



**FORMER DAIRY CREST DEPOT
DUNSBURY WAY, HAVANT**

PROPOSED RESIDENTIAL DEVELOPMENT

NOISE ASSESSMENT

SEPTEMBER 2018



the journey is the reward

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APPENDIX A: Glossary of Acoustic Terminology

APPENDIX B: Automated Measurement Graphs

1 Introduction

- 1.1 Mayer Brown Ltd has been instructed by Southern Cooperative to prepare this Noise Assessment which accompanies a planning application for the redevelopment of land at Dunsbury Way, Havant.
- 1.2 The proposed development seeks the demolition of existing buildings occupying the site and the erection of a new residential block delivering 78 new flats.
- 1.3 This noise assessment is structured as follows:
- **Section 2** describes the location of the site in relation to the existing transport infrastructure and neighbouring land uses.
 - **Section 3** outlines the development proposals.
 - **Section 4** discusses national and local planning policy and 'industry standard' design guidance relevant to noise.
 - **Section 5** presents the results of environmental noise monitoring at the site to determine existing noise levels.
 - **Section 6** assesses the suitability of the site for the proposed development.
 - **Section 7** presents a more detailed assessment of the residential areas of the site in line with ProPG guidance.
 - **Section 8** discusses how the temporary construction impacts of the scheme will be controlled; and
 - Conclusions are presented in **Section 9**.
- 1.4 A glossary of the acoustic terminology used in this report is provided at **Appendix A**.

2 Site Description

2.1 The location of the proposed development is shown in **Figure 2.1** below:

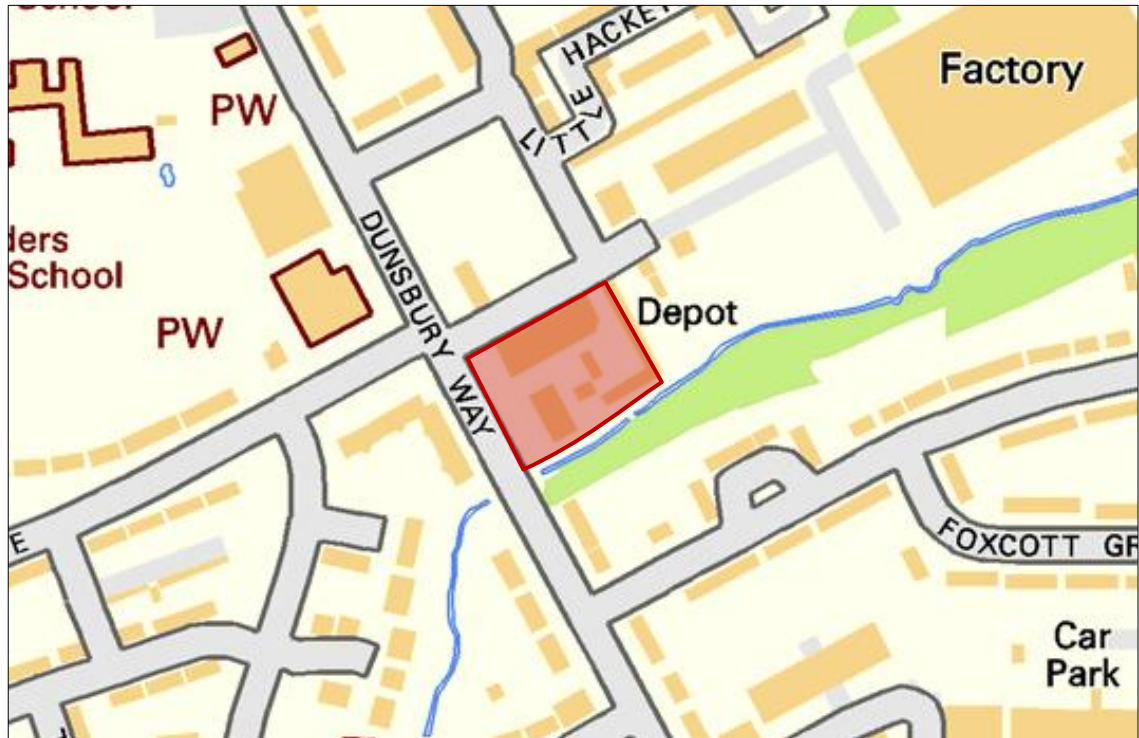


Figure 2.1: Site Location

- 2.2 The Application Site currently comprises a former Dairy Crest Depot, an existing A1 unit occupied by an end of life care services provider and an existing residential bungalow. The site is located within an area generally characterised by a mix of residential and commercial/industrial uses.
- 2.3 To the north, the site is bordered by Fulflood Road. This road gives access to existing dwellings in Little Hackets and existing commercial/industrial at Dunsbury Business Centre.
- 2.4 To the west, the site is bordered by Dunsbury Way land usage on the opposing side of land usage is predominantly residential.
- 2.5 To the south, the site adjoins an areas of woodland, beyond which are existing residential properties fronting Dunsbury Way.
- 2.6 To the east, the site adjoins existing commercial/industrial land currently occupied by a vehicle rental company.

3 Proposed Development

- 3.1 The proposed development seeks to create 78 new residential units. The proposed general arrangement of the flats is shown in **Figure 3.1** to **3.6** below:



Figure 3.1: Proposed General Arrangement: Ground Floor

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Figure 3.2: Proposed General Arrangement: 1st Floor

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Figure 3.3: Proposed General Arrangement: 2nd Floor

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Figure 3.4: Proposed General Arrangement: 3rd Floor

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Figure 3.5: Proposed General Arrangement: 4th Floor

4 Planning Policy Context

National Planning Policy

National Planning Policy Framework, (NPPF, 2018)

4.1 Current governmental guidance for the determination of planning applications is given in the revised “National Planning Policy Framework” (NPPF), published on 24 July 2018.

4.2 Paragraph 170 of the NPPF advises:

“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.

4.3 With specific regard to noise, paragraph 180 of the NPPF states:

“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.*

4.4 Paragraph 182 of the NPPF draws specific attention to the need to ensure that new development is compatible with existing businesses and community facilities and introduces an “agent of change” principle:

“Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as

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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."

- 4.5 With regard to 'adverse' impacts and 'significant adverse' impacts, the NPPF directs the reader to the advice contained in DEFRA's "Noise Policy Statement for England" (NPSE). This Policy Statement introduces the concept of a "Significant Observed Adverse Effect Level" (SOAEL), "Lowest Observed Adverse Effect Level" (LOAEL) and "No Observed Adverse Effect Level" (NOAEL). These are concepts aligned with toxicology outcomes derived from guidance given by the World Health Organisation.

[Noise Policy Statement for England](#)

- 4.6 Whilst the intent of the NPSE in relation to the NPPF is clear, the NPSE does not, at this time, provide any quantitative threshold values for each identified level of "effect". Indeed, the NPSE carefully highlights that:

"It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available."

[National Planning Practice Guidance](#)

- 4.7 The application of national planning is amplified in the governments "National Planning Practice Guidance" (NPPG). This seeks to help clarify understanding the perception of noise effects, outcomes and actions that should be taken to align decision making with the NPPF. In line with the NPPF concept of basing decision making on the identification of "significant" or "other" impacts on health and quality of life, the NPPG aligns its guidance with the NPSE.
- 4.8 The table below summarises this guidance:

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Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level (NOAEL)			
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 (LOAEL)			
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; closing windows for some of the time because of the noise. Potential for non-awakening sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level (SOAEL)			
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. having to keep windows closed most of the time, avoiding certain activities during periods of intrusion. 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
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	Prevent

Table 4.1: NPSE Guidance

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- 4.9 Whilst the NPPF and associated planning practice guidance sets out stringent imperatives to ensure the satisfactory development of land in relation to possible noise impacts, this policy and guidance does not generally provide any quantitative technical guidance defining what may be considered to constitute a “significant” or “other” adverse impact. In the absence of such technical guidance, reference needs to be made to sustainable development standards set out in local policy and/or relevant ‘industry standard’ guidance.

Local Planning Policy

Pre-Application Advice

- 4.10 Pre-application has been provided by Havant Borough Council. With regard to noise, the pre-application advice notes:

‘With regard to the Dairy Crest site, pre-application advice from Havant Borough Council’s environmental health team recommends that the application is accompanied by a noise assessment which proposes appropriate mitigation to protect future residents from noise associated with existing, neighbouring industrial uses.’

Havant Borough Core Strategy (Adopted March 2011)

- 4.11 The following core strategy policies from Havant Borough Council are relevant to noise:

Policy CS16 High Quality Design

Planning permission will be granted for development that is designed to a high standard, which helps to create places where people want to live, work and relax. All development should demonstrate that its design:

1. Responds to, draws inspiration from and respects local context and:

.....

e) The development does not cause unacceptable harm to the amenity of neighbours through smell, the loss of privacy, outlook, noise and overlooking.

.....

6. Mitigates negative environmental impacts through sustainable design and construction methods, resource efficiencies, particularly water and the provision of facilities for waste recycling.

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BS 8233: 2014; “Sound Insulation and Noise Reduction for Buildings

- 4.12 BS 8233: 2014 “Sound Insulation and Noise Reduction for Buildings” offers the following design guidance for indoor ambient noise levels within dwellings:

Activity	Location	07.00 to 23.00 hours	23.00 to 07.00 hours
Resting	Living Room	35dB $L_{Aeq,16hour}$	--
Dining	Dining Room/Area	40dB $L_{Aeq,16hour}$	--
Sleeping (daytime resting)	Bedroom	35dB $L_{Aeq,16hour}$	30dB $L_{Aeq,8hour}$

Table 4.2: BS 8233 Indoor Ambient Noise Level Design Guidance

- 4.13 Whilst the above guidance is given for dwellings, the above values are also considered to be appropriate for “rooms for residential purposes”, such as student accommodation.
- 4.14 A note accompanying the above Table states:
- “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.”*
- 4.15 Despite identifying that maximum values ‘may’ be set, guidance values for differing types of noise/frequency of events is not given. It can, however, be noted that the recommendations of BS8233 are aligned with guidance set out in the World Health Organisation’s “Guidelines for Community Noise”, and is discussed later in this section.
- 4.16 A further note to the above Table indicates that where “development is considered necessary or desirable”, the above guideline values can be relaxed by 5dB and “reasonable” internal conditions still be achieved.
- 4.17 With regard to external amenity spaces, Section 7.7.3.2 of BS 8233: 2014 states:
- “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 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ 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*

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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.

[“Guidelines for Community Noise” \(World Health Organisation, 1999\)](#)

4.18 The criteria outlined in this document provide a summary of research regarding the effects of noise on the community. Section 2 of the Guidelines presents a general discussion regarding the types of noise affecting communities and their measurement. The guidelines promote the use of the $L_{Aeq,T}$ noise index. However, where there are distinct events to the noise, such as with aircraft or railway noise, the guidelines recommend that measures of the individual events should be obtained (using, for example, L_{Amax} or L_{AE}), in addition to $L_{Aeq,T}$ measurements.

4.19 The guidelines identify three critical effects of noise on dwellings – speech interference, annoyance and sleep disturbance.

4.20 With regard to ‘**speech interference**’, section 4.2 of the Guidelines identifies that:

“Speech in relaxed conversation is 100% intelligible in background noise levels of about 35dB(A) and can be understood fairly well in background levels of 45dB(A).

Speech with more vocal effort can be understood when the background sound pressure level is about 65dB(A).”

4.21 With regard to ‘**annoyance**’, section 3.8 of the Guidelines states:

“Annoyance in populations exposed to environmental noise varies not only with the acoustical characteristics of the noise (source, exposure), but also with many non-acoustical factors of social, psychological, or economic nature. These factors include fear associated with the noise source, conviction that the noise could be reduced by third parties, individual noise sensitivity, the degree to which an individual feels able to control the noise (coping strategies) and whether the noise originates from important economic activity.”

4.22 Section 4.2.7 of the Guidelines further states that:

“The annoyance response to noise is affected by several factors, including the equivalent sound pressure level and the highest sound pressure level of the noise, the number of such events, and the time of day. Methods for combining these effects have been extensively studied. The results are not inconsistent with the

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simple, physically based energy equivalent energy theory, which is represented by the L_{Aeq} noise index.

.....

During the daytime, few people are seriously annoyed by activities with L_{Aeq} levels below 55dB; or moderately annoyed with L_{Aeq} levels below 50dB”.

- 4.23 With regard to ‘**sleep disturbance**’, Section 3.4 of the guidelines states:

“If negative effects on sleep are to be avoided the equivalent sound pressure level should not exceed 30dB(A) indoors for continuous noise. If the noise is not continuous, sleep disturbance correlates best with L_{Amax} and effects have been observed at 45dB or less. This is particularly true if the background noise level is low. Noise events exceeding 45dB(A) should therefore be limited if possible. For sensitive people an even lower limit would be preferred. It should be noted that it should be possible to sleep with a bedroom window slightly open (a reduction of outside to inside of 15dB). To prevent sleep disturbance, one should thus consider the equivalent sound pressure level and the number and level of sound events. Mitigation targeted to the first part of the night is believed to be effective for the ability to fall asleep”.

- 4.24 In section 4.3.1, the above guidelines are presented in terms of external noise levels incident on buildings:

“At night, sound pressure levels at the outside facades of the living spaces should not exceed 45dB L_{Aeq} and 60dB L_{Amax} , so that people may sleep with windows open”.

- 4.25 With regard to the frequency of noise events, the WHO guideline’s imply that indicated values should not be exceeded more than 10-15 time per night.

[ProPG: Professional Practice Guidance on Planning and Noise](#)

- 4.26 ProPG: Planning & Noise was published in May 2017. The guidance was authored by representatives from the Chartered Institute of Environmental Health (CIEH), Institute of Acoustics (IOA) and Association of Noise Consultants (ANC) and seeks to consolidate and standardise existing industry best practice in order to expedite the planning process with regard to the consideration of noise.

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4.27 The ProPG document promotes a two stage methodology for the acoustic assessment of a proposed residential development. Stage 1 involves an “Initial Site Risk Assessment”, to identify the likely risk of adverse effects from noise, were no subsequent mitigation to be included as part of the development proposal. The categorisation of potential risk is presented in Figure 1 of the guidance which is reproduced in **Figure 6.3** below:

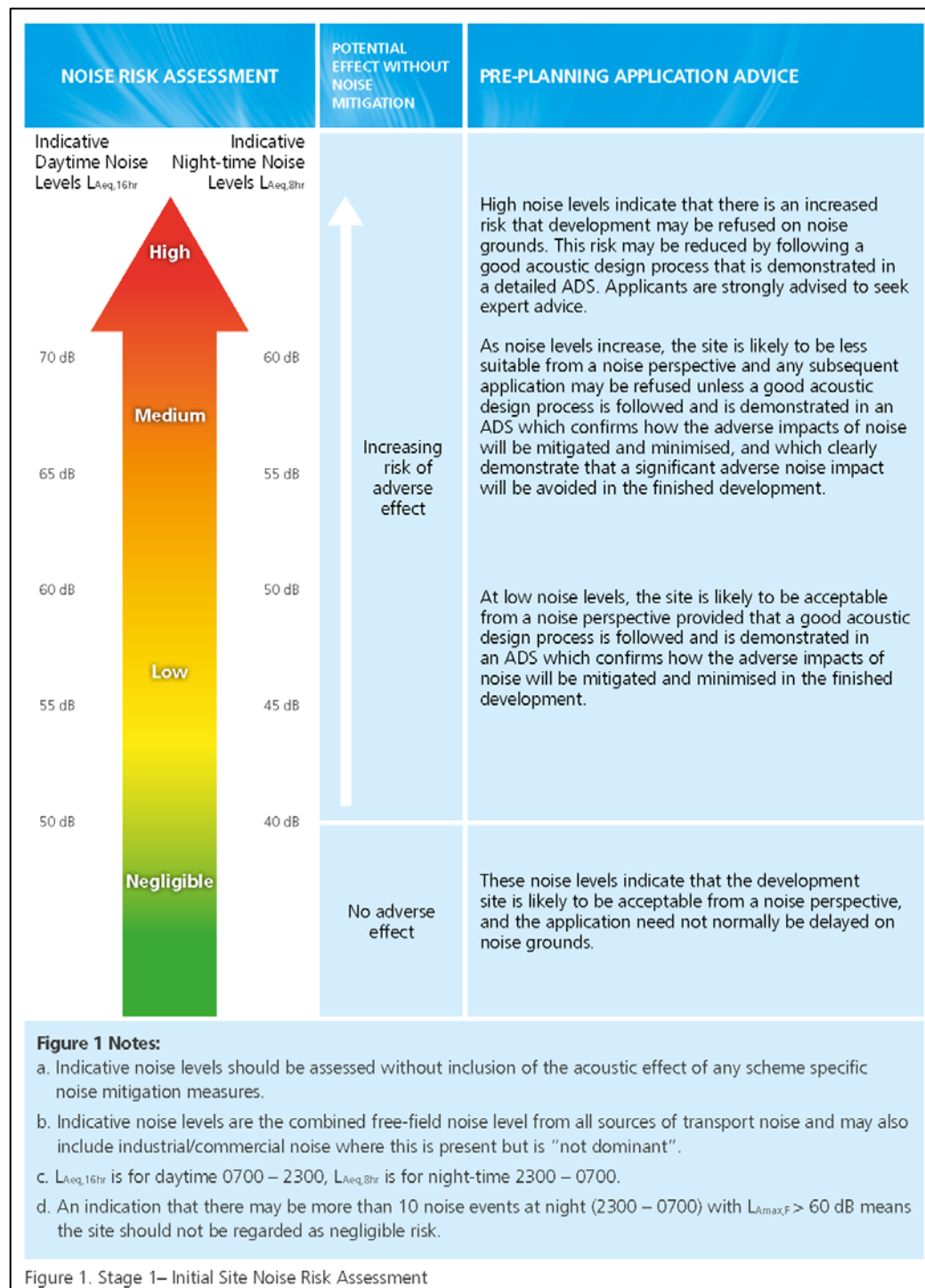


Figure 4.1: ProPG Initial Site Noise Risk Assessment

Noise Assessment

4.28 Where the Stage 1 assessment indicates that there is a potential for adverse effect, a Stage 2 “Full Assessment” should then be undertaken. This requires four elements to be considered:

- **Element 1:** Good Acoustic Design
- **Element 2:** Internal Noise Level Guidelines
- **Element 3:** External Amenity Area Noise Assessment
- **Element 4:** Assessment of Other Relevant Issues

BS 4142: 2014: Methods for Rating and Assessing Industrial and Commercial Sound

4.29 BS 4142: 2014 provides a rating and assessment methodology for assessing the potential adverse impact of industrial and commercial noise sources on neighbouring dwellings.

4.30 The assessment procedure initially compares the ‘**Rating Level**’ of the source with the ‘**Background Noise Level**’ when the source is not present.

4.31 The ‘**Rating Level**’ (L_{Ar}) referred to is the specific noise level of the noise source under investigation (in terms of the L_{Aeq} noise index), to which corrections are applied if the noise has certain audible characteristics. **Table 4.5** below summarises the corrections to be applied based on a subjective assessment of noise source characteristics.

Character Correction				
Feature / Perception	Tonality	Impulsivity	Intermittency	Other acoustic characteristics
Just Perceptible	+2dB	+3dB	When the specific sound has identifiable On/Off conditions that are readily distinctive. +3dB	+3dB
Clearly Perceptible	+4dB	+6dB		
Highly Perceptible	+6dB	+9dB		

Table 4.3: BS 4142: 2014 Character Correction for Rating Level Calculation

4.32 The ‘**Background Noise Level**’ (L_{A90}) represents the noise level that is exceeded for 90% of the stated measurement period. For assessment purposes, the background noise level needs to be determined without the noise source under investigation operating.

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- 4.33 The time of operation needs to be taken into account. During the day (normally taken to be 07.00 to 23.00 hours) a one hour measurement period is considered appropriate. During the night (normally taken to be 23.00 – 07.00 hours) a 15-minute time period is normally used.
- 4.34 The following guidance is then offered based on the outcome of this initial assessment:
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
 - A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
 - The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.
- 4.35 A note accompanying the above guidance states: *“Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.”*
- 4.36 The initial estimate of the impact should then be modified to account for its context. Such considerations include:
- The absolute level of the sound - the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low. Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.
 - Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.
 - The character and level of the residual sound compared to the character and level of the specific sound.

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- 4.37 The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions.

5 Baseline Conditions

Measurement Locations

- 5.1 Existing baseline noise conditions at the site have been established using a combination of automated and manned noise surveys. Noise levels were monitored at five locations as shown in **Figure 5.1** and described in **Table 5.1** below:



Figure 5.1: Noise Monitoring Locations

Location	Description
M1	At the northern corner of the site on Fulflood Road. The measurement microphone was positioned approximately 1.5m above ground level in broadly free field conditions.
M2	At western corner of the site, at the junction of Dunsbury Way and Fulflood Road. The measurement microphone was positioned approximately 1.5m above ground level in free field conditions.
M3	Overlooking Dunsbury Way. The measurement microphone was positioned approximately 1.5m above ground level in free field conditions.
M4	At the eastern corner of the site, within the service yard area of the former depot. The measurement microphone was positioned approximately 1.5m above ground level.
A1	At the north-east corner of the site. The measurement microphone was positioned approximately 4.5m above ground level in free field conditions, with a line of sight towards the neighbouring industrial/commercial land.
A2	On the southern boundary of the dairy site, adjoining the entrance to the adjoining A1 unit. The measurement microphone was positioned approximately 2.4m above ground level in broadly free-field conditions.

Table 5.1: Description of Noise Monitoring Locations

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5.2 The following instrumentation was used for the surveys:

Location	Description	Manufacturer	Model	Serial No.	Calibration Date
M1-4	Sound Level Meter	NTi Audio	XL2-TA	A2A-13108-EO	21/06/17
	Microphone		M2230A	A14228	
	Preamplifier		MC230A	6832	
A1	Sound Level Meter	SvanteK	SVAN 71	55550	04/06/2018
	Microphone		7052E	63684	
	Preamplifier		SV18	57249	
	Outdoor Mic. Kit		SA271U	n/a	n/a
A2	Sound Level Meter	SvanteK	SVAN 71	55551	04/06/2018
	Microphone		7052E	63681	
	Preamplifier		SV18	57254	
	Outdoor Mic. Kit		SA271U	n/a	n/a

Table 5.2: Measurement Instrumentation

- 5.3 The sound level analysers were calibrated before the survey and checked upon completion. No drift in calibration was observed.
- 5.4 The manual survey was undertaken between 13.00 to 16.00 hours on 19 September 2018.
- 5.5 The automated survey was undertaken over a notional 5 day period between 14 to 19 September 2018.
- 5.6 The sound level analyser used for measurements at Positons M1, M2, M3 and M4 was configured to measure the L_{A90} , L_{Aeq} , L_{A10} and $L_{Amax,fast}$ noise indices over a notional 10-15 minute period in each hour.
- 5.7 The automated sound level analysers at Positon A1 and A2 was configured to measure the L_{A90} , L_{Aeq} , L_{A10} and $L_{Amax,fast}$ noise indices over consecutive 15 minute time periods. The equipment was also configured to log at a higher (1 second) resolution to assist with the discrimination of noise events, in addition to audio recordings to assist with source identification.

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Measurement Results

5.8 The below tables and figures show the raw measurement results:

Location	Time	L _{A90,15mins}	L _{Aeq15mins}	L _{A10,15mins}	L _{Amax,fast}
M1	13:00 – 14:00	45.8	58.4	58.8	77.7
	14:00 – 15:00	48.0	57.8	56.8	80.7
	15:00 – 16:00	49.0	58.2	61.0	75.2
M2	13:00 – 14:00	51.6	62.5	65.5	78.2
	14:00 – 15:00	52.7	60.4	63.7	77.2
	15:00 – 16:00	52.7	62.5	64.9	82.5
M3	13:00 – 14:00	50.7	60.8	64.1	85.7
	14:00 – 15:00	52.2	61.9	65.5	77.6
	15:00 – 16:00	53.8	63.1	66.4	79.8
M4	13:00 – 14:00	47.6	51.1	53.6	71.7
	14:00 – 15:00	49.1	53.6	55.4	73.7
	15:00 – 16:00	48.5	52.3	53.6	71.9

Table 5.3: Manual Noise Measuring Results

5.9 The results of the automated noise monitoring are presented in **Figures 5.2** and **5.3** below. Higher resolution copies of these time history graphs are also attached at **Appendix B**.

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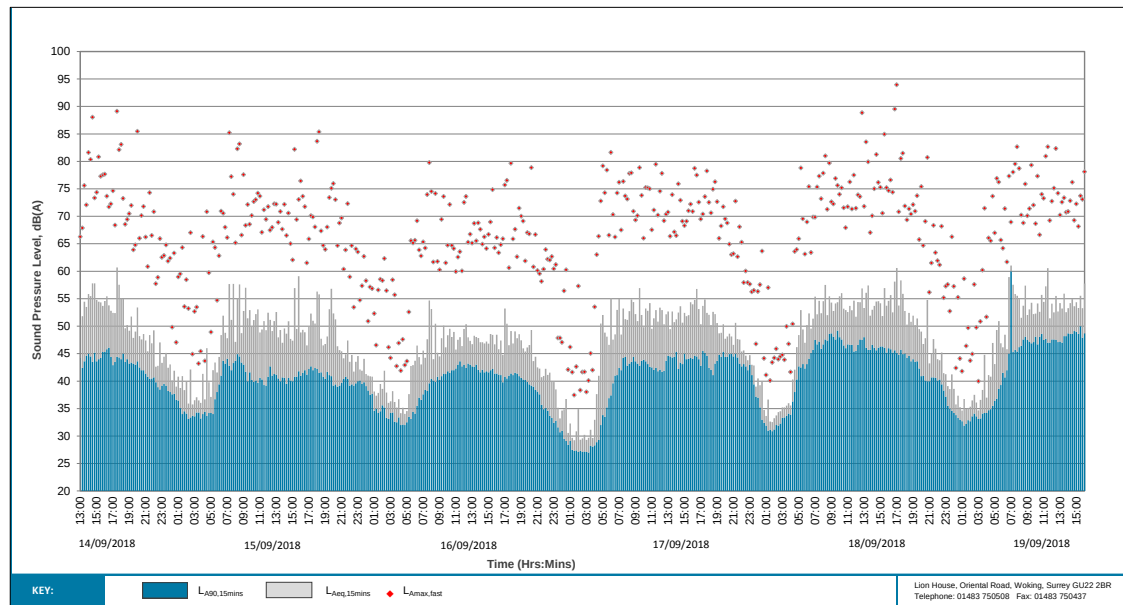


Figure 5.2: Time History Profile for Position A1

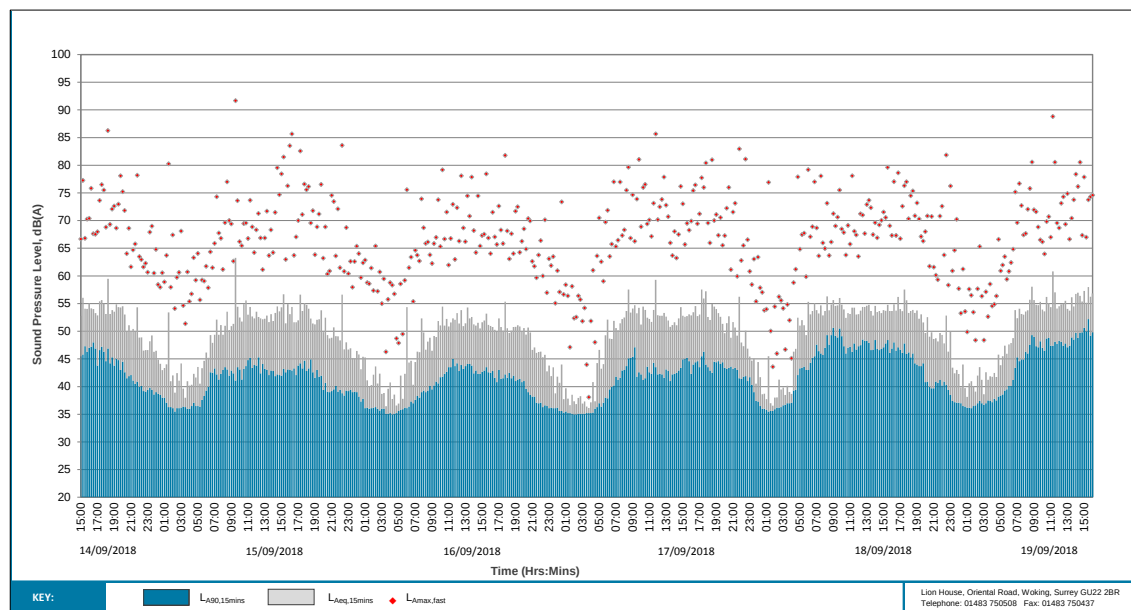


Figure 5.3: Time History Profile for Position A2

Weather

- 5.10 The weather during the manual surveys on 19th September 2018 was overcast and dry with a temperature of around 18°C, little/no wind and with around 8 oktas of cloud cover.
- 5.11 Due to the nature of the automated survey, i.e. unmanned, it is not possible to accurately comment on the weather conditions throughout the entire survey period. However, observations at the time of site attendances and publicly available historic online data,

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indicates that weather conditions were typically characterised as set out in **Table 5.3** below:

2018	Temp. (°C)		Humidity (%)		Wind Speed (km/h)		Pressure (hPa)		Rainfall(m m)
September	Max	Min	Max	Min	Max	Min	Max	Min	total
14	20	9	100	50	26	3	1019	1012	0.00
15	19	10	88	64	24	6	1019	1016	0.00
16	19	9	100	78	21	3	1017	1013	0.40
17	20	9	100	49	21	2	1021	1017	0.00
18	20	8	88	68	16	3	1022	1020	0.00
19	19	9	94	73	23	8	1021	1018	2.90

Table 5.4: Weather

Analysis of Data

Manual Noise Data

- 5.12 The measurement data for Positions M1/2/3 has been processed to determine typical daytime ($L_{Aeq,16hr}$) and night-time ($L_{Aeq,8hr}$) value due to road traffic noises. These values have been estimated in accordance with the shortened measurement procedure of CRTN¹. This analysis yields a predicted $L_{A10,18hr}$ value from which the $L_{Aeq,16hr}$ and $L_{Aeq,8hr}$ values have been estimated using the procedures developed by TRL/Casella Stanger for DEFRA².
- 5.13 Calculated manual noise measurement values are summarised in **Table 5.7** below.

Location	Day-time $L_{Aeq,16hr}$ (dB) (07:00 – 23:00)	Night-Time $L_{Aeq,8hr}$ (dB) (23:00 – 07:00)
M1	55.9	48.3
M2	61.7	53.6
M3	62.3	54.1

Table 5.5: Calculated Daytime and Night-time $L_{Aeq,T}$ values

¹ Department of Transport. (1988) "Calculation of Road Traffic Noise". HMSO, London.

² TRL/Casella Stanger (2006) for DEFRA. Method for Converting the UK Road Traffic Noise Index $L_{A10,18h}$ to the EU Noise Indices for Road Noise Mapping.

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Automatic Noise Data

5.14 Automatic noise measurement values from position **A1** and **A2** are summarised in Table 5.8 below.

Date	L _{Aeq,16hour}	Typical L _{Amax,fast}	Typical L _{A90}
14/09/2018	53.5	82.2	40.5
15/09/2018	52.0	77.5	39.3
16/09/2018	47.8	74.4	37.6
17/09/2018	52.1	77.7	42.1
18/09/2018	53.9	81.1	40.4
19/09/2018	55.2	80.1	46.3

Table 5.6: Daytime Noise Levels: Position A1

Date	L _{Aeq,8hour}	Typical L _{Amax,fast}	Typical L _{A90}
14/09/2018	43.4	67.9	33.6
15/09/2018	40.9	65.0	32.5
16/09/2018	45.7	74.3	27.1
17/09/2018	45.4	69.5	31.3
18/09/2018	46.5	73.4	32.7

Table 5.7: Night-time Noise Levels: Position A1

Date	L _{Aeq,16hour}	Typical L _{Amax,fast}	Typical L _{A90}
14/09/2018	53.7	77.2	40.1
15/09/2018	53.4	79.2	39.3
16/09/2018	50.8	74.3	37.7
17/09/2018	53.3	79.1	41.5
18/09/2018	53.6	76.8	40.7
19/09/2018	55.7	79.2	45.7

Table 5.8: Daytime Noise Levels: Position A2

Date	L _{Aeq,8hour}	Typical L _{Amax,fast}	Typical L _{A90}
14/09/2018	45.4	67.9	36.1
15/09/2018	44.4	64.0	35.1
16/09/2018	44.4	70.4	35.1
17/09/2018	48.3	76.1	35.8
18/09/2018	45.1	66.5	36.4

Table 5.9: Night-time Noise Levels: Position A2

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Discussion

- 5.15 Noise levels characterising the site are dominated by general traffic movements on Dunsbury Way and Fulflood Road.
- 5.16 Traffic on Fulflood Road included passenger vehicles accessing Little Hackets and commercial vehicles (including vans, HGV's and coaches) accessing the nearby commercial/industrial uses. The observed number of vehicle movements was however low.
- 5.17 Noise from plant or processes associated with the neighbouring commercial/industrial uses was not generally audible at the site and was not judged to have any dominant impact on measured noise levels.

6 Site Suitability - Residential

6.1 As noted earlier, ProPG guidance is intended to assist with determining the suitability of sites for residential development to protect them against general transport related noise sources. An initial noise risk assessment of the site has therefore been undertaken in accordance with this ProPG guidance.

6.2 **Figure 6.1** below summarises the daytime noise levels ($L_{Aeq,16hour}$) measured at the site:



Figure 6.1: Estimated Daytime Noise Levels ($L_{Aeq,16hour}$)

6.3 **Figure 6.2** below summarises estimated night-time ($L_{Aeq,8hour}$) noise levels.

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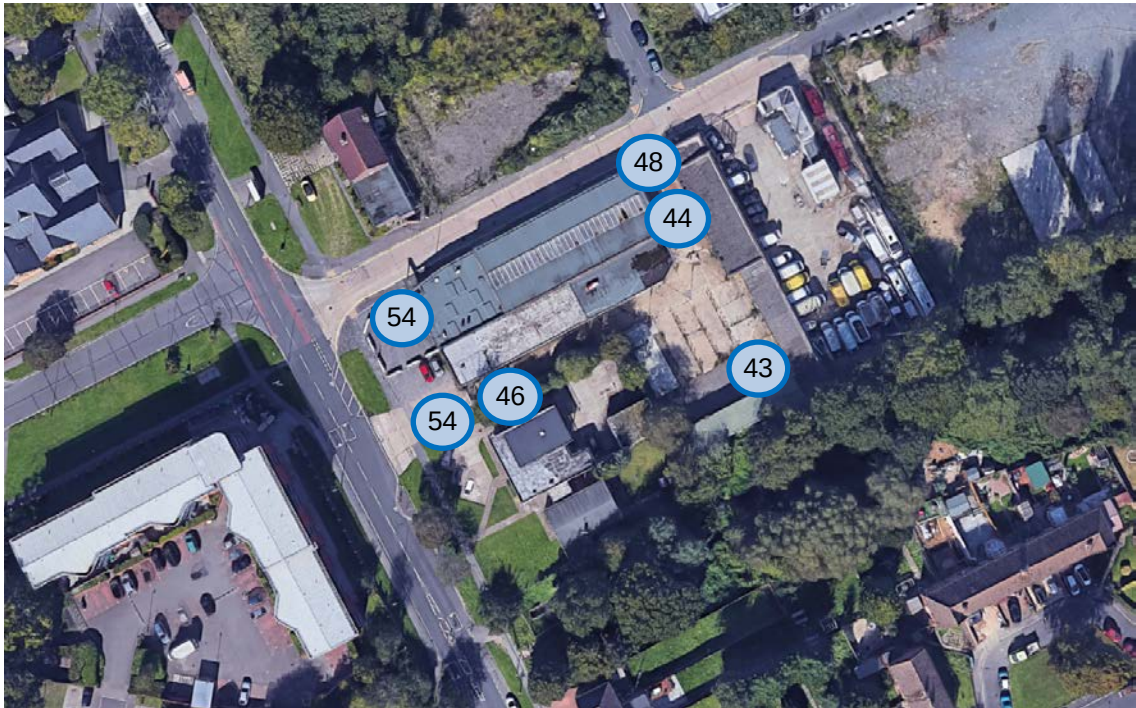


Figure 6.2: Estimated Night-time Noise Levels ($L_{Aeq,8hour}$)

6.4 The above figures show that the site boundary closest to Dunsbury Way would be categorised as having a “medium” (unmitigated) noise risk, whilst measurements positions on Fulflood Road and within the site would be categorised as a “low” (unmitigated) risk.

6.5 For low risk sites, ProPG states:

“At low noise levels, the site is likely to be acceptable from a noise perspective provided that a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development.”

6.6 For medium risk sites, ProPG states:

“As noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development..”

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- 6.7 It is therefore concluded that the site should be suitable for residential development, subject to the implementation of a good acoustic design process. A full noise assessment has therefore been undertaken in accordance with “Stage 2” of ProPG guidance.

7 ProPG Stage 2 “Full Assessment”

7.1 A ProPG Stage 2 “Full Assessment” requires consideration of four key elements:

- **Element 1** – Good Acoustic Design Process
- **Element 2** – Internal Noise Level Guidelines
- **Element 3** – External Amenity Area Noise Assessment
- **Element 4** – Assessment of Other Relevant Issues

7.2 Each of these elements is considered below.

Element 1 – “Good Acoustic Design”

7.1 A preferred hierarchy of strategies constituting a “*good acoustic design process*” for mitigating noise impacts is set out below:

- Reducing noise “at source”;
- Providing “buffer” zones to limit noise exposure;
- Reducing noise propagation across site (e.g. through the use of barriers);
- Developing the layout of the site to optimise acoustic protection (e.g. through the use of “barrier” blocks to help further limit noise propagation and the use of courtyard style development to protect external amenity areas);
- The orientation/general internal arrangement of buildings (e.g. by locating non-habitable rooms on ‘noisier’ facades and more sensitive uses on acoustically screened facades); and
- Providing buildings with appropriate sound insulation through the specification of appropriate external fabric constructions (in particular windows) and providing appropriate alternative means of ventilation if acceptable internal noise levels cannot be achieved if windows are open.

Reducing Noise “At Source”

7.2 As noted earlier in this report, noise levels at the site are dominated by vehicle movements on Dunsbury Way, with lower flows of passenger and commercial traffic characterising Fulflood Road. Clearly, such noise cannot be “removed” and it is not therefore considered feasible to provide any “*at source*” mitigation for this site.

Noise Assessment

Buffer Zones

- 7.3 Sound energy naturally decreases with increasing distance from a source. Effective noise mitigation can therefore be implemented through the introduction of “buffer zones” to avoid development in areas most significantly exposed to noise.
- 7.4 The building line of the proposed development has been set back from Dunsbury Way by approximately 12m which will help minimise incident noise levels. The proposed building has also been configured in an “L” shape, pushing the development away from the industrial areas to the east - albeit that noise from existing industrial uses was not judged to have any dominant effect on noise levels associated with these uses, as corroborated my measurements on the eastern site boundary.

Acoustic Screening

- 7.5 Acoustic screens (e.g. noise barriers, bunds, etc.) can usefully reduce noise propagation across a site. In order for a barrier to be effective, it must obviate the direct line of sight between a noise source and receptor location. The amount of acoustic screening provided is dependent on the geometric relationship between the “direct” path noise would travel (without the barrier in place), and the “indirect” path sound would need to travel “up and over” the barrier bund. The greater this path difference, the greater the attenuation provided, as shown in **Figure 7.1** below:

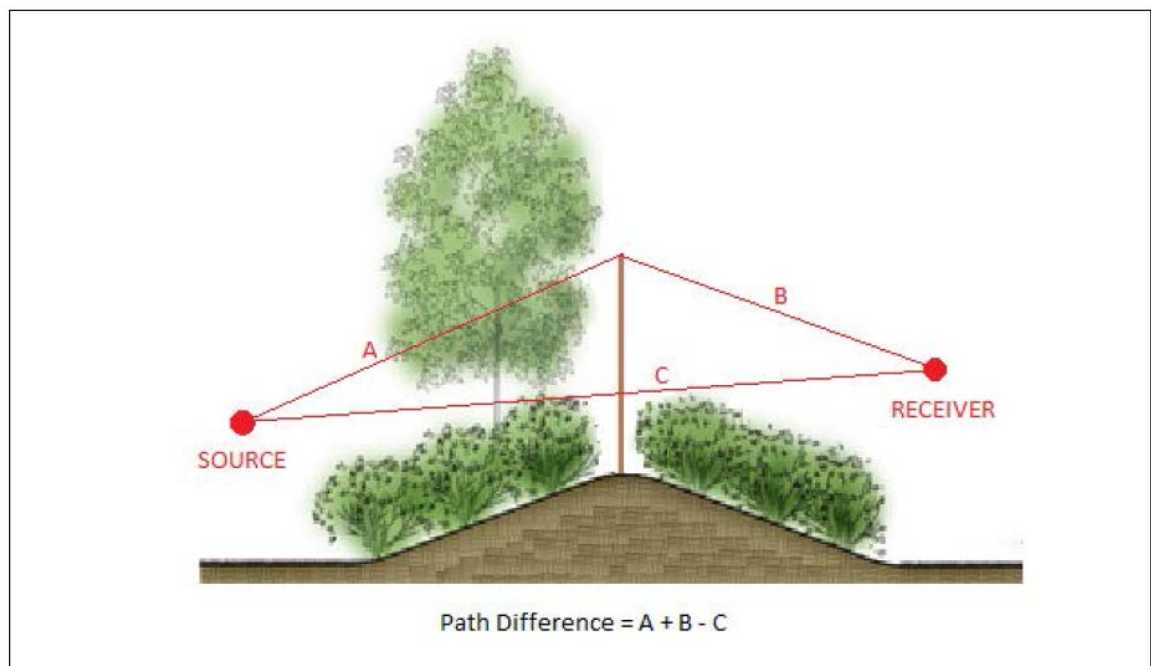


Figure 7.1: Calculation of Barrier Path Difference

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- 7.6 As noted earlier, the dominant noise sources at the site is noise from surrounding roads. The use of an acoustic barrier to mitigate noise incident on a proposed four storey building is not therefore considered practicable.
- 7.7 The building has, however, been developed with a strong frontage facing both Dunsbury Way and Fulflood Road, to provide a strong massing to these roads and minimise road noise at flats on the screened elevations of the buildings.
- 7.8 The existing arrangement of the site includes a continuous brick wall along the eastern elevation of the site (which provides structural support for existing covered parking within the service yard of the former dairy). This is shown in **Figure 7.2** below (as viewed from Fulflood Road looking across the existing car/van rental premises towards the site).

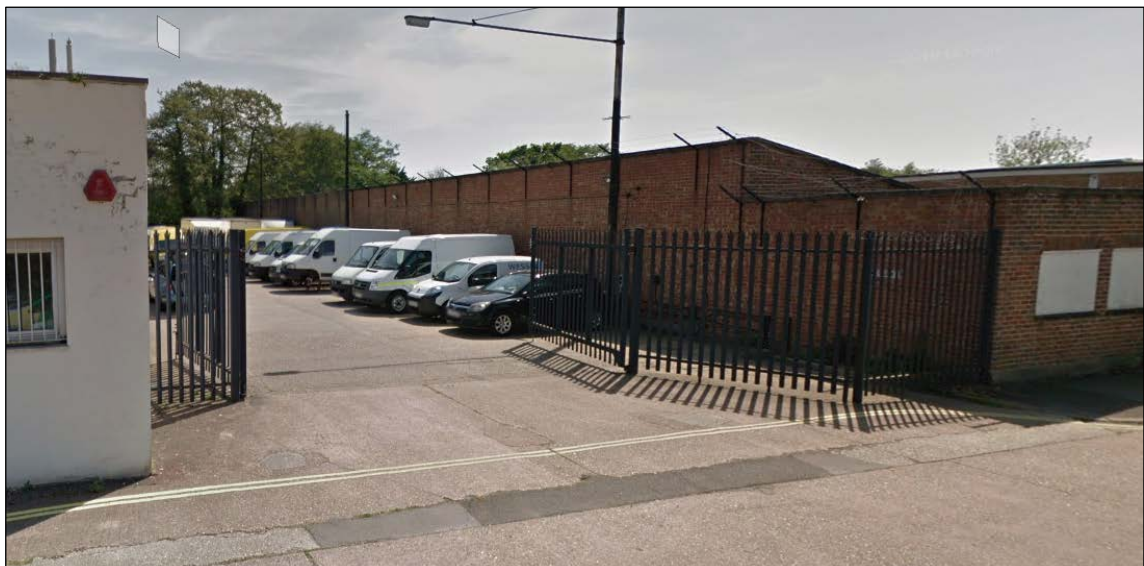


Figure 7.2: Existing Brick Wall Between Site and Adjoining Industrial/Commercial

- 7.9 The development proposals include the demolition of the roof structure but retention of the brick built boundary treatment. As such, whilst the noise survey did not indicate any dominant process or operational noise associated with existing industrial uses to the east of the site, the retention of the existing boundary wall should provide effective acoustic screening from any neighbouring industrial/commercial activities, as a matter of course.

Sound Insulation

- 7.10 Noise intrusion into dwellings can be readily controlled through the appropriate specification of external building fabric elements. Windows normally being the “weakest” component, in addition to consideration being given to the internal general arrangement of dwellings (such that non-habitable rooms are located on more noise exposed building

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elevations and with more noise-sensitive habitable rooms located on quieter (acoustically screened) elevations).

- 7.11 It is, however, important to appreciate that the sound insulation of windows will only be effective when they are closed. As such, it will also be necessary to ensure that, where properties cannot achieve acceptable internal noise levels when windows are open, properties are provided with appropriate (acoustically treated) alternative means of ventilation.

7.12

Conclusion

- 7.13 It is concluded that the proposed master planning for the site follows a good acoustic design process and includes embedded mitigation which helps minimise noise impacts, in line with the spirit of ProPG, the NPPF, NPSE and NPPG.

Element 2 – Internal Noise Levels

- 7.14 In order to ensure a good standard of residential amenity within dwellings, BS 8233: 2014 and ProPG guidance recommends that daytime noise levels should be below 35dB $L_{Aeq,16hour}$ and night-time values in bedrooms should be below 30dB $L_{Aeq,8hour}$. These values are considered to represent a LOAEL, in line with national planning policy guidance.
- 7.15 At night, WHO/ProPG guidance indicates that an LOAEL would be indicated when an event sound level of 45dB $L_{Amax,fast}$ is not exceeded more than 10-15 times per night.

General

- 7.16 The level of sound insulation required of a building façade will be determined by:
- **The noise levels incident on a particular area of façade.** In the case of this development, it is clear that higher levels of sound insulation will be required for facades overlooking Dunsbury Way, than for units on the screened side of the building.
 - **The sound insulation capabilities of the constituent building elements.** Noise intrusion into buildings is normally determined by the acoustic performance of the windows, since these represent the “weakest” element acoustically. For preliminary calculation purposes, it is assumed that “solid” external wall construction will maintain the following minimum apparent sound reduction indices:

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Apparent Sound Reduction Index, dB					
125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz
41	43	48	50	55	55

Table 7.1: Estimated Apparent SRI for Solid External Walls Elements

The above performance values should also be achievable with a masonry faced steel or timber framed construction system and therefore provides a robust assessment basis for reviewing the likely acoustic performance requirements of windows and feasibility of maintaining an appropriate level of sound insulation

- **The relative proportion of building elements.** The sound insulation required will increase as the façade area to a room increases. The sound insulation required of weaker performing elements (e.g. windows) will also increase when the proportional area of these is increased. Preliminary calculations are based on the general arrangements and elevational treatments shown on the drawings prepared by PWP Architects which accompany the application.
- **The acoustic conditions of the receiving room.** Noise intrusion into acoustically hard (reverberant) rooms, will increase sound insulation requirements. For the purpose of this preliminary assessment, a reverberation time of 0.5 seconds has been assumed for all rooms, in line with the standardised reverberation time implemented in Approved Document E of the Building Regulations 2010.

- 7.17 In order to assess the likely sound insulation requirements of glazing, preliminary noise intrusion calculations have been undertaken in accordance with BS EN 12354-3:2017 *“Estimation of acoustic performance of buildings from the performance of elements- Part 3: Airborne Sound Insulation Against Outdoor Sound”*.
- 7.18 These calculations indicate that noise intrusion will be readily comfortably controlled in line with ProPG and BS 8233: 2014 target values with the use of standard double glazing. It is therefore recommended that windows to all elevations are provided with glazing compatible with maintaining a minimum sound reduction performance of R_w 29dB.
- 7.19 Finalised acoustic performance requirements for glazing should be determined during the detailed design stage of the project based on finalised internal general arrangement and construction proposals.

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Ventilation

- 7.20 Approved Document F (ADF) of the Building Regulations 2010 (as amended) requires that all habitable rooms in dwellings are provided with “whole house” (background) ventilation and air extraction from humid areas.
- 7.21 It is therefore recommended that allowance is made for acoustic trickle ventilators offering a minimum sound reduction performance of $D_{ne,w}$ 35dB (in its open position). The provision of such ventilators will therefore enable windows to remain closed, whilst maintaining ADF ventilation requirements and would also be sufficient to provide effective control over noise ingress during normal occupation.
- 7.22 Existing noise measurements suggest that a lower specification of ventilator could provide adequate control of existing noise levels for units on the “rear” elevations of the building overlooking the car park. It is, however, recommended that ventilators specified at $D_{ne,w}$ 35dB (in its open position) are also used for units, to provide additional protection against noise associated with the use of the car park.
- 7.23 The above performance recommendations is based on an assumption that each room would be fitted with a single trickle ventilator. If more than one ventilator is required, the performance of each ventilator will should be increased in line with the corrections set out in the following table:

No of Ventilators	Correction to be Applied to Specified D_{ne} Performance Value
1	0
2	+3
3	+5

Table 7.2: Corrections for Multiple Ventilators

- 7.24 Finalised acoustic performance requirements for ventilators should be determined during the detailed design stage of the project based on finalised internal general arrangement and construction proposals.

Purge Ventilation

- 7.25 Approved Document F also requires that adequate provision is made for purge ventilation. Purge ventilation is the process of removing high concentrations of pollutants and water vapour released from occasional activities (such as painting and decorating) or accidental releases (such as smoke from burnt food or spillage of water). Since the

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need for purge ventilation is by its definition “occasional”, this is normally achieved by giving residents the ability to open their windows. Whilst noise intrusion will increase as a result of windows being open, the occasional and temporary occurrence of such a situation can be readily accepted, particularly since occupants are “*in control*” of both the timing and duration of purge ventilation being required.

- 7.26 It is therefore proposed that purge ventilation for all dwellings will be achieved by means of openable windows. This approach is consistent with the guidance given in section 8.4.5.4 of BS 8233; 2014 which states:

8.4.5.4 Ventilation

*The Building Regulations’ supporting documents on ventilation [48, 49, 50] recommend that habitable rooms in dwellings have background ventilation. Where openable windows cannot be relied upon for this ventilation, trickle ventilators can be used and sound attenuating types are available. **However, windows may remain openable for rapid or purge ventilation, or at the occupant’s choice.***

- 7.27 The acceptability of using openable windows for providing purge ventilation is also in accordance with paragraph 2.35 of ProPG guidance which states:

It should also be noted that the internal noise level guidelines are generally not applicable under “purge ventilation” conditions as defined by Building Regulations Approved Document F, as this should only occur occasionally (e.g. to remove odour from painting and decorating or from burnt food).

Thermal Comfort

- 7.28 Whilst not a statutory requirement, ADF highlights that windows may also need to be used to provide “rapid” ventilation to facilitate cooling of the premises, if there is a significant risk of properties “over-heating”.
- 7.29 It is generally accepted that an open window will provide an outside to inside sound reduction of around 15dB(A). It can therefore be seen that, in order to maintain ProPG internal target levels, external noise levels would need to be no greater than 50dB $L_{Aeq,16hour}$ daytime or a night-time value of 45dB $L_{Aeq,8hour}$ for “normal” design purposes. As noted earlier, these noise levels would be generally be considered to represent a “*Lowest Observed Adverse Effect Level*” (LOAEL).
- 7.30 For most urban development opportunities adjacent to transport infrastructure, noise level will exceed the above inferred LOAEL values. To add some context to this, it should

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be noted that “UK National Noise Incidence Study 2000/2001” (produced by the Building Research Establishment on behalf of DEFRA), indicated that up to 55% of the population live in dwellings exposed to noise levels above WHO guideline values during the daytime, whilst up to 68% live in accommodation exposed to values above WHO guidelines at night.

7.31 However, the above observations should not be taken to imply that development of land characterised by noise levels above WHO guideline values should be precluded. Indeed, national planning policy clearly directs that noise impacts need to be “*mitigated and reduced to a minimum*”, whilst avoiding “significant” impacts (i.e. impacts above a “*Significant Observed Adverse Effect Level*” (SOAEL)). The material consideration here is that exceedance of the WHO guidelines or other industry standard guidance should not be taken to imply that a “significant” adverse effect will be experienced. Indeed, there are current research findings which indicate that “*Significant Observed Adverse Effect Levels*” (SOAEL) are unlikely to occur unless there is a significant exceedance of the LOAEL values, particularly if occupants are not routinely exposed to such noise levels.

7.32 The above is recognised within the ProPG guidance, which offers the following commentary:

“Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal L_{Aeq} target levels may be relaxed by up to 5dB and reasonable conditions still be achieved. The more often internal noise level start to exceed the internal L_{Aeq} target levels by more than 5dB, the more that most people are likely to regard them as “unreasonable”. Where such exceedances are predicted, applicants should be required to show how the relevant number of rooms affected has been kept to a minimum. Once internal L_{Aeq} levels exceed the target by more than 10dB, they are highly likely to be regarded as “unacceptable” by most people, particularly if such levels occur more than occasionally. Every effort should be made to avoid relevant rooms experiencing “unacceptable” noise levels at all and where such level are likely to occur frequently, the development should be prevented in its proposed form”.

7.33 The above guidance therefore supports a view that an exceedance of the ProPG internal guideline values should not automatically be taken to infer that acoustic conditions are “unreasonable”. On the contrary, the advice presented clearly indicates that “reasonable” acoustic conditions can be maintained where internal L_{Aeq} noise level design guidance is

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exceeded by 5dB(A), and that noise levels might only be considered “unacceptable” where levels are more than 10dB(A) higher than the stated $L_{Aeq,T}$ values.

- 7.34 However, it can also be seen that ProPG indicates that the potential “acceptability” of noise intrusion does not solely relate to noise magnitude - consideration also needs to be given to the potential duration of any increased noise exposure. The implication here is that whilst a significantly increased noise exposure could be tolerated for occasional periods, this is likely to become increasingly unacceptable as the period of exposure increases.
- 7.35 This is clearly a material consideration when considering the potentially conflicting requirements of acoustic and thermal comfort - since such conflict might only exist for a limited period of time.
- 7.36 At the planning stage of a development, it is generally not practicable/proportionate for detailed thermal modelling to determine the significance of any over-heating risk to be quantified (which would be required to consider the potential duration that windows might need to be open to control overheating if reliant on natural ventilation).
- 7.37 This, coupled with the limited guidance on how the “acceptability” of acoustic/overheating consideration should be determined, prompted the Association of Noise Consultants to publish a draft *“Acoustics ventilation and Overheating: Residential Design Guide”* (February 2018). This document seeks to provide additional guidance to assist in identifying when external noise levels might indicate a “significant” risk of adverse health and quality of life effects, if reliance is placed on the use of openable windows to minimise the risk of excess heat within dwellings.
- 7.38 The guidance identifies the following initial risk categories:

External Free-Field Noise Level, ^[Note 1]		Examples of Outcome	Risk Category for Level 1 Assessment ^[Note 4]
$L_{Aeq,T}$ ^[Note 2] During 07.00 – 23.00	$L_{Aeq,T}$ ^[Note 3] During 07.00 – 23.00		

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≤ 52 dB	≤ 47 dB	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 the noise. Potential for some reported sleep disturbance. Affects the acoustic environment inside the dwelling such that there is a perceived change in the quality of life.	Low
>52 dB and ≤ 62 dB	>47 dB and ≤ 55 dB	Increasing risk of adverse effect due to impact on reliable speech communication during daytime or sleep disturbance at night. Although noise levels at the lower end of this category will cause changes in behaviour, they may still be considered suitable. Noise levels at the upper end of this category will result in more significant changes in behaviour and are only likely to be considered suitable if they occur for limited periods.	Medium
> 62dB	> 55dB	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.	High
Note 1 - The values presented in this table should not be regarded as fixed thresholds and reference can also be made to relevant dose-response relationships, such as those described in a DEFRA 2014 study [20]. Note 2 - A decision must be made regarding the appropriate averaging period to use. The averaging period should reflect the nature of the noise source, the occupancy profile and times at which overheating might be likely to occur. Further guidance can be found within the 2014 IEMA Guidelines [21]. Note 3 - Regular individual noise events should also be considered. Refer to Appendix A of ProPG for further guidance. Note 4 - The risk of an adverse effect occurring will also depend on how frequently and for what duration the mitigation of overheating is likely to result in increased internal noise levels.			

Table 7.3: ANC AVOG Consultation Draft Guidance

- 7.39 The results of the noise survey work indicate that the site will generally be considered to represent a low to medium risk, and thus existing noise conditions should not give rise to any significant adverse effect when windows are open.
- 7.40 Notwithstanding the above, efforts should still be made to minimise the potential risk of overheating when developing the detailed design of the building including giving consideration to:
- Utilising the benefits of additional thermal mass in the design;
 - Using “Low E” glass to minimise solar gains through windows;
 - Solar shading and shutters can be used to good effect to reduce the heating effect of the sun;

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- The use heat reflective finishes on walls and roofs.
- 7.41 Where a residual significant risk of extended overheating remains, additional means of ventilation or cooling should be considered to ensure that residents are provided with adequate provisions for maintaining thermal control over their home without the need for windows to be opened. Options could potentially include:
- The use of a summer “by pass” / boosted operation of MVHR units;
 - The use of additional mechanical systems to provide dedicated “rapid” ventilation of rooms (options previously encountered include proprietary direct input fans which can draw a rapid rate of ventilation through an external louvre; an enhanced extract system to provide more rapid air extraction; etc.)
 - The use of acoustic passive ventilators – assuming that an appropriate equivalent free area to provide rapid natural ventilation; and/or
 - The use of comfort cooling.
- 7.42 The specification of any additional ventilation strategy that appropriately responds to any material risk of over-heating is a detailed design matter that could be directly controlled through the use of appropriate planning conditions (e.g. the submission and approval of the proposed sound insulation scheme), in line with the aims of the NPPF, NPPG, NPSE.

Element 3 – External Amenity Area Noise Assessment

- 7.43 Guidance in the World Health Organisation's “Guidelines for Community Noise” recommends that, to avoid serious annoyance during the daytime and evening, noise levels in external amenity areas should not exceed 55dB $L_{Aeq,16hour}$.
- 7.44 Section 7.7.3.2 of BS 8233: 2014 states

“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 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ 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 noisy 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.”

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7.45 ProPG therefore requires that:

“If external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces should be considered so that they can be enjoyed as intended”.

The acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 – 55 dB $L_{Aeq,16hr}$.”

7.46 The proposed development provides private external amenity space for most flats, in the form of a private balconies/patios. In order to minimise noise levels characterising these spaces, it is proposed that balustrades to balconies are a “solid” construction, i.e. glazed (to help provide acoustic screening) and that, where balconies are “stacked” the underside of the balconies are acoustically treated (to minimise noise reflections).

7.47 These provisions will ensure that noise levels are controlled to the lowest practicable levels.

Element 4 - Assessment of other Relevant Issues

7.48 ProPG guidance indicates that this element of the assessment should include information regarding:

- compliance with relevant national and local policy;
- magnitude and extent of compliance with ProPG;
- likely occupants of the development
- acoustic design v unintended adverse consequences
- acoustic design v wider planning objectives

7.49 Each of these elements is considered below:

Compliance with Relevant National and Local Policy

7.50 The assessments presented in preceding sections conclude that the proposed scheme complies with relevant national and local planning policy.

Magnitude and Extent of Compliance with ProPG;

7.51 The magnitude and extent of compliance with ProPG guidance is considered to be fully addressed in preceding sections, i.e. the development implements “good acoustic design”; internal noise levels are adequately controlled (including analysis of all modes of ventilation of the properties) and noise levels in external amenity spaces have been reduced as far as practicable within the constraints of the site.

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[Likely Occupants of the Development](#)

- 7.52 The proposed development will deliver 78 new residential flats. The proposed occupants of the development are considered to have a “normal” sensitivity noise, which would not alter the preceding conclusions regarding policy compliance.

[Acoustic Design v Unintended Adverse Consequences](#)

- 7.53 The proposed delivery of the acoustic design intent of the development should not result in any unintended adverse consequences.

[Acoustic Design v Wider Planning Objectives](#)

- 7.54 Paragraph 002 of National Planning Practice Guidance states:

“Can noise override other planning concerns?”

It can, but neither the Noise policy statement for England nor the National Planning Policy Framework (which reflects the Noise policy statement) expects noise to be considered in isolation, separately from the economic, social and other environmental dimensions of proposed development.”

- 7.55 The preceding sections of this report conclude that the proposed development will avoid any “significant” noise impacts and will mitigate and reduce to a minimum other adverse impacts on health and quality of life. As such, the proposed development is considered to comply fully with national and local planning policy. These conclusions may therefore add weight to the wider planning objectives of the scheme (i.e. delivery of new housing).
- 7.56 The pre-application advice given by the Council's Environmental Health Team recommended that consideration should be given to *“appropriate mitigation to protect future residents from noise associated with existing, neighbouring industrial uses”*. Noise monitoring and subjective observations indicate that noise associated with neighbouring industrial/commercial land uses does not form a dominant characteristic of the existing noise environment. Notwithstanding this, the development makes provision for a number of mitigation strategies to provide contingency for noise associated with such uses, including the location of the proposed building on the site (i.e. locating away from the commercial land boundary); the appropriate specification of external building fabric elements / alternative means of ventilation and the retention of the existing brick built wall on the eastern boundary of the site.

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Conclusions

- 7.57 The assessments set out above consider all four elements of the recommended ProPG “Stage 2” assessment. The assessments conclude:
- The scheme proposals follow a good acoustic design process;
 - Internal noise levels can be adequately controlled through the use of appropriate specified glazing and alternative means of ventilation/thermal control provisions;
 - Noise levels in private amenity spaces have been reduced to the lowest practicable levels;
 - The scheme is considered to comply with national and local policy objectives relevant to noise; will not result in any “*unintended adverse consequences*” and provides an appropriate development site for the delivery of 78 new residential flats.
- 7.58 It is therefore concluded that the proposed residential development of the site accords with noise related national and local planning policy and industry standard good practice guidance.

8 Construction Noise and Vibration

8.1 Construction activities have the potential to cause noise and vibration disturbance to both residential and commercial uses in the vicinity of a site.

8.2 Potential noise and vibration impacts during the construction phase of the development include:

- Direct noise impacts due to noise from construction plant, machinery and processes;
- Direct vibration impacts due to vibration from construction plant, machinery and processes; and
- Indirect noise and vibration impacts due to construction traffic on neighbouring roads.

Construction Noise

8.3 At this stage, detailed information relating to the construction programme, plant, etc. is not available. As such, a detailed, quantitative assessment of construction noise and vibration has not been undertaken.

8.4 Notwithstanding this, it is clear that there are existing residential receptors to the north, south and west of the site, all of which will have a 'high' sensitivity to noise. Given the proximity of the dwellings, construction noise therefore has the potential to have a significant, adverse impact.

8.5 It is therefore recommended that noise and vibration effects during the construction phase of the works are mitigated through the use of appropriate operative and management controls, implemented through the use of a Construction Environmental Management Plan (CEMP). In principal, such measures will include:

- A general need for any contractor to implement the "best practicable means" for undertaking the works in line with the general guidance of BS5228:2009+A1:2014 (Parts 1 and 2);
- The use of prefabricated materials wherever possible;
- Optimising the Site layout to locate noise generating activities as far as possible away from sensitive receptors;
- Good housekeeping and management;
- Review of plant and activities to ensure noise minimisation measures are in place and operating;
- Controlling of Site traffic and setting up of access routes away from sensitive receptors;

Noise Assessment

- Provision of noise monitoring during activities likely to affect sensitive receptors;
- The use of 'silenced' plant and equipment to be used;
- The provision of screening around those parts of the Site at which activities are likely to generate noise;
- Noise generating plant would be located at a low level and as distant as possible from sensitive receptor;
- Plant would operate at low speeds, where possible, and incorporate automatic low speed idling;
- All plant would be properly maintained (greased, blown silencers replaced, saws kept sharpened, teeth set and blades flat, worn bearings replaced, etc.);
- Consideration to be given to temporary screening or enclosures for static noisy plant to reduce noise emissions and plant should be certified to meet any relevant standards;
- Early and good public relations with the adjacent tenants and occupants of buildings will also reduce the likelihood of complaints;
- Controlling the opening hours of the Site;
- Implementing an appropriate regime of proactive noise monitoring to ensure mitigation is effective.

8.6 With regard to noise monitoring, it is suggested that the potential effects of construction noise are most appropriately assessed by reference to *fixed noise limits*, as promoted in Annex E.2 of BS 5228-1:2009 +A1:2014: "Code of Practice for Noise and Vibration Control on Construction and Open Sites - Part 1: Noise". This states:

"Noise from construction and demolition sites should not exceed the level at which conversation in the nearest building would be difficult with the windows shut. [...] Noise levels, between say 07.00 and 19.00 hours, outside the nearest window of the occupied room closest to the site boundary should not exceed:

- *70 decibels (dBA) in rural, suburban and urban areas away from main road traffic and industrial noise;*
- *75 decibels (dBA) in urban areas near main roads in heavy industrial areas."*

8.7 Given the location of the site, a value of 70 dB $L_{Aeq,12hours}$ is considered to represent an appropriate SOAEL for construction noise.

8.8 The LOAEL is taken to be 55dB $L_{Aeq,12hours}$, this being aligned with the upper guideline value for daytime noise level determined WHO guidance for external daytime environmental noise levels of 55 dB $L_{Aeq,16hr}$.

Noise Assessment

- 8.9 Construction noise will be temporary and this is reflected in the noise impact levels indicated above. Notwithstanding this, if work activity cause a prolonged exposure to noise, the potential effect on receptors may be greater than indicated above and give rise to an unacceptable effect. Based on advice given in Annex E of BS 5228-1, it is therefore considered that additional significance should be given to an effect exceeding the SOAEL of 70dB, where such a noise impact is predicted to occur on 10 or more days of working in any 15 consecutive days, or for a total of 40 days in any six month period.
- 8.10 Combining the above magnitude and temporal criteria, gives the following refined noise effect matrix for construction noise:

Combined Noise Magnitude and Temporal Criteria	Magnitude of Impact
Daytime noise level less than 55dB $L_{Aeq,T}$	Negligible
Daytime noise level between 55 and 70 dB $L_{Aeq,T}$	Low
Daytime noise level greater than 70 dB $L_{Aeq,T}$ (For a period less than 10 days of working in any 15 consecutive days, or for a total of less than 40 days in any six month period)	Medium
Daytime noise level greater than 70 dB $L_{Aeq,T}$ (For a period more than 10 days of working in any 15 consecutive days, or for a total of more than 40 days in any six month period)	High

Table 8.1: Definitions of Magnitude of Effect – Construction Noise

Construction Vibration

- 8.11 Two potential effects of construction vibration need to be considered – (a) the potential effect of vibration on the structure of neighbouring buildings and (b) the potential effect of vibration on occupants within those buildings.
- 8.12 With regard to buildings, vibration can potentially cause cosmetic damage and in the extreme, structural damage. Criteria for a significant vibration effect have therefore been aligned with guidance for cosmetic damage set out in BS 5228-2. Such criteria should safeguard building from structural damage, whilst vibration below the threshold can be considered to be negligible since there would not be no effect. Recommended values are presented in **Table 10.2** below:

Noise Assessment

Type of Building	Peak Particle Velocity (PPV) in Frequency Range of 4 Hz to 15 Hz	Peak Particle Velocity (PPV) in Frequency Range of 15 Hz and Above
Reinforced or framed structures	50 mm/s at 4 Hz and above	
Industrial and heavy commercial buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz.	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above.

Table 8.2 Vibration Thresholds for Cosmetic Damage to Buildings

- 8.13 The potential effect of vibration on occupants within buildings can be assessed based on the guidance of Annex B of BS 5228-2, as set out in **Table 10.3** below:

Peak Particle Velocity (PPV)	Impact	Magnitude of Effect
0.14mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.	Negligible
0.3 mm/s	Vibration might be just perceptible in residential environments	Minor
1.0 mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.	Medium
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.	Major

Table 8.3 Magnitude of Effect – Construction Vibration: Human Comfort

- 8.14 Guidance in BS 5228-1:2009+A1:2014 suggests that vibration effects will not normally be significant beyond a distance of around 20m from the construction works. The nearest noise sensitive receptors to the site are generally beyond this initial scoping distance and, as such, it is considered unlikely that vibration associated with construction works will have any significant adverse impact on neighbouring noise sensitive receptors.
- 8.15 It is therefore recommended that construction vibration is also mitigated through the use of appropriate operative and management controls, implemented through the use of a Construction Environmental Management Plan (CEMP). In principal, such measures will include:

Noise Assessment

- A general need for any contractor to implement the “best practicable means” for undertaking the works in line with the general guidance of BS5228:2009+A1:2014 (Parts 1 and 2);
- Optimising the Site layout to locate vibration generating activities as far as possible away from sensitive receptors;
- Good housekeeping and management;
- Review of plant and activities to ensure noise minimisation measures are in place and operating;
- Where reasonably practicable, plant and/or methods or working causing significant levels of vibration (e.g. use of percussive breakers) should be replaced by other less intrusive plant and/or working methods;
- Consideration should be given to rotary bored piling methods (e.g. continuous flight auger injected piling) rather than driven piling techniques (should piling be required);
- Prior to piling, any known or suspected obstructions which could impede piling operations (and represent a risk of increased vibration) should be removed;
- The possible use of cut-off trenches (which can help control vibration in a similar to manner to the control of airborne noise with a screen or barrier);
- Early and good public relations with the adjacent tenants and occupants of buildings will also reduce the likelihood of complaints;
- Controlling the opening hours of the Site; and
- Implementing an appropriate regime of proactive vibration monitoring to ensure mitigation is effective.

9 Conclusions

Existing Noise Environment

- 9.1 Environmental noise monitoring has been undertaken to determine the existing environmental noise climate at the site. The site is dominated by noise associated with road traffic movements on Dunsbury Way and Fulflood Road.

Planning Policy Context and Design Guidance

- 9.2 The requirements of national and local planning policy relevant to the proposed scheme are discussed.
- 9.3 Reference has also been made to industry standard design guidance, in particular ProPG: Planning and Noise, recently published by the Institute of Acoustic, Association of Noise Consultants and Chartered Institute of Environmental Health.

Site Suitability - Residential

- 9.4 The potential risk of the site for residential development has been assessed in line with a ProPG Initial Site Noise Risk Assessment. This concludes that the western façade of the site is classified as 'medium risk', while the north side of the site is classified as 'low risk'.
- 9.5 The scheme has therefore been developed to minimise noise impacts. Mitigation includes:
- Designing the building in such a way as to reduce noise impact to the residents;
 - Designing the internal arrangements of flats to orientate principal habitable rooms away from noise sources;
 - The appropriate specification of external building fabric elements and alternative means of ventilation; and
 - Subject to a detailed assessment of overheating risk, the provision of additional means of provide rapid ventilation/cooling of the properties to assist with the thermal control of the units.

ProPG

- 9.6 With particular regard to the considerations required by ProPG, it is concluded that:
- The development proposals reflect a good acoustic design process;
 - Internal noise levels can be adequately controlled through the appropriate specification of glazing and alternative means of ventilation/cooling;

Noise Assessment

- Noise levels in external amenity spaces have been reduced to the lowest practicable levels and residents will have access to suitable alternative public amenity space.

Construction Noise and Vibration

- 9.7 It is recommended that the potential impact construction phase noise and vibration is controlled through appropriate operative and management controlled implemented through a Construction Environmental Management Plan.

Conclusion

- 9.8 It is concluded that the proposed development should not raise any residual significant or other adverse impacts on the health and/or quality of life for existing neighbouring dwellings in the vicinity of the site, or dwellings to be created by the development.
- 9.9 It is therefore concluded that the proposed development complies fully with noise related national and local planning policy

APPENDIX A: Glossary of Acoustic Terminology

General

A vibrating surface or turbulent fluid flow will cause pressure fluctuations in the surrounding air. These pressure fluctuations are perceived by the human ear as “sound”.

Measurement Units

The human ear can detect sound pressures as low as about 20 μPa , and can tolerate (for short periods) sound pressures as high as 200 Pa, an amplitude range of 10 million times. To take account of this huge amplitude range, sound pressure levels (often written in “acoustic shorthand” as SPL or Lp) are quantified using a logarithmic scale, the decibel (dB) scale. This is based on a reference pressure of 20 μPa , thus a sound pressure of 20 μPa would equate to 0dB and a pressure of 200Pa would equate to 140dB.

Frequency (Pitch) Characteristics

The sound received at any particular location is not solely influenced by the sound pressure level, the frequency characteristics (pitch) of the noise is also an important factor. Noise audible to a human (with “normal” hearing), typically covers the frequency range 20 Hertz to 20,000 Hertz. Hertz (Hz) are defined as the number of times the sound pressure fluctuates in one second. “Low” pitched sounds fluctuate less times per second than “high” pitched sounds. Whilst humans are capable of detecting a wide range of frequencies, the ear is not equally sensitive to all frequencies – the ear is most sensitive at frequencies towards the middle of the audible range and less sensitive to the lower and higher frequencies.

To take account of this frequency response, sound pressure fluctuations are normally quantified by applying a frequency-weighting network or filter which simulates the frequency response of the ear. In essence, this means that more significance is given to the frequencies at which the ear is most sensitive and less significance to those at which the ear is less sensitive. Noise measurements relating to human reaction are generally made using an “A-weighting” network. These measurements are reported as A-weighted decibels or dB(A). The A-weighted sound pressure level is written in “acoustic shorthand” as L_A .

Variation of Sound with Time

It will be appreciated that the sound pressure level of most noise sources will fluctuate with time. In order to take account of the way in which the human ear perceives noise, it is normal for the sound pressure level to be quantified using a time weighting network, to mimic the speed of response of the human ear. The standardised setting for most types of noise is a “Fast” time weighting.

The manner in which sound fluctuates with time can also influence the subjective manner in which noise is perceived. Noise can be continuous (showing no significant variation with time as in the case of a fan), intermittent (i.e. the noise is transient in it’s nature, such as a train pass-by) or impulsive (i.e. there is a sudden build up of noise - this can range from “clanking” types sounds as might be experienced next to railway goods yard or a high energy discharge such as an explosion)

Measurement of Sound

Sound pressure levels are measured using equipment comprising a pressure-sensitive microphone, associated amplifier, frequency weighting network, time weighted network and output indicator. In its simplest form this is a small hand-held instrument called a sound level meter. More sophisticated instrumentation (a sound level analyser) is also available which allows the real-time output of the frequency characteristics of the sound to be quantified.

Comparison of Sound Levels

To put the significance of noise measurement into context, the following Table presents the A-weighted sound pressure level of some typical sources:

Sound Pressure Level, dB(A)	Typical Noise Source . Activity
160	Saturn Rocket Taking Off
140	Military Jet Taking Off at 30m
100	Nightclub
90	Heavy goods vehicle driving past at 7m
80	Busy urban road
70	Domestic vacuum cleaner at 3m
60	Busy office environment
55	Normal speech at 1m
40	Whispered conversation at 2m
30	Bedroom at night (BS 8233: 1999)
20	Remote country location
0	Threshold of hearing – a very eery silence

Addition of Sound Levels

It is important to note that the use of a logarithmic scale to describe noise does not allow normal arithmetic addition. This means that two noise sources each generating a level of, say, 60dB(A) will not generate a combined sound level of 120dB(A). The values must be added logarithmically, which would actually yield a combined sound level of 63dB(A) in this example.

Subjective Perception of Sound Levels Changes

With regard to the human perception of sound level changes, the human ear:

- Cannot generally perceive a sound level difference of less than 3dB(A)
- Will perceive a sound level difference of 4-5dB(A) as “noticeable”
- Will perceive a sound level difference of 10dB(A) as a doubling (or halving) of loudness.

Acoustic Terminology

As stated previously, most sources of noise will fluctuate with time. In order to characterize such noise, it is therefore normal to represent the noise climate using a variety of noise parameters and statistical indices. The most commonly adopted noise parameters are described below:

$L_{Aeq,T}$	This is the equivalent continuous A-weighted sound level measured over a specified time period "T". This is the notional continuous sound level which, over the time T, contains the same amount of energy as the actual fluctuating sound being measured. This parameter is widely accepted as being the most appropriate noise descriptor for most environmental noise and the effects of noise on humans.
$L_{Amax,fast}$	This is maximum A-weighted sound pressure measured with a fast frequency response recorded during the stated measurement period. It is typically used to characterise the highest sound level caused during a noise event.
$L_{A90,T}$	This is the A-weighted sound pressure level exceeded for 90% of the specified time period "T". It is normally used to describe the underlying background noise level of an environment since it inherently excludes the effects of transient noise sources.

Noise Rating (NR) Level

When describing noise from building services installations, it is common to express noise levels in terms of a Noise Rating (NR) Level. The NR level is determined by plotting the measured frequency spectrum of a noise against a series of reference curves, which roughly approximate to equal loudness values. This method permits higher sound levels at low frequencies corresponding to the sensitivity of the human ear. The NR level is defined as the value of the highest curve "touched" by the plotted frequency spectrum. For typical sources of building services noise, the overall A-weighted sound level is numerically around 5-6dB higher than the NR level of the noise.

Airborne Sound Insulation Measurement Parameters

The ability of a building element to reduce airborne noise can be described by a number of different parameters relevant to both laboratory and on-site performance evaluation. In general, the higher these values, the better the resistance of the construction to the transmission of airborne sound. The most commonly used parameters include:

R_w	The " Weighted Sound Reduction Index " (R_w) is a single value measure of the intrinsic sound reduction capabilities of a construction, as measured in an acoustic laboratory. Measurement values are determined in accordance with the BS EN ISO 10140 series of standards and weighted in accordance with BS EN ISO 717-1: 2013.
R'_w	The " Weighted Apparent Sound Reduction Index " (R'_w) is a single value measure of the apparent sound reduction capabilities of a construction, when installed on-site (which will normally be some way lower than the laboratory value due to less favourable installation conditions, the quality of workmanship, etc.). Measurement values are determined in accordance with the BS EN ISO 10140 series of standards and weighted in accordance with BS EN ISO 717-1: 2013. In practice, the R'_w of a construction can only be reliably determined if "direct" sound transfer through the partition can confidently be taken as the dominant noise transfer path (i.e. there is no "flanking" sound transmission).
D_w	The " Weighted Sound Level Difference " (D_w) is a single value measure of the on-site sound reduction between two rooms. This value inherently includes "direct" sound transmission through any separating construction and "flanking" transmission through other building elements.

Measurement values are determined in accordance with BS EN ISO 140-4: 1998 (for Building Regulations compliance purposes) or BS EN ISO 16283-1: 2014 and weighted in accordance with BS EN ISO 717-1: 2013.

$D_{n,fw}$	The " Weighted Normalised Flanking Level Difference " ($D_{n,fw}$) is a single figure measure of the sound reduction between two rooms solely due to sound transmission through a specified flanking path. This parameter is frequently used to provide an indication of the sound reduction capabilities of suspended ceiling and raised access floor constructions where there is common void between adjacent rooms or as a measure of sound that may be transmitted between rooms through external curtain walling. Measurements are undertaken in accordance with BS EN ISO 10848-2: 2017 and weighted in accordance with BS EN ISO 717-1: 2013.
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Impact Sound Insulation Measurement Parameters

Some building elements also have the potential to generate "impact" noise, for example due to human "footfall" on floor structures, or the impact of rainfall on lightweight roofing components. A variety of parameters are again available to define the amount of noise likely to be generated. In general, the lower these values, the less sound the construction will generate as a result of impacts. Typical measurements parameters include:

$L_{nT,w}$	The " Standardised Impact Sound Pressure Level " is a "single number" rating describing the intrinsic impact sound insulation capabilities of a construction (such as a floor system) as measured in an acoustics laboratory. Values are determined in a vertical sound transmission suite by locating a "tapping machine" in the upper room of the suite and measuring the amount of sound radiated by the floor in the room below. Measurement values are determined in accordance with the BS EN ISO 10140 series of standards and weighted in accordance with BS EN ISO 717-2: 2013.
$L_{n,fw}$	The " Normalised Flanking Impact Sound Pressure Level " is a "single number" rating describing the amount of flanking sound that would be transmitted to an adjoining space (separated by a partition) due to impacts on the test sample. It is, for example, used to indicate the amount of noise that may be generated due to footfall noise on a raised access floor system. Values are determined in a horizontal sound transmission suite by locating a "tapping machine" one side of a separating partition built off the test sample and measuring the amount of noise radiated by the floor in the adjoining space on the other side of the partition. Measurement values are determined in accordance with BS EN ISO 10848-2: 2017 and weighted in accordance with BS EN ISO 717-2: 2013.

Room Acoustic Measurements

T	The " Reverberation Time " (T) of a room is defined as the time taken for the sound energy produced by a source Time (RT) to decay by 60 dB after the source has been switched off. The reverberation time of a space can be calculated by considering the volume of the room and the areas and sound absorption qualities of room surface finishes. Small, "soft" rooms tend to give low reverberation times, whilst large, "hard" rooms tend to give long reverberation times.
α_p	The " Practical Acoustic Absorption Coefficient " (α_p) is a measure of how much sound energy is absorbed by a building element at a particular frequency, as measured in accordance with BS EN ISO 354: 2003.
α_w	The " Weighted Absorption Coefficient " (α_w) is a single figure measure of the overall sound absorption capabilities of a building element determined in accordance with BS EN ISO 11654: 1997.

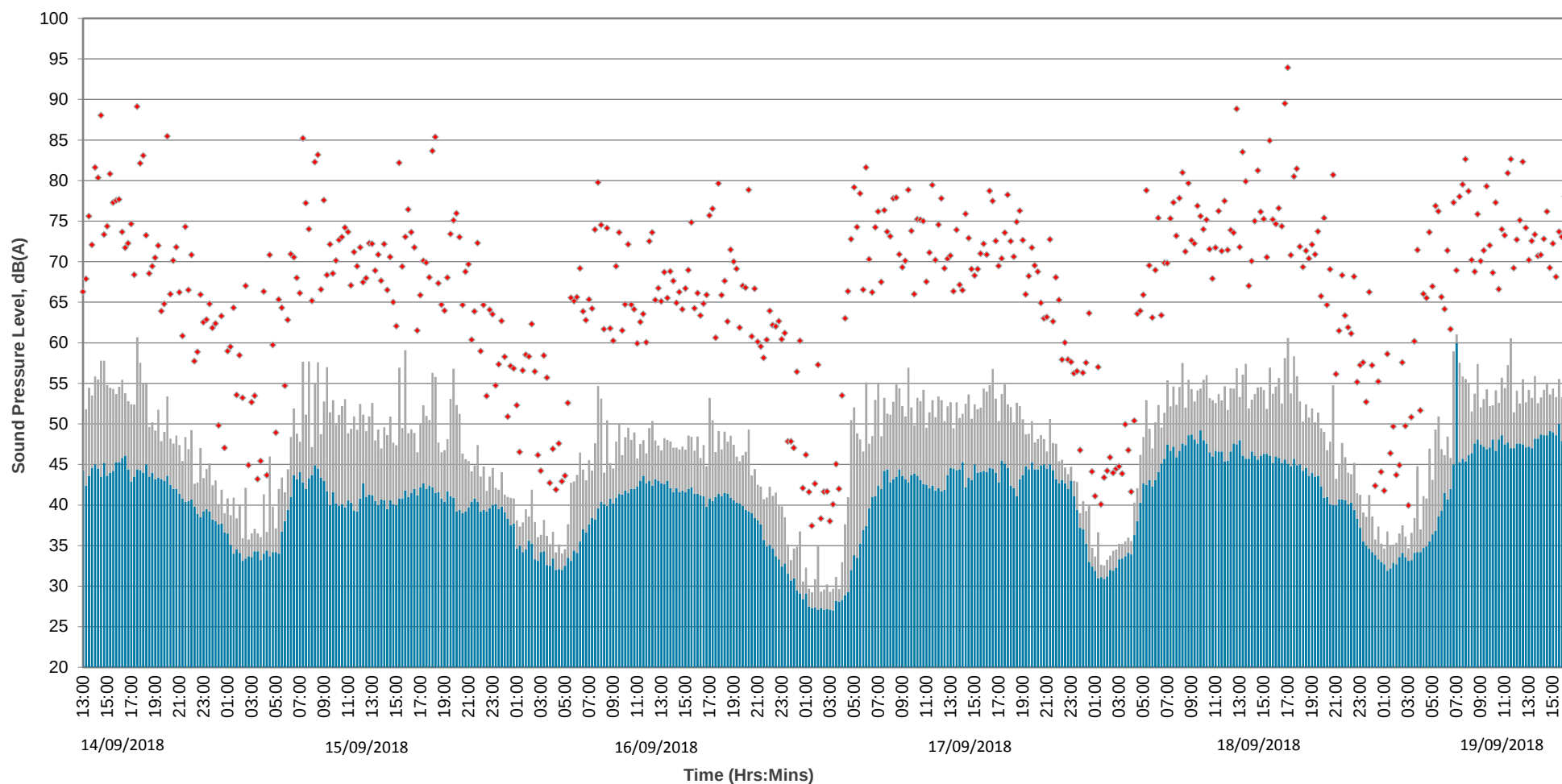
APPENDIX B: Noise Monitoring Time History Plots

Time History Graph A1

Project: Dunsbury Way, Havant

Measurement Location: Position A1

Survey Period: 14/09/18 to 19/09/18



KEY:



L_{A90,15mins}



L_{Aeq,15mins}

◆ L_{Amax,fast}

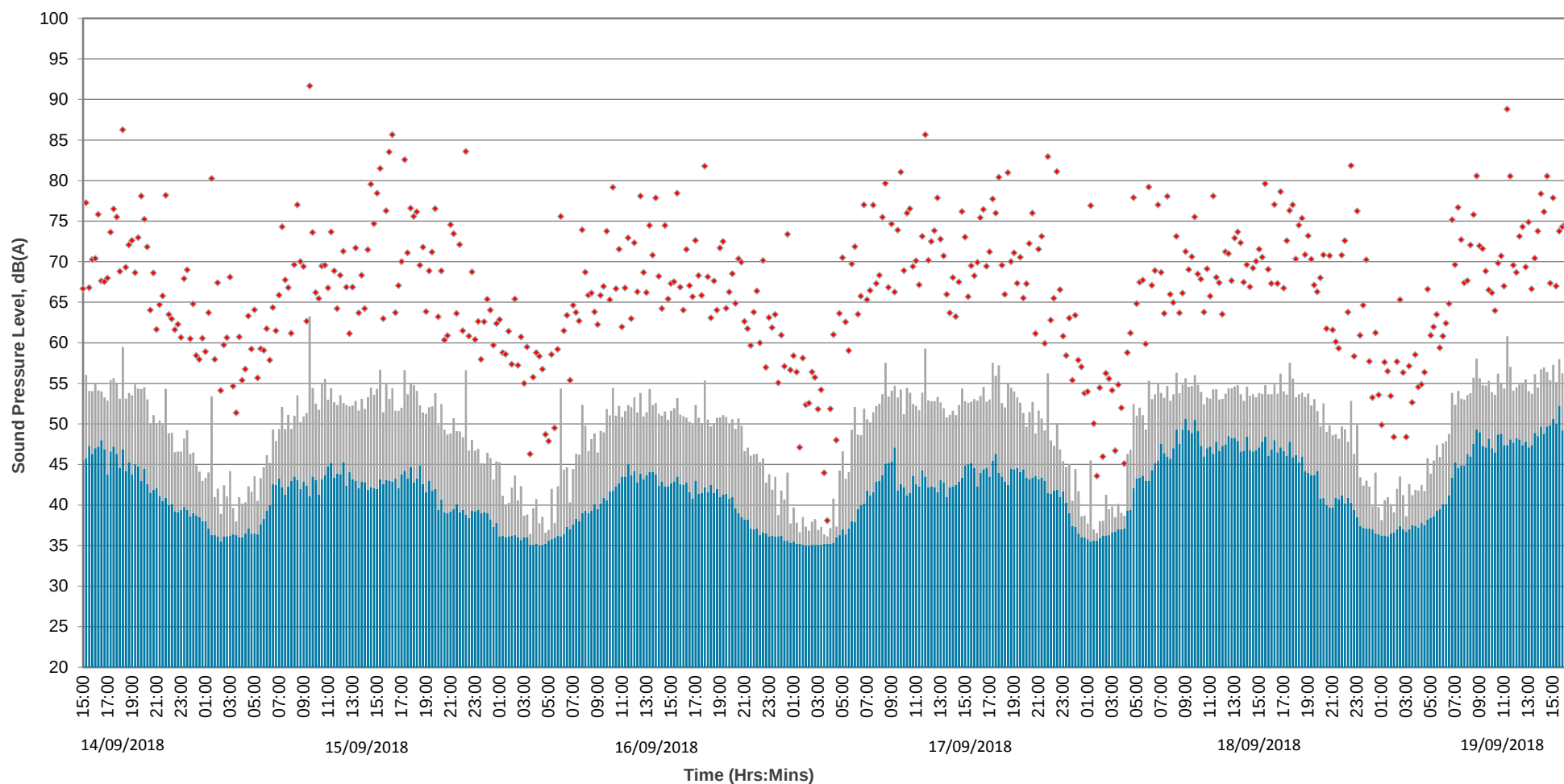
Lion House, Oriental Road, Woking, Surrey GU22 2BR
Telephone: 01483 750508 Fax: 01483 750437

Time History Graph A2

Project: Dunsbury Way, Havant

Measurement Location: Position A2

Survey Period: 14/09/18 to 19/09/18



KEY:



L_{A90,15mins}



L_{Aeq,15mins}

♦ L_{Amax,fast}

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