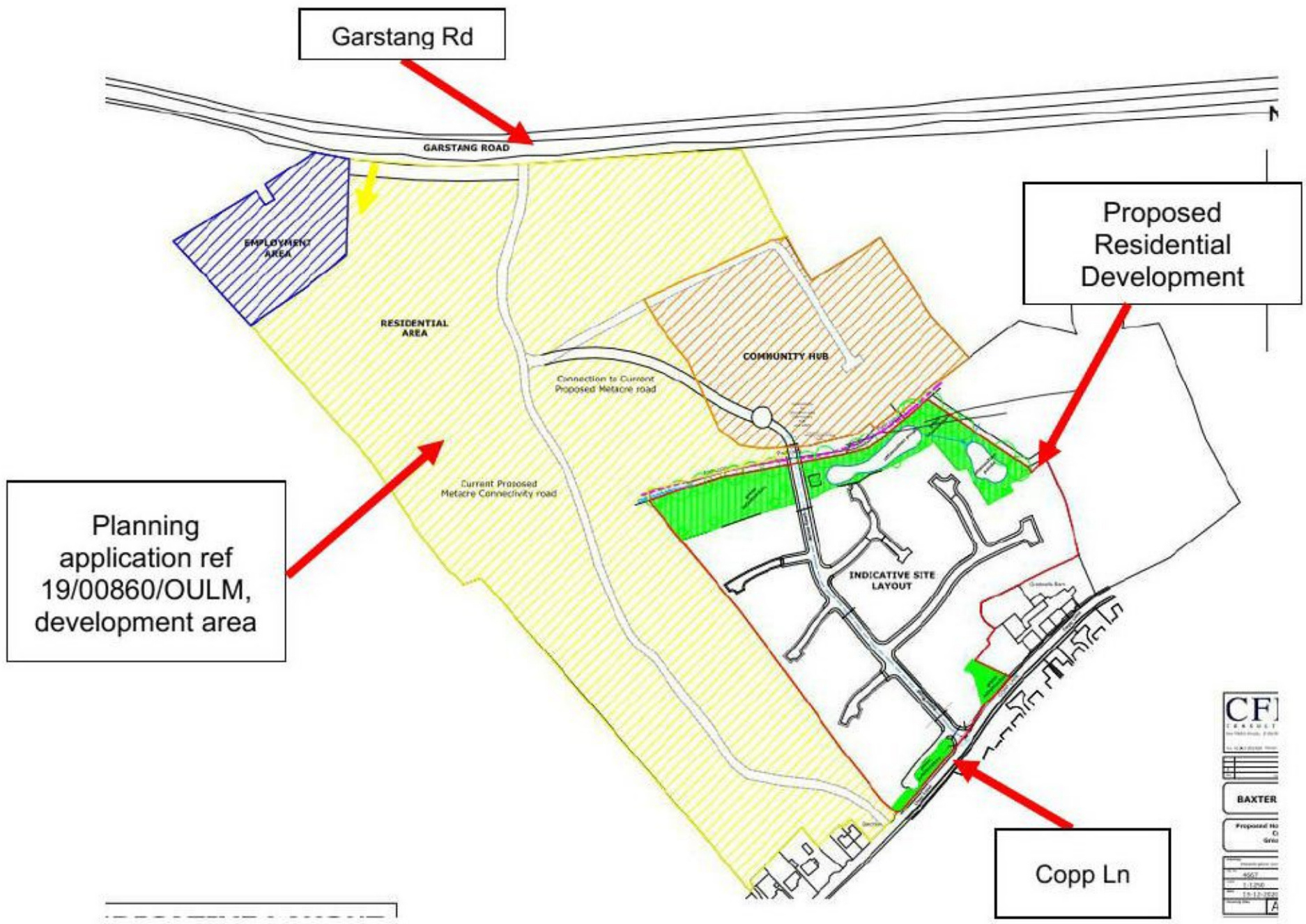

Figure 1: Site for development, boundary is marked red.

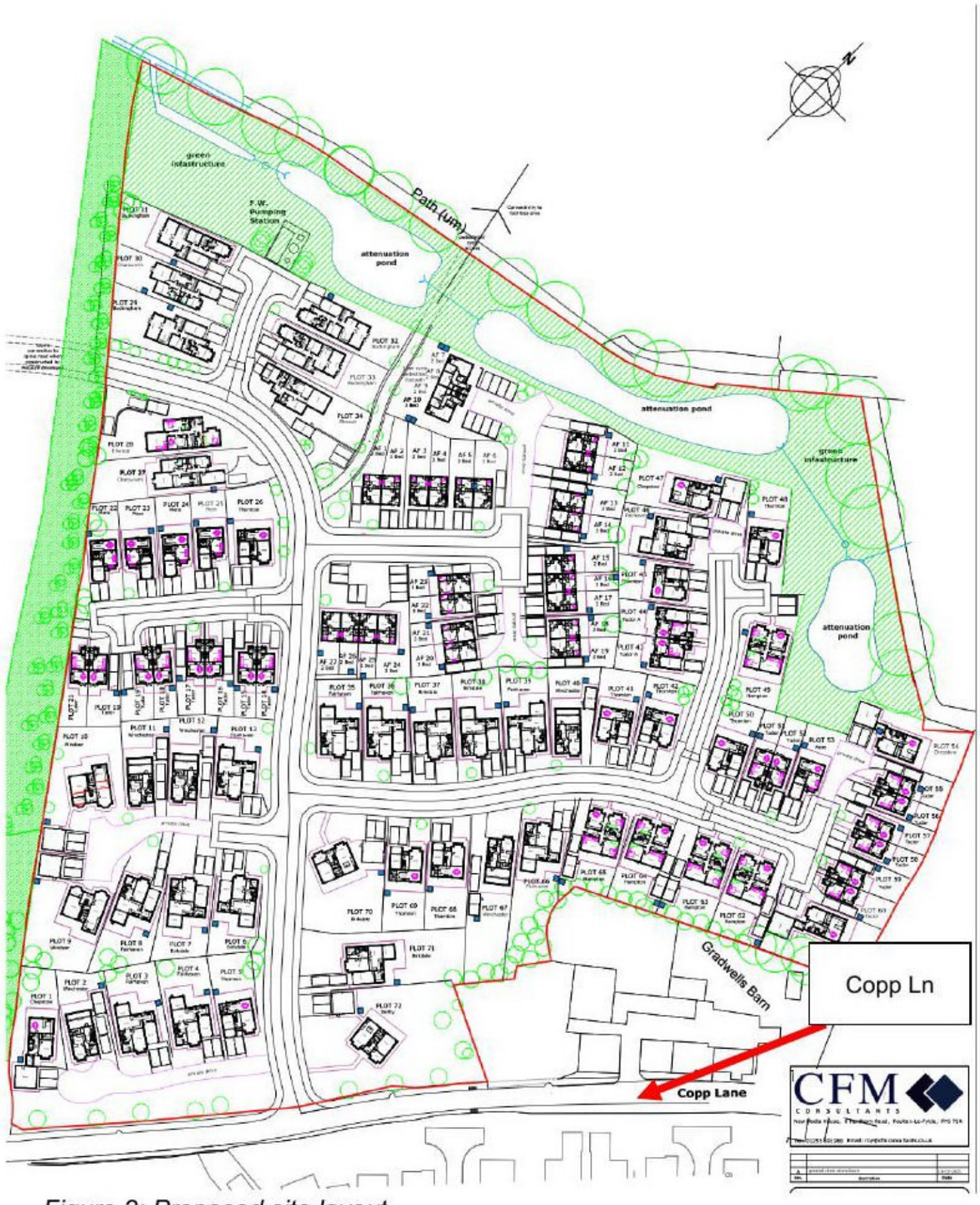

Figure 2: Proposed site layout

3.0 ASSESSMENT CRITERIA

3.1 National Planning Policy Framework (NPPF)

National Planning Policy is guided by the National Planning Policy Framework (NPPF) updated in June 2019. With regard to Noise the Framework states the following;

Planning policies and decisions should contribute to and enhance the natural and local environment by:

- *preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability.*

Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- *mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
- *identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.*

The terms '*significant adverse impact*' and '*adverse impact*' are defined in the explanatory notes of the 'Noise Policy Statement for England (NPSE) which states;

There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:

NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur.

The notes also offer an explanation of the term 'adverse impacts' as follows;

… refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such adverse effects cannot occur.

Although no specific noise limits for LOAEL and SOAEL have been defined, in 2014 the UK Government published a planning practice guidance document for noise which indicates where these limits fall with relation to the perception of noise, updated in July 2019. A summary is reproduced in Section 4.2 below, and the full document is published at https://www.gov.uk/guidance/noise--2. It is considered that guidance from other acoustic standards may be employed to determine suitable levels within the overall principal of the National Planning Policy Framework.

3.2 Planning Practice Guidance – Noise

The UK Planning Practice Guidance on noise offers further guidance on the typical levels which constitute the NOEL, LOAEL and SOAEL, reproduced in the table below;

Table 1: Planning Practice noise level guidance

Response	Examples of Outcomes	Increasing Effect Level	Action
-	-	No Observed Effect Level	-
Not present	No Effect	No Observed Effect	No specific measures required
-	-	No Observed Adverse Effect Level	-
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
-	-	Lowest Observed Adverse Effect Level	-
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

3.3 BS8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings

Dwelling houses, flats and rooms in residential use

British Standard 8233:2014, *Guidance on Sound Insulation and noise reduction for buildings*, gives guidance on internal noise levels within dwellings, flats and rooms in residential use when unoccupied. The following criteria are for Living and Dining Rooms for daytime use and Bedrooms for night time.

Table 2: BS8233 recommended indoor ambient noise levels

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	–
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	–
Sleeping (daytime resting)	Bedrooms	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

It should however be stressed that the above criterion relates to steady noise, in this case from road traffic etc., excluding unusual noise events departing from the typical noise character of the area.

In addition BS 8233 suggests, '*regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values'.*

With regard to gardens and external areas, BS 8233:2014 (section 7.7.3.2) gives the following advice:

For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50dB $L_{Aeq,T,}$ with an upper guideline value of 55dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.

3.4 WHO Guidelines for Community Noise

In 1999, the WHO (World Health Organisation) published Guidelines for Community Noise, stating the following internal noise levels are applicable within dwellings.

Table 3: WHO Guidelines for Community Noise criteria

Specific Environment	Critical Health Effect(s)	L_{Aeq} dB	Time Base (hours)*
Dwelling, indoors	Speech intelligibility & moderate annoyance, daytime & evening	35	16
Inside bedrooms	Sleep disturbance, night time	30	8

* Typically taken to be daytime/evening - 07:00 – 23:00 hours and night time 23:00 – 07:00 hours.

In addition to the above continuous equivalent noise levels, WHO guidelines indicates that exceedances of 45 dB L_{Amax} for single sound events should be limited to no more than 10 – 15 times per night, when measured with a 'fast' time weighting.

4.0 SURVEY DETAILS AND RESULTS

4.1 Previous noise survey

A previous noise survey was conducted to Copp Ln and Garstang Rd in 2019 by PDA Ltd, in relation to the adjacent potential residential development site to the west site boundary of the proposed development considered by this report. *(Adjacent site planning application ref 19/00860/OULMAJ, noise report ref J002579/3933/2/TD, dated August 2019)*. As the site is adjacent to the site considered by PDA report J002579/3933/2/TD and similarly Copp Ln runs to the south site boundary, the results of the previous noise survey are considered suitable for the purposes of modelling noise egress across the development considered by this report. The full noise survey results are available in PDA Ltd report J002579/3933/2/TD, dated August 2019. A summary of the noise survey method and results is provided below.

4.1.1 Noise Survey Details

A noise level survey was conducted at site over a period of circa 24 hours between 10:55 hours on Thursday 25th July and 11:30 hours on Friday 26th July 2019. All measurements were made and partially attended by Wesley Charlton of PDA Ltd.

Noise level measurements were conducted at two fixed positions (N1 & N2 Figure 3).

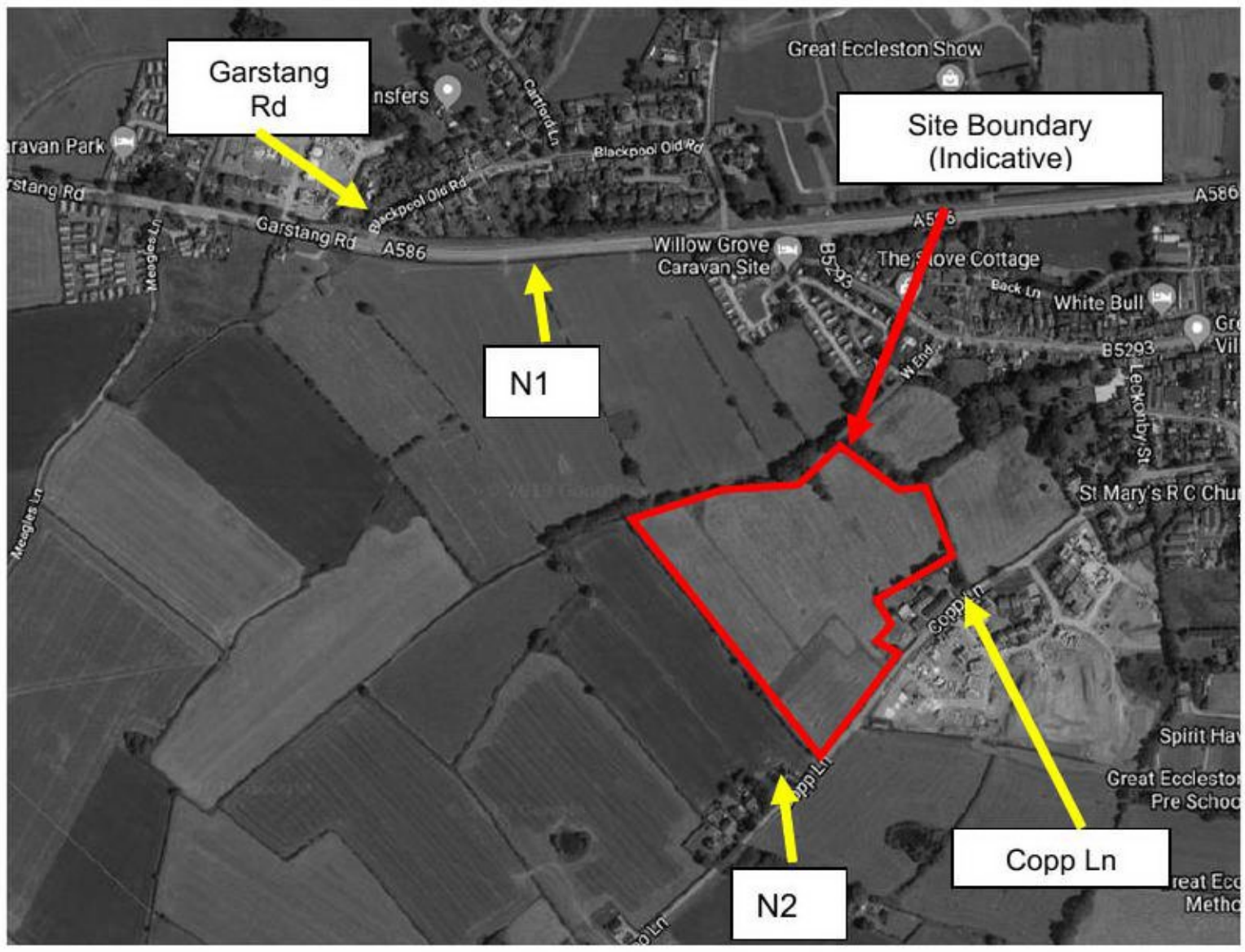

Figure 3: Noise Survey, Measurement Locations

A description of the noise monitoring positions and noise meters employed at each position is given below.

- N1– North site boundary, adjacent Garstang Rd.
- N2– South site boundary, adjacent Copp Ln.

In accordance with IEC 61672-1:2002 both noise meters have a class 1 frequency response and can operate as an integrating sound level meter with frequency analysis and statistical functions.

The noise meters were set to measure 'A' weighted, broadband and octave band sound pressure levels and various statistical parameters. All noise measurements were made at a height of 1.5m utilising a 5-minute sampling period. The meters were field calibrated to 94dB at 1kHz both before and after each measurement, in addition to this a valid calibration certificate is held for both meters and calibrators. It was ensured that the sound level meters were fitted with windshields at all times.

Audio recordings were made throughout the survey.

4.1.2 Description of Noise Sources

The ambient noise climate at both positions was dominated by noise from traffic sources. The majority of traffic noise originated from Garstang Rd. Other noise sources observed include birdsong and occasional noise from pedestrians.

4.2 Measured Noise Results

Full details of the measured results are available in PDA Ltd report ref J002579/3933/2/TD, dated August 2019, planning application ref 19/00860/OULMAJ.

A summary of the measured noise levels is given in Table 4 below.

Table 4: Summary of Long-Term noise measurements

Measurement Location	$L_{Aeq,16hr}$ (07:00-23:00) dBA	$L_{Aeq,8hr}$ (23:00-07:00) dBA	11th Greatest L_{Amax} (23:00-07:00) dBA
N1	67	61	81
N2	61	50	75

5.0 INTERNAL NOISE LEVELS, NOISE BREAK-IN CALCULATIONS & MITIGATION

5.1 Break-In Calculations Method

An assessment of the required acoustic insulation performance for the residential façades has been conducted. The assessment has been based on achieving the internal ambient acoustic conditions specified in Section 3 to this report.

The design for the final site layout has not been finalised at this point. To provide an initial acoustic specification for the windows/glazing, noise levels incident to the new residential properties have been modelled across the site based on the current proposed site layout design. It should be noted that the noise levels incident to each property will be dependent on the final site layout. Revisions to proposed glazing and ventilation strategies may therefore be required once the design for site layout has been confirmed.

Results from the noise survey have been used to inform a Sound Plan (SP) computer model which predicts the external noise levels at the façades of the properties of the new development and the noise levels in the external areas to each property. This software has been set up to model the sources by taking into account for all reflections and shielding around the site. Please note that the calculations follow the methodology detailed within ISO 9613-2 Acoustics - Attenuation of sound during propagation outdoors – Part 2: General method of calculation.

An overview of the model is depicted below.

Figure 3: SP Model Overview

The results from the SP model have been used to calculate the internal noise levels within the proposed new properties.

Internal noise levels have been determined by calculating the noise break-in through the façade elements in octave frequency bands from 63 Hz – 8kHz. The internal noise levels have been determined, taking into account the sound insulation and area of each element, the room volume and reverberation time, and finally A-weighting the resulting spectrum to determine the internal noise levels. In accordance with the reverberation time standardisation detailed within ISO 140-4 the reverberation time within residential habitable rooms is assumed to be 0.5 seconds.

Minimum acoustic specifications have been identified for the glazing and trickle ventilators. These have been summarised as detailed in Sections 5.4 below.

5.2 External Walls

The following construction details have been assumed for our calculations for all rooms within the residential properties.

Table 5: Sound Reduction Indices, Basic Façade Construction, Break In Calculations

Façade Construction	**Brickwork outer leaf, cavity with mineral wool, blockwork, plasterboard layer inner leaf**							
Frequency	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Sound Reduction Index, R, dB	40	45	46	45	54	64	75	70

The sound insulation properties for the basic building envelope construction have been taken from Insul (sound insulation modelling software).

5.3 Room Dimensions & Volumes

The following room dimensions & volumes have been assumed for our calculations for all residential properties.

Table 6: Estimated Room Dimensions

Room	**External Wall Area m^2**	**Window Area m^2**	**Room Volume m^3**
Bedroom	8.1	1.5	28
Lounge	6.0	6.0	48
Kitchen/Diner	6.0	6.0	48

5.4 Mitigation Strategies

Based on the results of the SP model, residential properties will achieve the recommended internal ambient noise levels within all habitable rooms utilising the following mitigation strategies.

Table 7: Bedrooms, Minimum Acoustic Specification

Windows/Glazing Noise Insulation								
Typical Product	***Minimum Sound Reduction Index R (dB) at Octave Band Centre Frequency (Hz)***							***R_w***
	63	***125***	***250***	***500***	***1000***	***2000***	***4000***	
4/12/4	20	24	20	25	35	38	35	31
Ventilation Noise Insulation								
Typical Product	***Minimum D_{ne} (dB) at Octave Band Centre Frequency (Hz)***							***$D_{ne,w}$***
	63	***125***	***250***	***500***	***1000***	***2000***	***4000***	
Simon Framevent	32	36	33	33	31	29	31	31

Table 8: Living Rooms/Kitchens, Minimum Acoustic Specification

Windows/Glazing Noise Insulation								
Typical Product	***Minimum Sound Reduction Index R (dB) at Octave Band Centre Frequency (Hz)***							***R_w***
	63	***125***	***250***	***500***	***1000***	***2000***	***4000***	
4/12/4	20	24	20	25	35	38	35	31
Ventilation Noise Insulation								
Typical Product	***Minimum D_{ne} (dB) at Octave Band Centre Frequency (Hz)***							***$D_{ne,w}$***
	63	***125***	***250***	***500***	***1000***	***2000***	***4000***	
Simon Airstrip 300	23	28	26	26	29	29	29	29

5.5 Further Details on Glazing & Ventilators

Notes on Glazing Insulation

For the glazing specifications in Tables 8-9, all sound insulation values quoted above must be achieved by the overall combination of frame and glazing, and not just by the glazing alone. The frame should not reduce the performance of the system overall.

Glazing framing systems must be fully sealed with any small gaps (<10mm nominal) around the perimeter to be stuffed with dense mineral wool to full frame depth and sealed both sides with acoustic non-setting mastic, with additional weathering protection to be applied additionally externally to this. No gaps should be left unsealed.

Notes on Ventilation Insulation

The ventilator inlets described in Tables 8-9, are calculated to provide adequate sound insulation to maintain internal noise levels compliant with the guidance criteria when used in conjunction with the specified glazing described in Tables 8-9. Selected ventilation inlets should provide equal or greater sound insulation performance across the frequency range to the values in Tables 8-9. Specifications are based on the use of one (1) ventilator per room only.

The acoustic specification relates to the combined performance of all ventilation elements. Where two or more ventilators are required to meet the ventilation requirement, the acoustic performance for a single ventilator must be selected so that the combined performance is as stated in the Tables 8-9. As an example, to achieve an overall acoustic insulation performance of $D_{n,e,w}$ 31 dB utilising two ventilators in a single wall, both individual ventilators should be rated at $D_{n,e,w}$ 34 dB. Requirements should be checked with the manufacturer.

Please note that the specification of vents is in terms of acoustic performance only. It should be checked by others that the ventilation requirements of the Building Regulations are also met.

Fan-assisted ventilation systems it should be reviewed to ensure that the fan itself does not exceed the noise criteria as specified in Section 3.

5.5.1 Break-In Noise Calculations Results

Based on mitigation strategies as outlined in Section 5.4 being implemented into the final building envelope design the following predicted internal noise levels have been calculated. The calculated noise levels as presented below are based on worst affected residential property in regards to noise egress from Copp Ln.

Table 10: Calculated Internal Ambient Noise levels With Mitigation Strategy

Room Type	$L_{Aeq16hr}$, Day Time,(07:00-23:00), dBA	L_{Aeq8hr}, Night Time,(23:00-07:00), dBA	L_{AMax}, Night Time,(23:00-07:00), dBA
Bedroom	33	24	45
Lounge	34	-	-
Kitchen/Dining	34	-	-

As can be seen from Table 10, with the implication of the mitigation strategy as outlined in Section 5.4 of this report, the internal ambient noise levels are expected to be within the internal noise level limits as recommended by WHO 1999 & BS 8233.

6.0 EXTERNAL AMBIENT NOISE LEVELS

The SP Model as detailed in Section 5.1 has been utilised to predict the external noise levels to the proposed residential dwellings. An overview of the model is provided below.

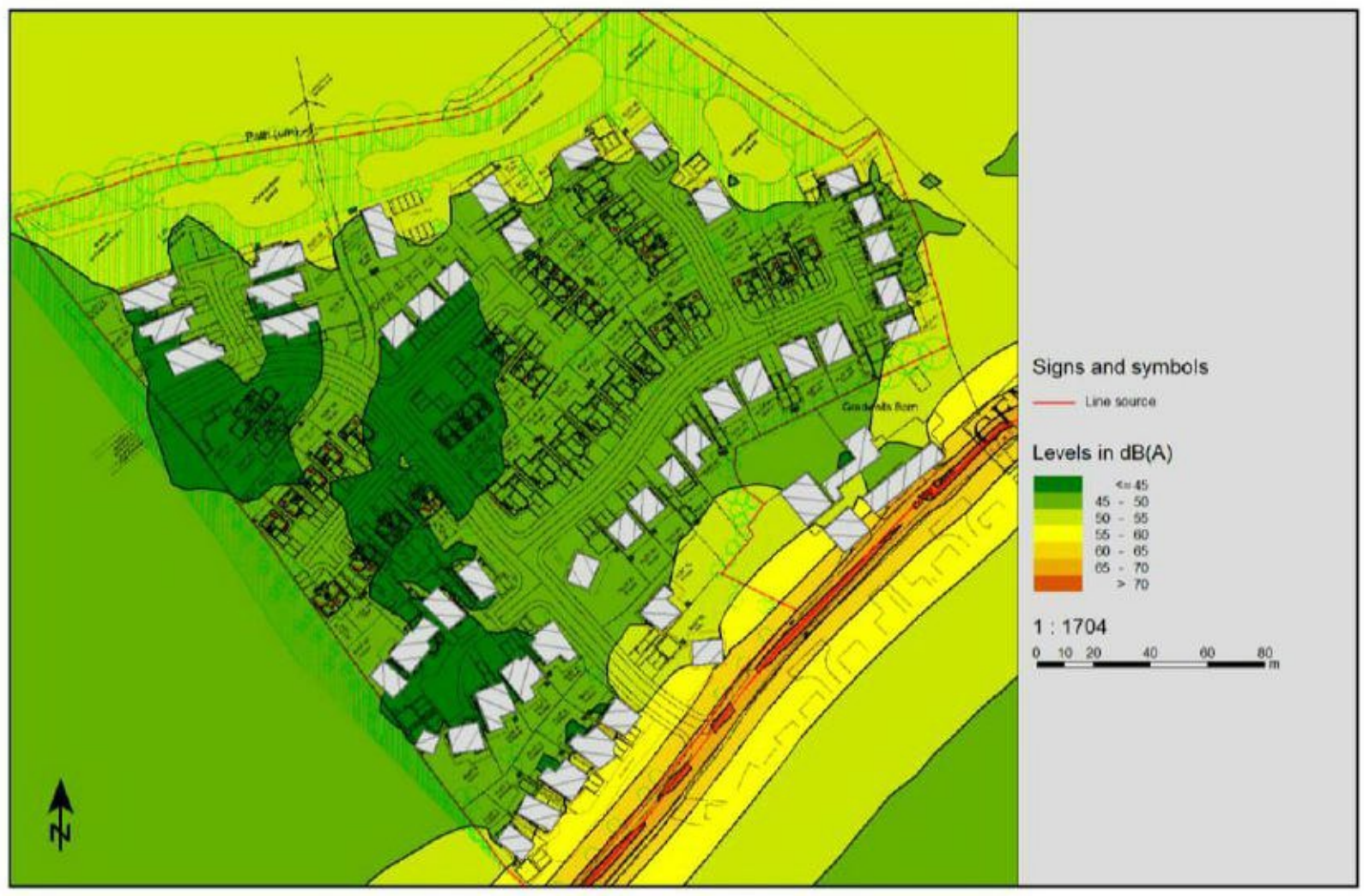

Figure 4: SP Model External Noise Levels Overview

From 4 it can be noted that all of the external amenity gardens to the proposed residential properties are expected to achieve the recommended BS 8233, 50 and/or 55 dBA criteria.

7.0 CONCLUSION

At the request of CFM Consultants Ltd, PDA Ltd has carried out a noise impact assessment for the proposed residential development at Gradwells Farm, Copp Lane, Great Eccleston, PR3 0YN. Currently the proposed site consists of open farmland.

The suitability of the site for residential development in regards to noise has been assessed against the recommended design criteria of WHO Guidelines for Community Noise 1999 & BS 8233:2014.

Noise egress across site has been modelled based on results of a previous noise survey conducted in relation to the adjacent potential residential development to Copp Lane (planning application ref 19/00860/OULMAJ).

Internal and external ambient noise levels for the proposed residential properties have been calculated based on the results of the noise survey and estimated dimensions for the room volumes and external façade/window areas.

To achieve the WHO 1999 & BS 8233 design criteria regarding internal noise levels, suitable minimum noise insulation specifications have been derived for the windows and trickle ventilators of each residential property.

All external amenity gardens to the proposed residential properties are expected to achieve the recommended BS 8233, 50 and/or 55 dBA criteria.

All results are presented in this report.

PDA calculations for internal noise levels have been based on assumed construction details and room dimensions as described in Sections 5.2-5.3 of this report. CFM Consultants Ltd should check these construction details and inform PDA of any discrepancies as these could influence the conclusions of this report.

APPENDIX I – DEFINITION OF ACOUSTIC TERMS

The decibel
This is the basic unit of noise, denoted dB.

A-Weighting
This is a weighting process which simulates the human ear's different sensitivity at different frequencies. A weighting can be shown two typical ways, 50 dB(A) L_{eq} or 50 dB L_{Aeq}. Both mean the same thing. (See below for a definition of L_{eq}). The dB(A) level can be regarded as the overall level perceived by human beings.

L_{eq}* and *$L_{eq(s)}$
This is the equivalent continuous noise level which contains the same acoustic energy as the actual time-varying sound. In other words it is a kind of average noise level. It is denoted dB L_{eq} or, for A-weighted figures dB(A) L_{eq} or dB L_{Aeq}. It can also be expressed in terms of frequency analysis (see later). $L_{eq(s)}$ is the sample L_{eq} level.

L_n
This is the level exceeded for n% of the time. It is denoted dB L_n or, for A-weighted figures dB(A) L_n or dB L_{An}. It can be expressed in terms of frequency analysis (see later). L_{90} is the level exceeded for 90% of the time and is a measure of the lowest level typically reached. L_{10} is the level exceeded for 10% of the time and is the highest level typically reached. L_{50} is the level exceeded for 50% of the time and, mathematically, it is the median.

L_{max}
This is the maximum level reached during a measurement period. The "time constant", or the ability of the equipment to respond to impulses is usually expressed along with it, e.g. "Fast", "Slow", etc. It is denoted dB L_{max} or, for A-weighted figures dB(A) L_{max}, dB L_{Amax}, etc. It can also be expressed in terms of frequency analysis.

Frequency Analysis
Whereas dB(A) gives a very useful overall figure, it has its limitations in that it cannot be used to model or predict the effect of noise control and mitigation as this nearly always has radically different performance at different frequencies.

Frequency analysis expresses an overall noise level at each frequency or band of frequencies in the audible range. Octave band analysis divides the audible range into 10 bands from 31.5 Hz to 16 kHz and the noise level in each band can be expressed in any form e.g. L_{eq}, L_{90}, L_{max} etc. One third octave band analysis uses 30 bands.

Narrow band analysis takes the process to resolutions of less than 1 Hz. This is useful for identifying the existence of tones (whines, hums, etc.) and in pin-pointing the sources.