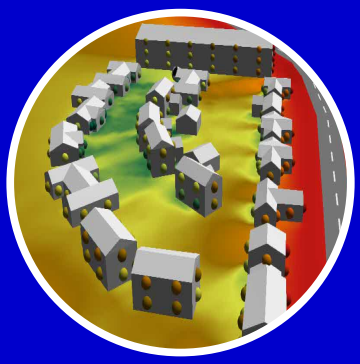


Acoustics | Noise | Vibration | Air Quality

Consultants in

Noise Impact Assessment

Project: Proposed Change of Use to Vehicle Repair Garage

Site: The Pine House Company
Ixworth Road
Stowlangtoft
Suffolk
IP31 3JS

Report Ref: IEC / 4382/ 01/ AVH

i-e-c.co.uk
Established 2005

Independent Environmental Consultancy Limited
Consultants in Acoustics | Noise | Vibration | Air Quality

Noise Impact Assessment

Proposed Change of Use to Vehicle Repair Garage at
The Pine House Company, Ixworth Road, Stowlangtoft
Suffolk, IP31 3JS

Prepared For	RUMAC Ltd The Stables Summer Road Walsham-Le-Willows Bury St Edmunds Suffolk IP31 3AJ
Report No.	IEC/4382/01/AVH
Report Prepared By	A V Hook BSc(Hons) MSc MIOA MIEnvSc MIAQM
Signed	[redacted]
Issue Date	15 April 2022

Document Review Sheet

Recommendations given in this report are solely for acoustic purposes. The project manager or architect must ensure that any measures adopted for acoustic purposes comply with other requirements and regulations, including (but not limited to) structural requirements, Standards, building controls, safety and control of fire.

This report has been prepared with all reasonable skill, care and diligence.

Issue Ref.	Date	Description	Author	Checked	Authorised
01	15/04/2022	First Issue	AVH	AVH	

Professional Membership

Independent Environmental Consultancy are full members of the Association of Noise Consultants.

Contents

1.0 Introduction

1.1 RUMAC Ltd are to submit a planning application to Mid Suffolk Council for the proposed change of use to Vehicle Repair Garage at The Pine House Company Site, Ixworth Road, Stowlangtoft.

1.2 As part of the planning application, Mid Suffolk Council has requested an assessment of operational noise from the proposed development at the nearest residential properties.

1.3 At the request of RUMAC Ltd, Independent Environmental Consultancy Limited have been commissioned to undertake an assessment of environmental noise and provide technical advice, as required, for noise mitigation measures for the proposed development.

1.4 The report assesses the impact of the proposed development with regards noise. It describes the methods used to assess the impacts, the baseline conditions and potentially affected noise sensitive receptors within the vicinity.

1.5 This study benefits from a baseline noise survey carried out between Friday 8th and Tuesday 12th April 2022.

Aims and Objectives of Assessment

1.6 The aim of this assessment is to provide information to determine the likely impact of noise from the Site on noise-sensitive receptors. The assessment includes consideration of the following issues:

- Information on the existing noise climate.
- Information on the noise impact upon existing residential dwellings in the locality.
- Noise mitigation measures necessary to comply with current noise standards and guidance.

Sources of Information

1.7 The following drawings have been supplied by the applicants planning consultant (Locus Planning) for use in the assessment.

Issued By	Drawing Title	Drawing Reference	Revision	Issue Date
Studio 35 Architecture Ltd	Existing and Proposed Plans and Elevations	PL01	-	March 2022

1.8 Information used in this assessment has been obtained from the following sources:

- National Planning Policy Framework NPPF (2021) Ministry of Housing, Communities & Local Government.
- Noise Policy Statement for England: NPSE (2010) Department for Environment, Food & Rural Affairs.
- Planning Practice Guidance: PPG (2014) Ministry of Housing, Communities & Local Government.
- British Standard 7445: 2003 Description and measurement of environmental noise.
- British Standard 4142:2014+A1: 2019 Methods for rating and assessing industrial

and commercial sound.

- British Standard 8233: 2014 Guidance on sound insulation and noise reduction in buildings.
- Guidelines for Community Noise –World Health Organisation: 1999.
- IEMA (2014) Guidelines for Environmental Noise Impact Assessment.
- ISO 9613-2 (1996) Acoustics –Attenuation of sound during propagation outdoors: General method of calculation.

2.0 Site Description

2.1 Introduction

2.1.1 The proposed change of use site is located to the west of Ixworth Road (A1088) in Stowlangtoft. The Site was formerly used as a garage premises, known as Spinneys Garage, until a change of use was granted in 2002 (Ref. 0138/02).

Figure 2.1: Location of The Pine House Company Site

Approximate Site Area *Source: Google Earth*

2.2 General Environs

2.2.1 The main sources affecting the existing noise climate relates to the following:

- Traffic using the local road network.

2.3 Nearest Noise-Sensitive Receptors

2.3.1 The nearest residential properties to the proposed development site are Red Ridge to the north and Spinney Bungalow to the south.

2.3.2 Appendix B of the report shows the position of the Site in relation to the nearest noise sensitive receptor positions and also details the environmental noise monitoring location.

2.4 Proposed Change of Use for The Pine House Company Site

2.4.1 The building fabric will remain largely unaltered, although 3 additional roller doors will be installed on the rear elevation of the building, with the existing two large windows removed.

2.4.2 The proposed hours of operation provided by the applicant are presented below:

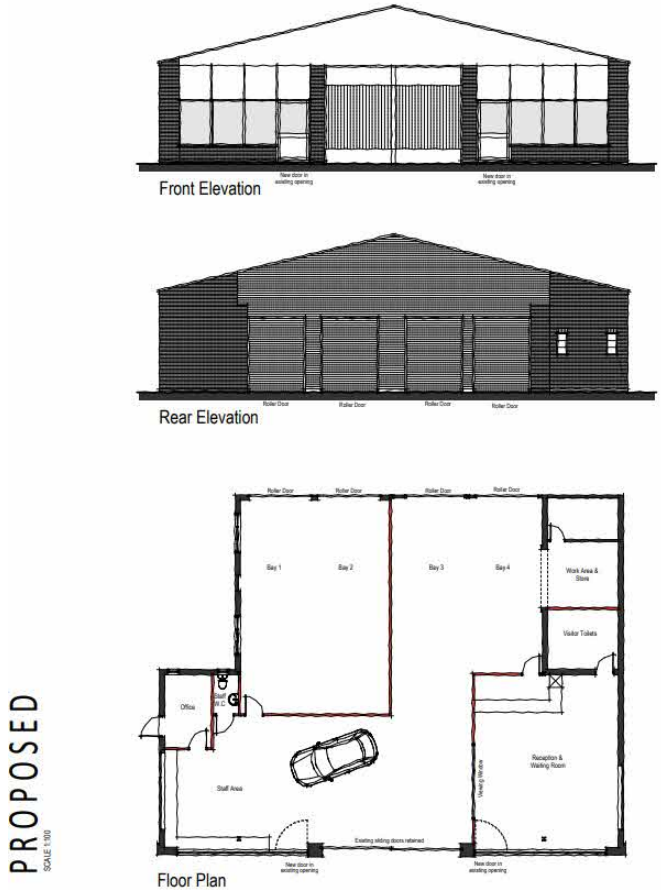
- 08:00 to 17:30, Monday to Friday and 08:00 to 13:00 on Saturdays.

2.4.3 The following list of plant and hand-tools associated with the vehicle repair garage have been supplied by the applicant and were viewed at an existing premises in Ixworth:

- Clarke Compressor;
- Car lifts; and
- Hand tools such as wrench, airline, etc.

2.4.4 Figure 2.2 below shows the proposed layout of the building.

Figure 2.2: Proposed Building Layout



2.4.5 Existing sliding doors on the front elevation of the building will be retained, with new doors formed either side in the existing openings. The glazing either side will also be retained.

Figure 2.3: View of front elevation of the building

Figure 2.4: View of rear elevation of the building

2.4.6 Existing large single glazed windows located on the rear elevation of the building will be removed, with additional roller doors to provide access into the building.

3.0 Noise Criteria

3.1 Legislation, Policy and Guidance

3.1.1 The following section outlines the key planning policy and guidance that relates to the assessment of residential amenity and protection of residents from environmental noise sources.

3.2 General Planning Guidance

3.2.1 The National Planning Policy Framework (NPPF)[1] was updated in July 2021 and sets out the government's planning policies for England and how these are expected to be applied.

3.2.2 In terms of considering noise impact, Chapter 15 of NPPF 'Conserving and enhancing the natural environment' states:

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

e) 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. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans."

3.2.3 The following section within the NPPF also specifically refers to noise.

"Ground conditions and pollution

185. 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:

a) 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;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and

c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.

3.2.4 The NPPF considers the impact of new development on existing businesses and community facilities stating:

[1] *National Planning Policy Framework NPPF, July (2021) Ministry of Housing, Communities & Local Government.*

"187. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed."

The Noise Policy Statement for England (NPSE): 2010

3.2.5 The Noise Policy Statement for England (NPSE) was published in March 2010. It specifies the following long-term vision in policy aims: *"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*

- *Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise adverse impacts on health and quality of life; and*
- *Where possible, contribute to the improvement of health and quality of life."*

3.2.6 The NPSE introduced three concepts to the assessment of noise, which includes:
NOEL –No Observed Effect Level
This is the level below which no effect can be detected and below which there is no detectable effect on health and quality of life due to noise.
LOAEL –Lowest Observed Adverse Effect Level
This is the level above which adverse effects on health and quality of life can be detected.
SOAEL –Significant Observed Adverse Effect Level
This is the level above which significant adverse effects on health and quality of life occur.

3.2.7 The above categories are however undefined in terms of noise levels and for the SOAEL the NPSE indicates that the noise level will vary depending upon the noise source, the receptor and the time of day/day of the week, etc. The need for more research is therefore required to establish what may represent an SOAEL. It is acknowledged in the NPSE that not stating specific SOAEL levels provides policy flexibility until there is further evidence and guidance.

3.2.8 The following commentary is given on the representation of NOEL, LOAEL and SOAEL in relation to existing British Standards/ International guidelines:
NOEL –Inaudibility
LOAEL –The guideline values for community noise in specific environments as set out in Table 1 of the WHO Guidelines for Community Noise 1999 and Table 4 of British Standard 8233: 2014 Guidance on sound insulation and noise reduction in buildings.

3.2.9 The NPSE concludes how the LOAEL and SOAEL relate to the three aims listed in paragraph 3.2.5.' above. The initial aim relates to avoiding significant adverse effects on health and quality of life, it then addresses the situation where the noise impact falls between the LOAEL and the SOAEL when:

"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."

3.2.10 The final aim envisages pro-active management of noise to improve health and quality of life, again taking into account the guiding principles of sustainable development.

3.2.11 The Government is undertaking a review of technical guidance but currently there is no agreed methodology for noise to accompany the NPPF guidance.

3.2.12 The Government has recently removed the existing Planning Policy Guidance on noise, which was known as PPG24: 1994. The National Planning Policy Framework, which has recently been published states *"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;"*

Planning Practice Guidance (PPG): 2014

3.2.13 The Ministry of Housing, Communities & Local Government (formerly the Department for Communities and Local Government) published the final version of the Planning Practice Guidance (PPG) on 06 March 2014[2]. The PPG provides further information with regard new developments which may be sensitive to the prevailing acoustic environment.

3.2.14 The PPG includes a table summarising the noise exposure hierarchy, based on the likely average response. Under the heading of 'perception' the 'noticeable and not intrusive' assessment of noise is defined as '*noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such there is a perceived change in the quality of life*'. The increasing effect level under these conditions is deemed to be '*no observed adverse effect*' and no specific measures are required.

3.2.15 Full details of the Planning Practice Guidance on effects are provided in Table 3.1.

Table 3.1: Noise Exposure Hierarchy

Perception	Example of Outcomes	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
	Lowest Observed Adverse Effect Level		
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, 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	Observed Adverse Effect	Mitigate and reduce to a minimum

[2] *Planning Practice Guidance PPG (2014) Ministry of Housing, Communities & Local Government.*

	the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.		
	Significant Observed Adverse Effect Level		
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, 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 Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Present

3.2.16 The subjective nature of noise means there is not a simple relationship between noise levels and its effects. Factors to be considered in determining if noise is a concern are identified including the absolute noise level of the source, the existing ambient noise climate, time of day, frequency of occurrence, duration, character of the noise and cumulative impacts.

3.3 Relevant Guidance & Standards

British Standard 4142: 2014+A1: 2019 'Methods for rating and assessing industrial and commercial sound

3.3.1 British Standard BS4142[3] was revised in 2014 and updated in 2019. The scope of the Standard has been extended to methods for rating and assessing sound of an industrial and/or commercial nature, which includes:

a) sound from industrial and manufacturing processes;
b) sound from fixed installations which compromise mechanical and electrical plant and equipment;
c) sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and
d) sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from a forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

3.3.2 The method is based on the difference between the background noise level without the industrial/commercial source and the noise level of the industrial source (specific

[3] *British Standard BS4142 (2014)+A1 (2019) 'Methods for rating and assessing industrial and commercial sound' British Standards Institution.*

sound) at the receiver location. The noise is rated for having tonality, impulsivity, intermittency or other distinguishable characteristics that may attract attention. In cases where the noise contains multiple characteristics, the penalties are cumulative.

3.3.3 In the majority of cases, the greater the difference between the rated noise level (specific noise and corrections for character) and background noise level, the greater the magnitude of impact (see Table 3.4).

Table 3.4: Assessment of the Impacts

Difference	Assessment
Around +10 dB or more	Likely to be an indication of a significant adv impact, depending on the context
Around +5 dB	Likely to be an indication of an adverse impact, depending on the context

3.3.4 In Section 8 of the 1997 version of the Standard "Assessing the noise for complaint purposes" it is stated that an excess above the existing background noise level L_{A90} of up to 5 dB(A) due to noise from fixed plant at a new development is of 'marginal significance'. This has been interpreted, since the introduction of the Standard in 1967, that a 5 dB(A) excess due to new, fixed plant noise source is, in general, acceptable.

3.3.5 In terms of establishing the rating level, corrections for the noise character has to be taken into consideration. These include the following factors:

Tonality
For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible.

Impulsivity
A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible and 9 dB where it is highly perceptible.

Other sound characteristics
Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

NOTE 2 Where tonal and impulsive characteristics are present in the specific sound within the same reference period then these two corrections can both be taken into account. If one feature is dominant then it might be appropriate to apply a single correction. Where both features are likely to affect perception and response, the corrections ought normally to be added in a linear fashion.

Intermittency

When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. This can necessitate measuring the specific sound over a number of shorter sampling periods that are in combination less than the reference time interval in total, and then calculating the specific sound level for the reference time interval allowing for time when the specific sound is not present. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

3.3.6 BS4142:2014 acknowledges that where background and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background (particularly at night).

British Standard 8233: 2014 (BS8233: 2014)

3.3.7 British Standard 8233:2014 'Guidance on sound insulation and noise reduction of buildings'[4] offers guidance on suitable internal noise levels for spaces when they are unoccupied.

3.3.8 The suggested design criteria for reasonable listening and resting/sleeping conditions are given in Table 4 of BS8233, and reproduced in Table 3.3.

Table 3.3: Relevant Information from BS 8233:2014

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

3.3.9 It can be seen that a design standard should be adopted to ensure internal noise from steady external sources in living rooms should not exceed 35 dB $L_{Aeq,16hour}$.

3.3.10 The design criteria for bedrooms suggests that a noise level not exceeding 35 dB $L_{Aeq,16hour}$ during the daytime (07:00 to 23:00) and 30 dB $L_{Aeq,8hour}$ during the night-time (23:00 to 07:00).

World Health Organisation Guidelines: 1999 –Guidelines for Community Noise (WHO)

3.3.11 The World Health Organisation's (WHO) 'Guidelines for Community Noise'[5] report for external environmental noise levels states that;

"4.2.7 Annoyance responses

[4] *British Standard BS 8233 (2014) 'Guidance on sound insulation and noise reduction of buildings' British Standards* Institution.
[5] *Guidelines for Community Noise, World Health Organisation (1999).*

During the daytime, few people are seriously annoyed by activities with L_{Aeq} levels below 55 dB; or moderately annoyed with L_{Aeq} levels below 50 dB. Sound pressure levels during the evening and night should be 5-10 dB lower than during the day..".

3.3.12 For night-time noise sources the WHO guidelines recommend a night-time (23.00-07.00) 8-hour noise level of 30 dB L_{Aeq} inside bedrooms (for a reasonably steady noise source) to avoid sleep disturbance.

3.3.13 For internal noise levels during the daytime and evening period it is suggested that a noise level of 35 dB $L_{Aeq,16h}$ (07.00-23.00 hours) is achieved to avoid speech intelligibility and moderate annoyance.

3.3.14 A summary of the guideline internal noise levels, taken from Table 1 of the WHO guidelines, is given in Table 3.4.

Table 3.4: Relevant Information from WHO Guidelines

Specific Environment	Critical Health Effect(s)	L_{Aeq} [dB]	Time Base [hours]	$L_{Amax, fast}$ [dB]
Dwelling, indoors	Speech intelligibility & moderate annoyance daytime & evening	35	16	-
Inside bedrooms	Sleep disturbance, night-time	30	8	45
Outdoor living area	To avoid serious annoyance, daytime and evening	55	16	-
Outdoor living area	To avoid minimal moderate annoyance, daytime and evening	50	16	-

3.3.15 An extract from Section 3.4 of 'Guidelines for Community Noise' states that;

"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10-15 times per night (Vallet & Vernet 1991), and most studies show an increase in the percentage of awakenings at SEL values of 55-60 dBA (Passchier-Vermeer 1993; Finegold et al. 1994; Pearsons et al. 1995."

3.3.16 The extract confirms that some researchers believe that people can be exposed to 10 -15 events above 45 dB L_{Amax} and still achieve a good nights sleep, and that as the noise level from an event increases above 45 dB(A) then the risk of sleep disturbance increases. As the WHO tend (not unreasonably) to take a cautious approach, the 45 dB(A) in their Table 4.1 is actually a level below which there is a not a material effect on the quality of sleep.

3.3.17 The World Health Organisation (WHO) Europe has published the WHO Environmental Noise Guidelines for the European Region (2018)[6]. This supplements existing WHO Guidelines.

[6] *The World Health Organisation (WHO) Europe has published the WHO Environmental Noise Guidelines for the European Region (2018).*

IEMA (2014) Guidelines for Environmental Noise Impact Assessment

3.3.18 The Institute of Environmental Management Assessment (IEMA) has provided 'Guidelines for Environmental Noise Impact Assessment'[7]. The guidelines set out an example of how changes in noise level can be categorised by significance.

3.3.19 Section 3 titled 'The Process of Assessing Noise Impacts' considers how noise impact of a development should be assessed. It is advised that the assessment should include an understanding of the existing noise climate –the baseline condition, the prediction noise likely to be generated, mitigation and the assessment of noise impact at the sensitive receptors.

3.3.20 The document sets out examples of how the change in noise can be assessed and categorised. Table 3.5 below presents the example significance categories and their relative noise change ranges.

Table 3.5: IEMA Change in Noise Level and Relevant Categories of Significance

Noise Change dB (A)	Category
≤ 2.9	Negligible Impact
3.0 –4.9	Small Impact
5.0 –9.9	Medium impact
10.0 or more	Large impact

3.3.21 The guidelines states that the assessor should set out the criteria specific to each assessment and to determine whether or not other factors would change the category of significance to another category. However, the above assessment reflects key benchmarks of the human response to changes in noise level.

3.3.22 In terms of noise effect level from operational noise, an approach for defining Lowest Observed Adverse Effect Level (LOAEL) and Significant Observed Adverse Effect Level (SOAEL) is presented in Table 3.6.

Table 3.6: Effect Level for Permanent Residential Buildings from Operational Noise

Day	Time (hours)	Lowest Observed Adverse Effect Level (dB)	Significant Observed Adverse Effect Level (dB)
Any day	07:00 –23:00	50 $L_{Aeq,16hour}$	65 $L_{Aeq,16hour}$
Any night	23:00 –07:00	40 $L_{Aeq,8hour}$	55 $L_{Aeq,8hour}$

[7] *IEMA(2014) Guidelines for Environmental Noise Impact Assessment.*

ISO 9613-2 (1996) Acoustics –Attenuation of sound during propagation outdoors: General method of calculation

3.3.23 Noise predictions carried out in the report utilise proprietary noise modelling software CadnaA, with the ISO 9613-2 module. The model assumes downwind propagation of noise from the source to each of the identified receptor positions.

3.3.24 ISO 9613-2 states that the uncertainty for distances up to 100m is ± 1 dB, increasing to ± 3 dB for distances of between 100m and 1km.

3.4 Proposed Criterion

3.4.1 The noise assessment will need to be carried out using BS4142: 2014+A1: 2019 `*Methods for rating and assessing industrial and commercial sound*'. This involves a comparison of existing background noise against specific site noise.

3.4.2 BS4142: 2014 states "*A difference of around +10 dB or more indicates a likely significant adverse impact (depending on the context). A difference of around + 5dB is likely to be an indication of an adverse impact (depending on the context).*

3.4.3 The standard advocates that each site should take the context of the proposal into consideration and that *"not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact".*

3.4.4 In terms of planning policy, rating levels which do not exceed +5dB above the background sound level are considered to be below the Lowest Observable Adverse Effect Level (LOAEL).

3.4.5 This noise effect level for the daytime period from the example approach within the Institute of Environmental Management Assessment (IEMA) 'Guidelines for Environmental Noise Impact Assessment' accords with the threshold within the WHO Guidelines for avoiding moderate annoyance. It is considered reasonable and appropriate to assess operational noise in absolute terms as well as relative terms:

- LOAEL - ≤50 dB(A) $L_{eq,16hour}$
- SOAEL - >65 dB(A) $L_{eq,16hour}$

4.0 Environmental Noise Survey & Technical Investigation

4.1 Introduction

4.1.1 The baseline environmental noise survey was carried out between Friday 8th and Tuesday 12th April 2022. The monitoring was carried out in accordance with advice provided in BS7445: 2003 `Description and measurement of environmental noise'[8].

4.1.2 Subjective observations during installation and retrieval of the monitoring equipment showed that the existing acoustic environment is dominated by traffic using the local road network.

4.2 Environmental Noise Survey Methodology

4.2.1 The purpose of the environmental noise survey was to characterise the existing ambient and background noise levels at the nearest residential receptors.

4.2.2 The instrumentation displayed below was used for the measurements undertaken during the baseline noise survey.

Table 4.1: Details of Instrumentation

Manufacturer	Equipment	Serial No.	Calibration Due Date
Pulsar	Sound Level Meter Type 45	PN1142	30/03/2023
Pulsar	Acoustic Calibrator Type 105	53536	06/10/2022

4.2.3 The following set-up parameters were used on the sound level meter during noise measurement procedures:

Frequency Weighting: 'A' or Linear (1:1 octave bands)
Measurement Periods: 15 minutes

4.2.4 The sound level meter was calibrated with the electronic calibrator prior to the commencement and on the completion of the survey. No significant drift in calibration was observed. The meter used during the survey is a precision grade Class/Type 1.

Calibration Setting: 94 dB @ 1kHz
Meter Setting: Fast Response

4.3 Measurement Procedure

4.3.1 Environmental noise monitoring was undertaken at least 3.5m from any vertical reflecting surface and at a height of 1.5m above ground level (free-field conditions). The meteorological conditions during the measurement period are presented in Table 4.2.

[8] *British Standard 7445:2003 Description and measurement of environmental noise. British Standards Institution, 2003.*

Table 4.2: Summary of meteorological conditions

Date	Description	Wind Speed (ms^{-1})	Wind Direction	Temp. (ºC)
08 April 2022	Fair	<1-2	NE	3-10
09 April 2022	Fair	<1-4	NW	3-7
11 April 2022	Fair	3-5	SE	8-15
12 April 2022	Fair	1-2	SE	12-18

4.3.2 The noise survey measurements were conducted in climatic conditions suitable for monitoring environmental noise levels in accordance with advice given in British Standard 7445: 2003 `Description and measurement of environmental noise'.

4.4 Environmental Noise Survey Results

4.4.1 The results of the baseline survey during the proposed operating hours of the business are summarised below (full survey results are presented in Appendix C).

Table 4.3: Daytime noise levels measured at monitoring location (08:00 to 17:30 hours Weekdays)

Location Ref.	Description	Coordinates		Statistical Parameters (dB)		
		X (Eastings)	*Y (Northings)*	$L_{Aeq,T}$	$L_{A90,T}$ (arithmetic)	L_{A90} (modal)
MP1	Adjacent to Spinney Bungalow	595130	267810	48.5-52.1	38.9-40.7	40

Table 4.4: Daytime noise levels measured at monitoring location (08:00 to 13:00 hours Saturday)

Location Ref.	Description	Coordinates		Statistical Parameters (dB)		
		X (Eastings)	*Y (Northings)*	$L_{Aeq,5hour}$	$L_{A90,5hour}$ (arithmetic)	L_{A90} (modal)
MP1	Adjacent to Spinney Bungalow	595130	267810	48.8	40.7	42

4.4.2 For the purposes of the assessment, modal background sound levels have been used for the establishing typical and representative levels. These values are the most commonly obtained over the entire survey period.

Table 4.5: Daytime background sound levels

Location Ref.	Location Description	Daytime Weekdays (08:00-17:30) Background Sound Level L_{A90} (dB)	Daytime Saturday (08:00-13:00) Background Sound Level L_{A90} (dB)
MP1	Adjacent to Spinney Bungalow	40	42

4.4.3 BS4142: 2014+A1: 2019 states that where the 'rating' level ($L_{Ar,Tr}$) does not exceed the measured background sound level the resultant impact would be low. Where the rating level does not exceed the background sound level by more than 5 dB(A), the resultant impact is interpreted to be below adverse, depending on the context.

4.4.4 Table 4.6 details noise criterion at each of the nearest noise-sensitive receptor positions.

Table 4.6: Noise criterion for low impact at residential receptors based on BS4142: 2014+A1: 2019

Location Ref.	Location Description	Background Sound Level L_{A90} (dB)	Rating Level ($L_{Ar,Tr}$) Criterion (dB) 'Low Impact'	Rating Level ($L_{Ar,Tr}$) Criterion (dB) 'Below adverse impact'
R1	Spinney Bungalow	40	40	45
R2	Red Ridge	40	40	45

4.5 Source Identification and Building Fabric Measurements

4.5.1 Measurements were carried out at an existing vehicle repair garage in Ixworth. The purpose was to identify noise levels from the most significant plant, machinery and hand tools which will be relocated to The Pine House Company site.

4.5.2 The visit on 8th April 2022 also served the purpose of identifying frequency characteristics of the significant noise sources. We understand that the premises was operating under typical conditions and representative of a normal working day.

4.5.3 Reverberant noise levels were logged for in excess of 3 hours, with sources comprising of vehicle engine noise, noise from electrical tools used for vehicle maintenance, radio and intermittent operation of the compressor.

4.5.4 The instrumentation displayed in Table 4.7 was used for the measurements undertaken inside the existing premises.

Table 4.7: Details of instrumentation

Manufacturer	Equipment	Serial No.	Calibration Due Date
Norsonic	Sound Level Meter Type 140	1402944	14/10/2023
Norsonic	Sound Level Meter Type 118	31337	23/04/2022
Norsonic	Acoustic Calibrator 1251	34495	14/10/2022

4.5.5 The sound reduction afforded by the respective elements of the existing building at The Pine House Company site has also been estimated using a pink noise source within the building. The following instrumentation was used to conduct the test measurements.

Table 4.8: Details of test instrumentation

Manufacturer	Equipment	Serial No.	Calibration Due Date
JBL	EON 15 G2 Loudspeaker	P0363-1418A	N/A
NTI	Minirator MR2 Signal Generator	G2L-RABME-G0	N/ A
Norsonic	Sound Level Meter Type 140	1402944	14/10/2023
Norsonic	Acoustic Calibrator 1251	34495	14/10/2022

4.5.6 Noise level measurements were carried out externally at distance during the test procedure, such that the internal and external noise levels could be directly correlated and assist with validating the site noise model.

5.0 Assessment of Noise Impact

5.1 Introduction

5.1.1 The impact assessment is carried out using BS4142: 2014+A1: 2019 `*Methods for rating and assessing industrial and commercial sound*'. Absolute noise criterion from the WHO Guidelines and IEMA (2014) Guidelines for Environmental Noise Impact Assessment have also been used to provide further context to the overall assessment.

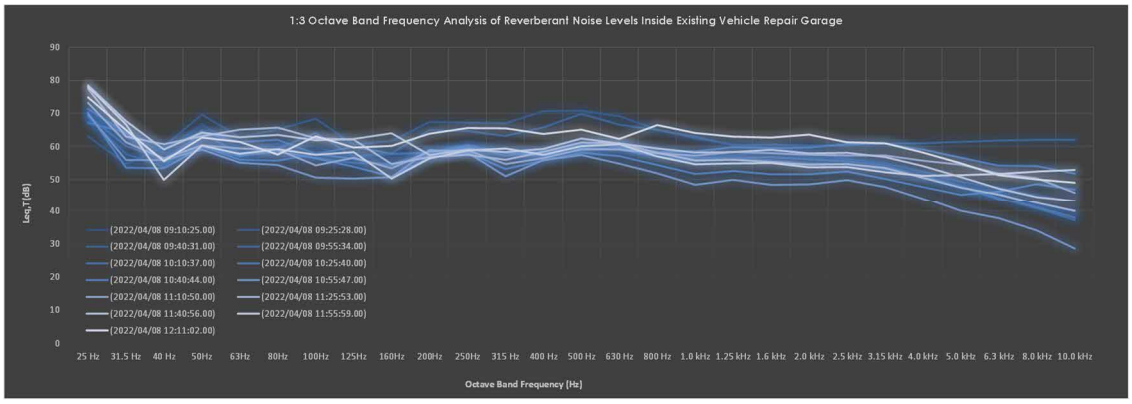
5.2 Operational Noise Sources

5.2.1 The highest reverberant noise levels measured during the monitoring exercise at the existing premises are presented in Table 5.1, with Figure 5.1 detailing 1:3 octave band noise levels throughout the measurement period.

Table 5.1: Typical reverberant noise level

Building	Reverberant Sound Pressure Level L_p (rev) dB Octave band c.f. –Hz								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Existing Vehicle Repair Garage	66.5	65.7	69.1	72.6	68.0	65.2	65.9	66.7	74.7

Figure 5.1: Summary of 1:3 octave band frequency analysis of reverberant noise levels measured inside existing Vehicle Repair Garage



5.2.2 Frequency analysis in 1:3 octave bands shows that reverberant noise levels measured inside the building did not contain a prominent, discrete tone.

5.2.3 Spot measurements of the main noise generating plant were also carried out during the monitoring exercise. Measurements with the Clarke compressor operating showed a noise level of 92.6 dB(A) at a distance of 1m. The compressor was located in the corner of the building (Q=8 for point source on ground at junction of two walls), resulting in an estimated sound power level L_{WA} of 95 dB.

5.2.4 The reverberation time of the existing and proposed garage premises are likely to be very similar once fitted out. Therefore, measured reverberant levels inside the existing premises remain unadjusted for the purposes of the assessment.

5.2.5 We have been advised by the applicant that the premises will typically operate with the roller doors on the rear elevation open. This will enable vehicles to enter the building from the rear using the access route along the southern boundary of the Site and provide ventilation to the workplace.

5.2.6 Assessment of vehicles accessing the building via the rear elevation roller doors is based upon the evaluation of noise emission from car movements and car activity (such as car pass-by, door closing and engine start-up with pull away). Vehicle movements have been considered in terms of SEL (L_{AE}).

5.2.7 The information contained in Table 5.4 can be used to establish a source noise level based on the number of activity events over the required assessment period using the following equation:

LAeq,T = SEL + 10 log N - 10 log T
Where:
SEL is the LAeq over a one second period, and represents the noise energy from an event compressed into one second;
T is the reference time period in seconds; and
N is the number of movements in the time period, T.

Table 5.2: Event noise levels for car parking and vehicle movements

Activity	Single Event Noise Level (L_{AE}) at 10m (dB)	Maximum Noise Level (L_{Amax}) at 10m (dB)
Car pass-by	67	66
Car start-up and pull away	72	70
Door slamming	64	71

5.2.8 We have not been supplied with a Transport Statement for the proposed development. However, we have assumed 8 movements during a peak hour period.

5.3 Sound Insulation Performance of Building Fabric

5.3.1 The walls of the building are mainly brick, block or brick/block cavity constructions. The sliding door at the front of the building is to be retained and field testing of the door shows the sound reduction is around 13 dB.

5.3.2 An existing roller door is located on the rear elevation of the building. Exploratory testing of the door construction indicates a sound reduction of approximately 10 dB.

5.3.3 The estimated acoustic performance of the building elements is displayed in Table 5.3.

Table 5.3: Acoustic performance of building elements

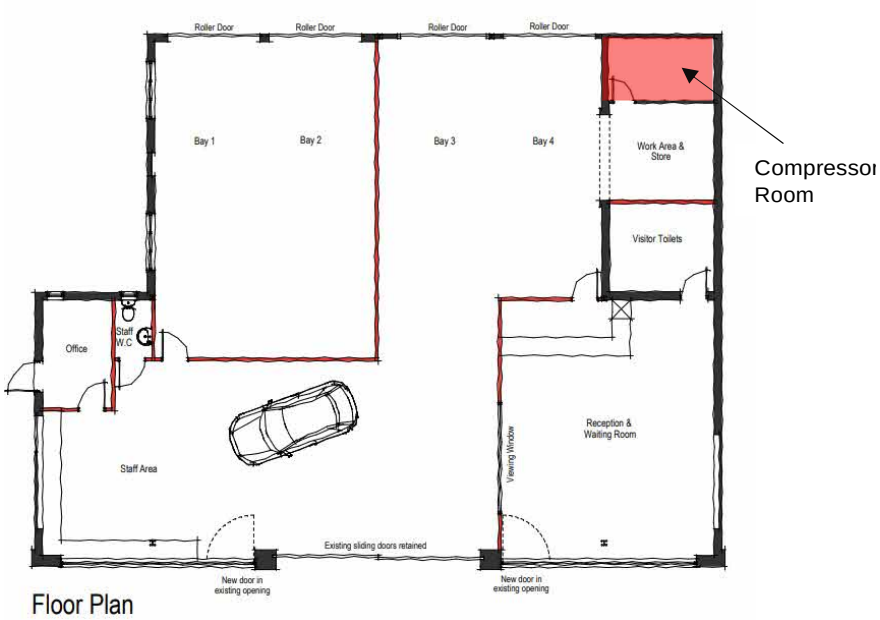
Building Element	Estimated Weighted Sound Reduction Index R_w (dB)
Masonry walls	50
Main timber sliding door	13
Roller door	10
Corrugated fibre cement roof	26
Single glazed windows	20

5.4 Noise Mitigation Measures and Site Management

5.4.1 Mitigation measures are to be implemented through improvements to the building and management of site operations. The assessment includes implementation of the following measures:

- Timing of operations (restricted opening hours which can be secured through condition);
- Housing of compressor in enclosed plant room within main building (see Figure 5.2);
- Roller doors to be kept closed as much as practicable;
- Glazing on southern elevation of building to be made good and windows to be secured (unopenable);
- No externally mounted fixed plant; and
- Minimum 2m high acoustic fencing along southern and northern boundary to protect adjacent gardens of nearest noise-sensitive receptors.

Figure 5.2: Compressor plant room inside main building (fully enclosed)



5.5 Predicted Noise Levels

5.5.1 In order to model the proposed operational scenarios, CadnaA modelling software has been utilised for the generation of noise maps of the highest likely site generated noise.

5.5.2 The noise maps have been produced using the ISO 9613-2: 1996 module for the site plant complement. The methodology takes into account source position, distance, duration of activity, screening from buildings/barriers or the intervening ground in relation to the nearest sensitive receptors.

5.5.3 For all noise prediction calculations, the ground absorption coefficient has been set to '0.5' representing mixed ground. The temperature was set to 10 °C, with relative humidity to 70%. Receptor heights have been modelled at 1.5m above ground level.

5.5.4 The modelling includes all four roller doors being open to enable car movements in and out of the building, as well as ventilation. This is likely to represent a 'worst-case' scenario in terms of operational noise from the Site.

5.5.5 The model incorporates measured existing site noise levels, manufacturer's performance data or from our in-house database.

5.6 Impact Assessment

5.6.1 Noise breakout from the building and car movements have been calculated at the identified noise-sensitive receptor locations. The results of the modelling exercise are presented in Table 5.4.

Table 5.4: Summary of Predicted Plant Noise Levels $L_{Aeq,T}$

Location Ref.	Noise-Sensitive Receptor	Predicted Daytime Noise Level $L_{Aeq,1hour}$ dB
R1	Spinney Bungalow	42
R2	Red Ridge	42

5.6.2 Noise levels have been assessed using relative criterion (BS4142: 2014+A1: 2019) and absolute criterion (WHO and IEMA Guidelines).

Relative Criterion - British Standard 4142: 2014+A1: 2019

5.6.3 British Standard 4142 (BS4142) is used as guidance in the determination of the likely impact from an industrial or commercial noise source. The method is based on the difference between the background noise level without the industrial/commercial source and the noise level of the industrial source (specific sound) at the receiver location. The noise is rated for having tonality, impulsivity, intermittency or other distinguishable characteristics that may attract attention. In cases where the noise contains multiple characteristics, the penalties are cumulative.

5.6.4 In terms of tonality, the measurements carried out at the existing Ixworth premises suggests that the plant does not exhibit tonal characteristics which is likely to be clearly perceptible above the residual noise climate. Therefore, no penalty for tonality has been applied.

5.6.5 Site activities may generate impulsive/intermittency characteristics. Therefore, a penalty of + 3 dB has been applied for impulsivity/intermittency.

5.6.6 In conclusion, we would add +3 dB to the calculated noise levels in order to take into account potentially distinguishable characteristics.

Table 5.5: Daytime BS4142 Assessment for Operational Scenario

Description	Result	Relevant Clause from BS4142: 2014 +A1: 2019	Commentary
Calculated specific sound level (free-field)	R1 = 42 dB $L_{Aeq,1hour}$ R2 = 42 dB $L_{Aeq,1hour}$	7.3.6	Predicted free-field sound level at receptor. Level determined by calculation using CadnaA ISO 9613
Background sound level	R1 = 40 dB $L_{A90,T}$ R2 = 40 dB $L_{A90,T}$	8.1 & 8.2	Background free-field sound level measured over a number of days
Acoustic feature correction	+3 dB	9.2	Impulsivity/ intermittency characteristics
Rating level ($L_{Ar,T}$)	R1 = 45 dB R2 = 45 dB		
Excess of rating over background sound level	R1 = 5 dB R2 = 5 dB		Assessment indicates operational noise should not result in an adverse impact taking context into account
Uncertainty of the assessment			

5.6.7 The results of the BS4142 assessment shows that operational noise from the Site is unlikely to result in an adverse impact. In terms of planning policy, rating levels which do not exceed +5 dB above the background sound level are considered to be below the Lowest Observed Adverse Effect Level (LOAEL).

Absolute Criterion –Noise Effect Level (WHO NNG/IEMA Guidelines)

5.6.8 Predicted noise levels compared with noise effect level have been considered to provide further context.

Table 5.6: Predicted Noise Levels $L_{Aeq,T}$ against Noise Effect Level

Location Ref.	Noise-Sensitive Receptor	Predicted Daytime Noise Level $L_{Aeq,1hour}$ dB	LOAEL (dB) $L_{Aeq,16hour}$ dB	SOAEL (dB) $L_{Aeq,16hour}$ dB
R1	Spinney Bungalow	42	≤50	>65
R2	Red Ridge	42	≤50	>65

5.6.9 Comparison of the mitigated plant noise against relevant absolute criterion shows that levels would be well below the (LOAEL) during the proposed operating hours.

5.7 Statement of Uncertainty and Assumptions

5.7.1 Uncertainty limits the accuracy of the above assessment including measurement, calculation or prediction. These factors include:

- This assessment includes measurements of reverberant noise levels from machinery, hand tools and plant located at the existing premises.
- Background noise levels have been measured over a number of days and the modal value obtained for at the monitoring location. The background levels are considered typical and representative of the intended operational hours of the proposed development;
- The uncertainty of the assessment has been reduced as far as practicable by carrying out measurements of the main noise generating plant and using proprietary modelling software (module ISO 9613-2) to calculate noise levels at the nearest residential dwellings;
- Noise predictions carried out in the report utilise proprietary noise modelling software CadnaA, with the ISO 9613-2 module. The model assumes downwind propagation of noise from the source to each of the identified receptor positions.
- ISO 9613-2 states that the uncertainty for distances up to 100m is ± 1 dB, increasing to ± 3 dB for distances of between 100m and 1km.

5.7.2 We consider the assumptions made in the calculations to be reasonable and reduces uncertainty to a level considered not to have a significant outcome of the assessment based on the information provided.

6.0 Conclusions

6.1 Noise breakout from the building and associated car movements have been considered using the BS 4142: 2014+A1: 2019 assessment methodology. The result of the assessment shows that mitigated noise emissions from the Site would not result in an adverse impact with noise levels below the Lowest Observable Adverse Effect Level (LOAEL).

6.2 Taking into account the context that the Site was previously used as a garage, the existing acoustic climate and proposed noise control measures, the residential amenity of the nearest residential receptors would be adequately protected and not result in an unacceptable change in noise level.

6.3 Based on the results of the assessment, it is recommended that planning consent can be granted as operational noise levels would not generate a significant adverse impact.

Appendices

Appendix A

A.0 NOISE PERCEPTION AND TERMINOLOGY

A.1 Terminology

A.1.1 Between the quietest audible sound and the loudest tolerable sound there is a million to one ratio in sound pressure (measured in pascals, Pa). Because of this wide range a noise level scale based on logarithms is used in noise measurement called the decibel (dB) scale. Audibility of sound covers a range of approximately 0 to 140 dB.

A.1.2 The human ear system does not respond uniformly to sound across the detectable frequency range and consequently instrumentation used to measure noise is weighted to represent the performance of the ear. This is known as the 'A weighting' and annotated as dB(A).

A.1.3 The following lists the sound pressure level in dB(A) for common situations.

Table A.1: Noise Levels for Common Situations

Typical Noise Level dB(A)	Example
0	Threshold of hearing
30	Rural area at night, still air
40	Public library Refrigerator humming at 2m
50	Quiet office, no machinery Boiling kettle at 0.5m
60	Normal conversation
70	Telephone ringing at 2m Vacuum cleaner at 3m
80	General factory noise level
90	Heavy goods vehicle from pavement Powered lawnmower, operator's ear
100	Pneumatic drill at 5m
120	Discotheque - 1m in front of loudspeaker
140	Threshold of pain

A.1.4 The noise level at a measurement point is rarely steady, even in rural areas, and varies over a range dependent upon the effects of local noise sources. Close to a busy motorway, the noise level may vary over a range of 5 dB(A), whereas in a suburban area this may increase up to 40 dB(A) and more due to the multitude of noise sources in such areas (cars, dogs, aircraft etc.) and their variable operation. Furthermore, the range of night-time noise levels will often be smaller and the levels significantly reduced

compared to daytime levels. When considering environmental noise, it is necessary to consider how to quantify the existing noise (the ambient noise) to account for these second to second variations.

A.1.5 A parameter that is widely accepted as reflecting human perception of the ambient noise is the background noise level, L_{A90}. This is the noise level exceeded for 90% of the measurement period and generally reflects the noise level in the lulls between individual noise events. Over a 1-hour period the L_{A90} will be the noise level exceeded for 54 minutes.

A.1.6 The equivalent continuous A-weighted sound pressure level, L_{Aeq}, is the single number that represents the total sound energy measured over that period. The L_{Aeq} is the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period. It is commonly used to express the energy level from individual sources that vary in level over their operational cycle.

A.1.7 The R_w is a single number rating used to describe the sound insulation of building elements. Traditional masonry walls will achieve no less than 48 dB R_w, single glazed windows approximately 25 dB R_w. The figure is mostly used when calculating noise transmission through building elements.

A.1.8 Human subjects, under laboratory conditions, are generally capable of noticing changes in steady levels of 1 dB(A). However, in the general environment changes of around 3 dB(A) can be detected. It is generally accepted that a change of 10 dB(A) in an overall, steady noise level is perceived to the human ear as a doubling (or halving) of loudness. (These findings do not necessarily apply to transient or non-steady noise sources such as changes in noise due to changes in road traffic flow, or intermittent noise sources).

A.2 Perception - Frequency

A.2.1 Frequency is the rate at which the air particles vibrate. The more rapid the vibrations, the higher the frequency and perceived pitch. Frequency is measured in Hertz (Hz).

A.2.2 A young person with average hearing can generally detect sounds in the range 20 Hz to 20,000 Hz (20 kHz). Figure A.1[9] below illustrates the range of frequencies, for example, the lowest note on a full scale piano, 'A', has a fundamental at 28 Hz, and the highest, 'G', a fundamental at 4186 Hz (there will be higher order harmonics). Human speech is predominantly in the range 250 Hz - 3000 Hz.

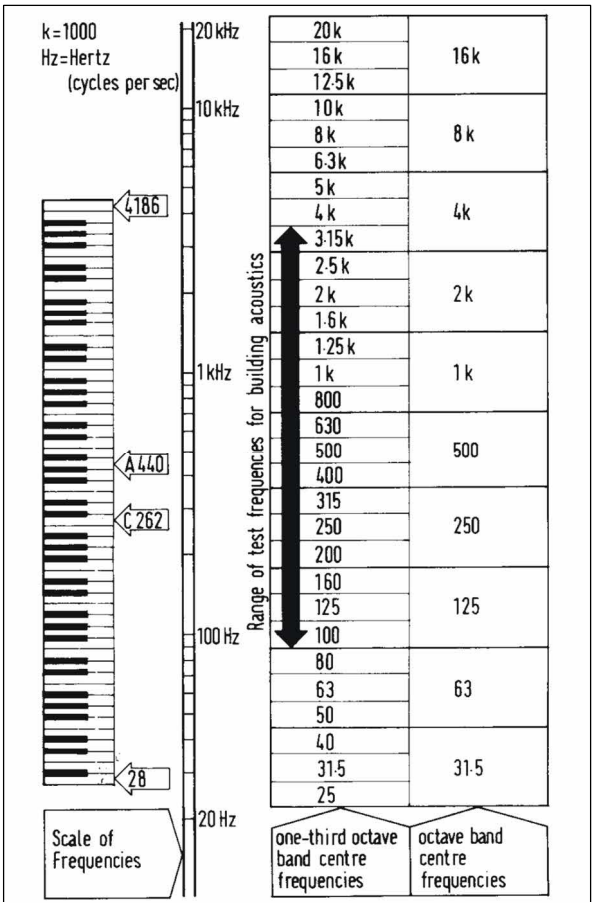
A.2.3 The musical term 'octave' is the interval between the first and eighth note in a scale and represents a doubling of frequency. A series of octave and one-third octave bands have been derived, as shown in the Figure overleaf, and these are commonly used in noise measurements where it is necessary to describe not only the level of the source noise but also the frequency content. The frequency content of a noise source can be useful for identifying acoustic features such as a whine, hiss or screech.

A.2.4 In most instances it is necessary only to specify and use the overall A-weighted noise values, for example when assessing noise from fixed plant (pumps, motors, refrigeration plant etc.), road traffic and general industrial sources. However, in certain circumstances it is necessary to consider the contribution to the overall A-weighted

[9] *BRE and CIRIA (1993) Sound Control for Homes. BRE Report 238, CIRIA Report 127.*

noise level in individual octave frequency bands, such as when assessing architectural acoustics or noise from amplified music events.

Figure A.1: 1/1 Octave and 1/3 Octave Frequency Bands



Appendix B

Site Plan Indicating Noise Monitoring Location

Monitoring Location

Nearest Noise-Sensitive Receptors (NSRs)

Source: Google Earth

Appendix C.1

Environmental Noise Survey Results: Monitoring Position 1 (MP1) Adjacent to Spinney Bungalow

Date (dd:mm:yy)	Start Time (hh:mm)	Statistical Parameters (dB)			
		L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}
08/04/2022	08:00	59.5	72.3	54.8	43.6
08/04/2022	08:15	60.1	68.0	55.0	43.5
08/04/2022	08:30	50.2	68.4	53.7	42.0
08/04/2022	08:45	49.5	72.9	52.7	39.3
08/04/2022	09:00	50.0	74.5	52.8	38.4
08/04/2022	09:15	46.8	60.8	50.8	38.7
08/04/2022	09:30	48.0	65.2	51.9	39.6
08/04/2022	09:45	47.3	65.3	50.8	38.9
08/04/2022	10:00	49.0	66.8	52.1	39.4
08/04/2022	10:15	48.0	64.2	52.2	38.0
08/04/2022	10:30	53.5	67.2	57.8	40.5
08/04/2022	10:45	57.9	66.5	58.8	57.0
08/04/2022	11:00	61.4	68.6	66.4	40.7
08/04/2022	11:15	53.5	65.3	58.1	38.4
08/04/2022	11:30	47.3	65.4	51.0	36.1
08/04/2022	11:45	54.2	79.7	54.4	37.8
08/04/2022	12:00	48.1	64.0	52.4	36.8
08/04/2022	12:15	47.7	67.8	51.9	37.5
08/04/2022	12:30	49.0	65.0	53.3	34.7
08/04/2022	12:45	46.9	68.1	50.8	34.4
08/04/2022	13:00	49.1	63.5	53.2	37.5
08/04/2022	13:15	47.4	65.8	51.4	36.9
08/04/2022	13:30	49.1	63.5	52.9	40.3
08/04/2022	13:45	48.2	65.8	51.9	38.2
08/04/2022	14:00	49.5	64.0	53.3	39.8
08/04/2022	14:15	50.0	62.6	54.1	41.4
08/04/2022	14:30	50.0	62.0	54.2	39.7
08/04/2022	14:45	51.2	62.3	54.9	43.1
08/04/2022	15:00	51.2	65.0	54.8	42.6
08/04/2022	15:15	52.6	68.3	54.9	42.8
08/04/2022	15:30	51.7	65.9	55.0	43.5
08/04/2022	15:45	51.7	69.0	55.6	41.0
08/04/2022	16:00	51.6	63.5	55.2	44.7
08/04/2022	16:15	51.0	63.2	54.5	43.1
08/04/2022	16:30	51.7	63.4	55.5	42.4
08/04/2022	16:45	52.3	66.1	56.0	43.9
08/04/2022	17:00	52.5	67.6	56.3	42.5
08/04/2022	17:15	51.8	71.3	55.6	42.1

Exploratory testing of building fabr – data not included in baseline levels

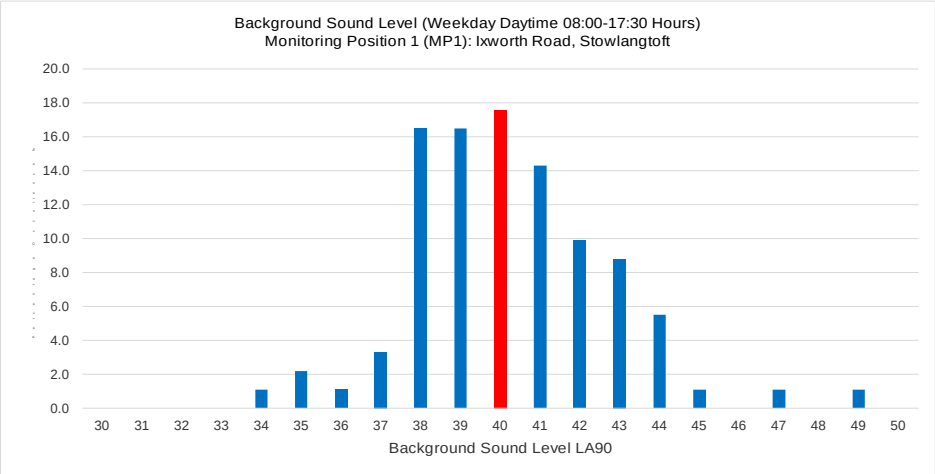
Date (dd:mm:yy)	Start Time (hh:mm)	Statistical Parameters (dB)			
		L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}
09/04/2022	08:00	47.2	69.5	50.4	39.7
09/04/2022	08:15	48.5	71.9	50.9	38.1
09/04/2022	08:30	48.0	75.5	51.1	39.0
09/04/2022	08:45	47.0	63.1	50.3	37.7
09/04/2022	09:00	48.8	76.5	51.7	38.0
09/04/2022	09:15	47.0	76.9	49.5	38.7
09/04/2022	09:30	48.4	79.2	50.4	39.1
09/04/2022	09:45	48.8	65.9	52.1	39.8
09/04/2022	10:00	48.1	66.1	51.0	41.0
09/04/2022	10:15	47.7	62.2	50.6	41.5
09/04/2022	10:30	49.4	67.7	52.8	41.1
09/04/2022	10:45	49.1	70.9	50.9	41.9
09/04/2022	11:00	47.8	64.8	50.7	40.6
09/04/2022	11:15	49.1	62.4	51.8	42.8
09/04/2022	11:30	48.9	71.9	52.1	41.5
09/04/2022	11:45	48.3	59.0	51.3	42.7
09/04/2022	12:00	48.9	60.3	51.9	42.4
09/04/2022	12:15	51.6	81.4	53.3	42.9
09/04/2022	12:30	49.5	74.0	52.5	42.4
09/04/2022	12:45	50.5	62.6	53.3	43.0

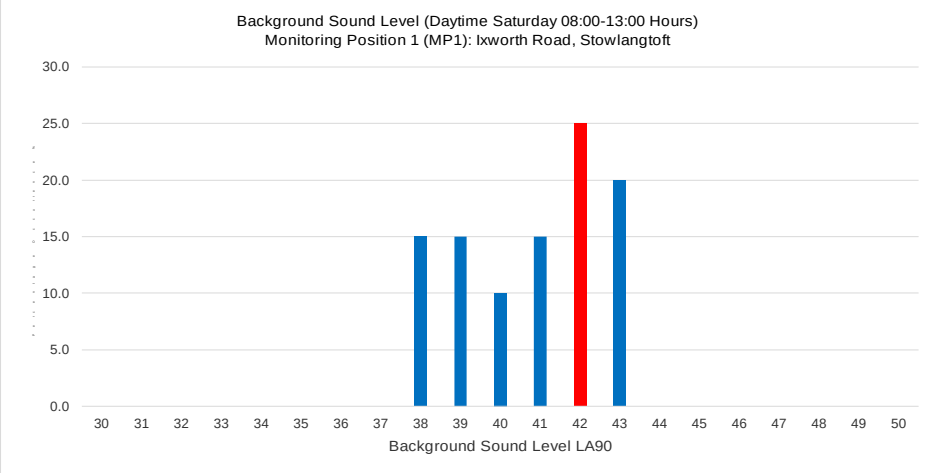
Date (dd:mm:yy)	Start Time (hh:mm)	Statistical Parameters (dB)			
		L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}
11/04/2022	08:00	50.2	65.1	54.2	42.4
11/04/2022	08:15	50.0	63.3	53.9	40.1
11/04/2022	08:30	49.9	63.2	53.2	41.2
11/04/2022	08:45	47.5	64.2	51.6	38.3
11/04/2022	09:00	50.0	65.7	54.0	39.3
11/04/2022	09:15	47.7	62.4	51.8	38.5
11/04/2022	09:30	48.4	61.9	52.4	39.7
11/04/2022	09:45	48.6	61.4	52.7	39.2
11/04/2022	10:00	47.8	63.3	51.8	39.4
11/04/2022	10:15	49.3	77.1	52.4	38.8
11/04/2022	10:30	49.4	64.4	53.3	39.8
11/04/2022	10:45	48.1	65.0	51.9	37.9
11/04/2022	11:00	47.9	64.4	52.0	38.0
11/04/2022	11:15	46.8	64.8	50.0	38.1
11/04/2022	11:30	49.5	65.8	52.7	39.5
11/04/2022	11:45	49.2	63.8	53.5	38.6
11/04/2022	12:00	49.3	73.9	52.4	40.6
11/04/2022	12:15	47.1	64.0	50.5	40.0
11/04/2022	12:30	48.0	67.6	51.5	41.2
11/04/2022	12:45	48.4	66.9	52.1	39.9
11/04/2022	13:00	48.3	60.8	52.0	40.4
11/04/2022	13:15	47.7	61.2	51.6	40.8
11/04/2022	13:30	59.4	80.1	62.6	41.4
11/04/2022	13:45	61.9	84.7	63.4	46.9
11/04/2022	14:00	47.3	61.3	51.2	39.6
11/04/2022	14:15	46.7	61.8	49.9	38.6
11/04/2022	14:30	52.4	71.7	55.1	39.5
11/04/2022	14:45	59.8	86.9	62.5	49.3
11/04/2022	15:00	47.1	60.0	50.5	40.9
11/04/2022	15:15	49.4	72.0	51.8	41.3
11/04/2022	15:30	48.8	61.3	52.4	41.5
11/04/2022	15:45	48.7	61.9	52.0	42.9
11/04/2022	16:00	48.7	65.1	52.1	41.6
11/04/2022	16:15	48.6	62.8	52.4	40.6
11/04/2022	16:30	50.7	70.0	54.2	43.4
11/04/2022	16:45	49.2	61.7	52.8	42.9
11/04/2022	17:00	50.7	66.7	54.2	43.5
11/04/2022	17:15	49.8	61.9	53.5	42.3

Date (dd:mm:yy)	Start Time (hh:mm)	Statistical Parameters (dB)			
		L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}
12/04/2022	08:00	51.1	66.5	55.0	41.7
12/04/2022	08:15	49.6	62.6	53.5	41.2
12/04/2022	08:30	49.6	64.9	53.2	42.3
12/04/2022	08:45	48.5	67.0	52.2	39.6
12/04/2022	09:00	49.0	65.6	52.9	39.2
12/04/2022	09:15	48.3	63.2	52.4	39.5
12/04/2022	09:30	46.5	60.4	49.8	39.6
12/04/2022	09:45	48.0	64.7	51.5	38.5
12/04/2022	10:00	47.5	63.4	51.3	38.7
12/04/2022	10:15	46.8	60.5	50.9	37.6
12/04/2022	10:30	46.5	63.6	50.4	37.5
12/04/2022	10:45	48.4	64.0	52.7	38.0
12/04/2022	11:00	49.3	66.9	53.2	38.2
12/04/2022	11:15	48.4	64.8	52.2	38.7
12/04/2022	11:30	47.2	65.1	51.1	35.2
12/04/2022	11:45	48.0	67.1	50.4	37.4

Appendix C.2

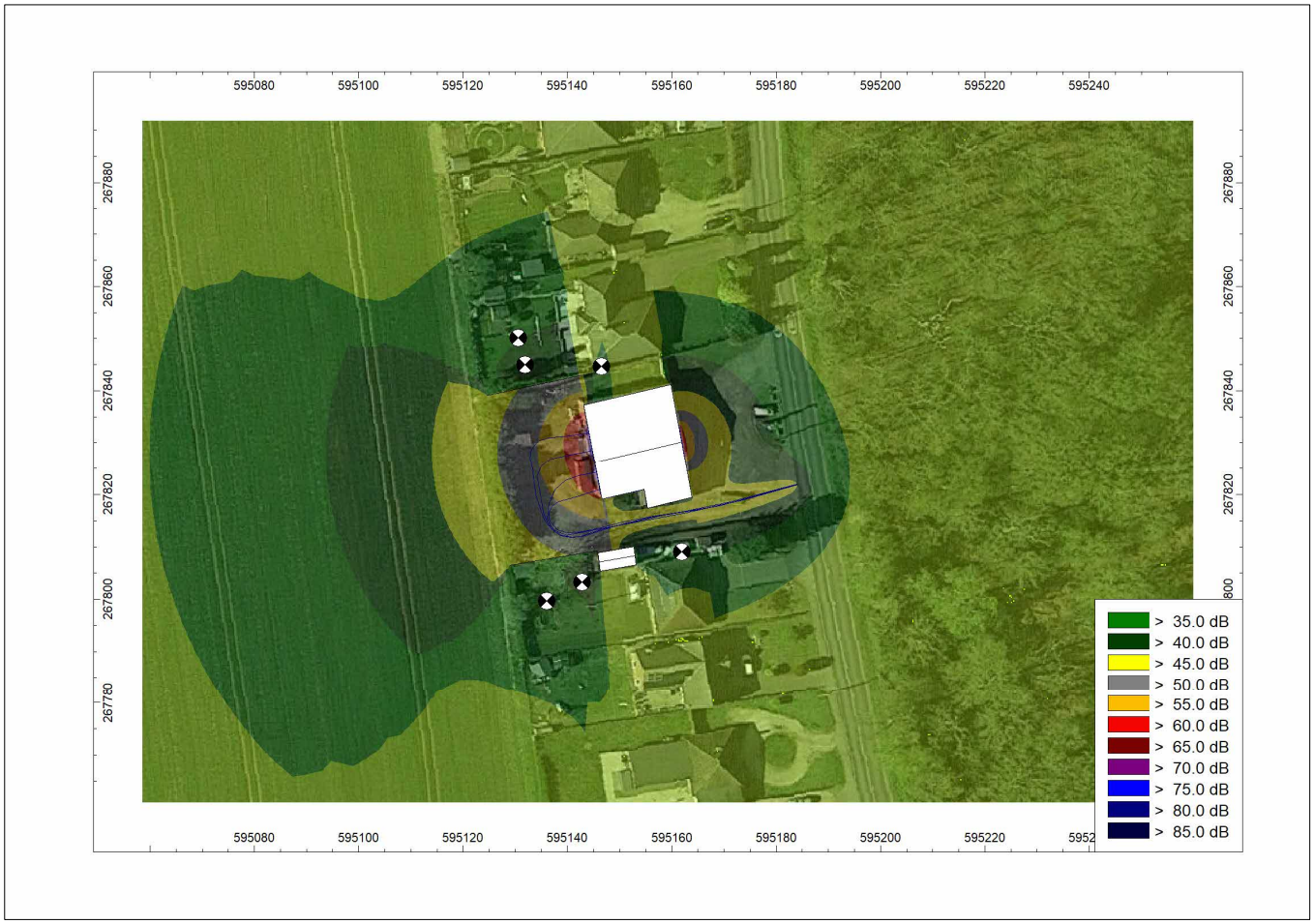
Modal Analysis of Background Sound Levels: Monitoring Position 1 (MP1) Adjacent to Spinney Bungalow





Appendix D

Noise Mapping: Operational Scenario



Appendix E

Acoustic Barrier Recommendations

An acoustic barrier can be made of any material which can form a fairly dense and impervious layer between the noise of concern and the receiver.

An earth bank or bund provides a good screen and may be increased in height by the addition of a good quality close-boarded timber fence along the top.

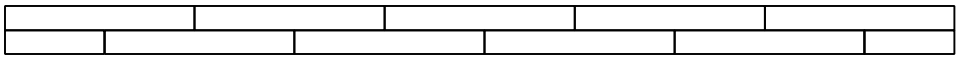
The fence should comprise close fitting overlapping boards, such that the whole is impervious with no gaps or cracks between the boards. The design should ensure that gaps and cracks do not occur as the fence weathers.

The fence should be sealed to the ground at its base.

The surface weight of the fence should be at least 10 Kg/m^2. The effects of wind loading must be taken into account in the design of the fence and its supports. The requirements for overall durability and wind loading are normally more demanding than the surface weight requirement for noise control.

The overall effectiveness of a barrier for noise control is normally determined by the noise diffracted over the top of the barrier, or around the ends, rather than by the amount of noise passing through it.

Plan view of suitable wooden fence configuration



Stowlangtoft –2m high acoustic barrier to north & south, as shown.

Independent Environmental Consultancy Limited
Consultants in Acoustics| Noise| Vibration| Air Quality
i-e-c.co.uk