

# Noise Impact Assessment

At:

81a/81 Whinbush Road,  
Hitchin,  
Hertfordshire,  
SG5 1PZ

For:

Viva Property Group Limited

**Private and Confidential**

Ref: 5551 24 04 15 Ltr 09 Rev B TI BB

Sevenoaks Environmental Consultancy Ltd,  
145a Hastings Road, Pembury, Kent, TN2 4JU  
Tel: 01892 822999



Association of Geotechnical &  
Geoenvironmental Specialists



Sevenoaks  
Environmental  
Consultancy Ltd

## EXECUTIVE SUMMARY

---

This noise impact assessment has been undertaken in order to assess a proposed plant installation for residential use at 81 Whinbush Road, Hitchin, Hertfordshire.

The proposed plant installation comprises 9 No. aroTHERM plus 5kW Air Source Heat Pumps (ASHP).

A background noise survey has been undertaken as detailed in the report, in order to determine an appropriate noise emission criterion, in accordance with the requirements of North Herts Council.

Calculations were undertaken for the nearest receivers, identified as existing adjacent residential properties to the north and south. It should be noted that if there are closer receivers that Clement Acoustics is not aware of, a reassessment will be necessary, and this should therefore be confirmed by the Client.

It has been demonstrated that compliance with the established criterion is feasible, dependent on the following material considerations:

- The plant could be in use at any time over a 24 hour period
- The noise emissions data for the proposed units, as obtained from available manufacturer information
- Plant and receiver locations are as established in this report and marked on the attached site plan

If there is any deviation from the above, Clement Acoustics must be informed, in order to establish whether a reassessment is necessary.

Clement Acoustics has used all reasonable skill and professional judgement when preparing this report. The report relies on the information as provided to us at the time of writing and the assumptions as made in our assessment.

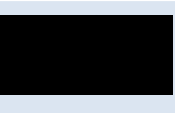
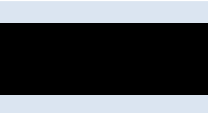
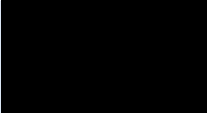
This report is designed to be suitable to discharge typical plant noise planning conditions, as per our original scope of work. The report should not be relied upon for further reasons, such as the detailed design of mitigation measures.

## CONTENTS

|     |                                         |   |
|-----|-----------------------------------------|---|
| 1.0 | INTRODUCTION .....                      | 1 |
| 2.0 | SITE DESCRIPTION .....                  | 1 |
| 3.0 | ENVIRONMENTAL NOISE SURVEY .....        | 1 |
| 3.1 | UNATTENDED NOISE SURVEY PROCEDURE ..... | 1 |
| 3.2 | WEATHER CONDITIONS .....                | 2 |
| 3.3 | EQUIPMENT .....                         | 2 |
| 4.0 | RESULTS.....                            | 3 |
| 5.0 | NOISE CRITERIA .....                    | 3 |
| 5.1 | RELEVANT LOCAL POLICY .....             | 3 |
| 5.2 | LOCAL AUTHORITY CRITERIA.....           | 4 |
| 6.0 | PLANT NOISE IMPACT ASSESSMENT .....     | 5 |
| 6.1 | PROPOSED INSTALLATION .....             | 5 |
| 6.2 | NOISE IMPACT ASSESSMENT.....            | 6 |
| 6.3 | BRITISH STANDARD REQUIREMENTS.....      | 7 |
| 7.0 | CONCLUSION .....                        | 8 |

## LIST OF ATTACHMENTS

|                  |                                  |
|------------------|----------------------------------|
| 17936-NIA-01-SP1 | Indicative Site Plan             |
| 17936-TH1        | Environmental Noise Time History |
| Appendix A       | Glossary of Acoustic Terminology |
| Appendix B       | Acoustic Calculations            |

| Issue | Date of Issue | Author                                                                              | Reviewed                                                                            | Reviewed                                                                             | Revision A Authorised                                                                 |
|-------|---------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| RevA  | 15/04/24      |  |  |  |  |
|       |               | <b>Matthew Markwick</b><br>Principal Consultant<br>MSc MIOA                         | <b>Andy Thomas</b><br>Principal Consultant<br>BSc (hons) MIOA                       | <b>Duncan Martin</b><br>Director<br>BSc (Hons) MIOA                                  | <b>John Smethurst</b><br>Director<br>BSc (Hons) MIOA                                  |

| Issue | Comment                                                                   |
|-------|---------------------------------------------------------------------------|
| 0     | First Issue                                                               |
| RevA  | Consideration of additional receiver (Rec 4) at Local Authority's request |

## 1.0 INTRODUCTION

---

Clement Acoustics has been commissioned by Sevenoaks Environmental Consultancy Ltd to undertake a plant noise impact at 81 Whinbush Road, Hitchin, Hertfordshire. Previously measured noise levels have been used to determine noise emissions criteria for a proposed plant installation in agreement with the planning requirements of the North Herts Council.

This report presents the results of the environmental survey followed by noise impact calculations.

An acoustic terminology glossary is provided in Appendix A.

## 2.0 SITE DESCRIPTION

---

The site was previously occupied by a vehicle repair / MOT garage. Proposals are to redevelop the site to create 8 new build residential flats and a separate 2 bed dwelling formed by a change of use of an existing building (81a Whinbush Road). The surrounding area is predominantly residential in nature.

Current proposals are to install 8 no. Air Source Heat Pumps in multiple locations on the rear of the new build block and 1 to the rear of the change of use dwelling to provide heating for each respective residence.

Existing residential properties to either side of the site, as well as the most exposed of the new dwellings themselves have been identified as the nearest affected receivers. A 4<sup>th</sup> receiver – on the rear façade of property on Verulam Road to the East is also considered at the request of the Local Authority.

These nearest noise sensitive receivers were identified through observations on-site and by review of site plans. If there are any receivers closer than those identified within this report then a further assessment will need to be carried out. Therefore, the closest noise sensitive receiver should be confirmed by the client before the plant is installed

Locations are shown in attached site plan 17936-NIA-01-SP1.

## 3.0 ENVIRONMENTAL NOISE SURVEY

---

### 3.1 Unattended Noise Survey Procedure

A noise survey was previously carried out at two positions on the site to inform Clement Acoustics report Reference 17936-NEA-01 *Noise Exposure Assessment* in relation glazing and ventilation for the proposed dwellings. The Environmental Health Officer has confirmed that this data may be used for the purpose

the fixed plant assessment presented herein (to ensure a robust assessment, the quietest of the two positions will be considered).

Measurements were undertaken at the position shown on indicative site drawing 17936-NIA-01-SP1. The choice of this position was based both on accessibility and on collecting representative noise data in relation to the nearest affected receiver.

The microphone was mounted on a pole at 1<sup>st</sup> storey level at the front of the site. The microphone was positioned away from the nearest vertical reflective surfaces.

The position was considered to be free-field according to guidance found in BS 4142: 2014, and a correction for reflections has therefore not been applied.

Continuous automated monitoring was undertaken for the duration of the survey between 10:25 on 26 November 2022 and 11:30 on 28 November 2022.

The measurement procedure generally complied with BS 7445: 1991: 'Description and measurement of environmental noise, Part 2- Acquisition of data pertinent to land use'.

### **3.2 Weather Conditions**

At the time of set-up and collection of the monitoring equipment, the weather conditions were generally dry with light winds. It is understood that the weather conditions during the unattended survey were of the same nature.

It is considered that the weather conditions did not significantly adversely affect the measurements and are therefore considered suitable for the measurement of environmental noise.

### **3.3 Equipment**

The equipment calibration was verified, by means of a field verification check, before and after use and no abnormalities were observed.

The equipment used was as follows.

- 1 No. Svantek Type 957 Class 1 Sound Level Meter
- Rion Type NC-74 Class 1 Calibrator

## 4.0 RESULTS

The  $L_{Aeq: 5min}$ ,  $L_{Amax: 5min}$ ,  $L_{A10: 5min}$  and  $L_{A90: 5min}$  acoustic parameters were measured at the location shown in site drawing 17936-SP1.

Measured noise levels are shown as a time history in Attachment 17936-TH1, with average ambient and minimum background noise levels summarised in Table 4.1.

It should be noted that the guidance of the latest revision of British Standard 4142: 2014 +A1 2019 'Methods for rating and assessing industrial and commercial sound' [BS 4142], as detailed in Section 8.1 of the standard is as follows:

*'The objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods.'*

Therefore, the typical background noise level will be used for the purpose of this assessment.

| Time Period                   | Average ambient noise level<br>$L_{Aeq: T}$ , dB | Typical background noise level $L_{A90: 5min}$ ,<br>dB |
|-------------------------------|--------------------------------------------------|--------------------------------------------------------|
| Daytime<br>(07:00 - 23:00)    | 57                                               | 47                                                     |
| Night-time<br>(23:00 - 07:00) | 44                                               | 33                                                     |

**Table 4.1 Average ambient and typical background noise levels**

## 5.0 NOISE CRITERIA

### 5.1 Relevant Local Policy

Condition 17 of the associated Planning Decision Notice issued by North Herts Council states the following:

Prior to the commencement of the development, a pre-construction energy sustainability statement to confirm the energy saving measures to be utilised in the development as identified in the preliminary report by Vision Energy dated 3/11/2022 shall be submitted to and approved in writing by the Local Planning Authority. In the event that air source heat pumps are to be utilised, the following additional information shall be provided:

- (i) a revised noise assessment to explain the impact these will have the local noise environment and any appropriate mitigation measures;
- (ii) revised elevations to illustrate the specific location of the air source heat pumps.

These additional documents and details shall be approved in writing prior to the commencement of development. Thereafter, the development shall be carried out in complete accordance with the approved details.

Reason: To ensure that (i) the development delivers appropriate energy improvements (ii) that measures do not compromise the local noise environment and; (iii) the measures do not compromise the design and appearance of the building.

## 5.2 Local Authority Criteria

The Local Authority have advised that they require an assessment in line with the methodology of BS 4142.

It is noted that Local Authority has referred to the *Heat Pumps Professional Advice Note* issued jointly by the Chartered Institute of Environmental Health and the Institute of Acoustics which provides a simplified methodology for the assessment of ASHPs.

This recommends that *“where it is practical to do so, it is recommended that the installation sound rating level does not exceed 35dB at any noise sensitive façade of neighbouring residential premises”*.

However, given the very low measured background levels for this site, this guidance is not considered appropriate to protect existing residential receivers which are likely to be more sensitive to change. A more robust BS 4142 assessment will therefore be presented, in line with stated local authority requirements to ensure the amenities of the existing residents are protected.

In a BS 4142 assessment, corrections are applied to noise levels in order to calculate a noise rating level for the effects of proposed activities on nearby noise sensitive receivers.

In a BS 4142 assessment, corrections are applied to measured noise levels in order to calculate a noise rating level for the effects of the source on nearby noise sensitive receivers. BS 4142 states that a noise rating 5 dB above the background noise level is likely to be an indication of an adverse impact. If the difference is 10 dB or more, then this is stated as likely to be an indication of a significant adverse impact. Where the rating level does not exceed the background noise level, this is stated as an indication of the sound source having a low impact.

This assessment will compare noise emissions to the measured background noise levels shown in Table 4.1.

It is understood that the proposed plant units will be for residential use and may be operational at any time. Assessment criteria will therefore be based on the quietest night-time period.

Based on the results of the environmental noise survey and requirements of North Herts Council, Table 5.1 presents the proposed plant noise emission criteria to be achieved at 1 m from the nearest existing noise sensitive receiver.

| Period                 | Receiver | Plant Noise Emission Limit $L_{Aeq,T}$ , dB |
|------------------------|----------|---------------------------------------------|
| At any time<br>(24hrs) | All      | 33                                          |

**Table 5.1 Plant noise emission limits**

The noise limit has been based on the typical background level for quietest periods as per the requirements of BS 4142.

## 6.0 PLANT NOISE IMPACT ASSESSMENT

### 6.1 Proposed Installation

The proposed plant installation comprises 9 No. aroTHERM plus 5kW.

Noise emissions for the proposed plant units, as provided by the manufacturer, are shown in Table 6.1. Loudest modes of operation have been used in order to present a robust worst-case assessment.

| Unit              | Sound Power Level in each Frequency Band, Hz |     |     |     |    |    |    |    | dB(A) |
|-------------------|----------------------------------------------|-----|-----|-----|----|----|----|----|-------|
|                   | 63                                           | 125 | 250 | 500 | 1k | 2k | 4k | 8k |       |
| aroTHERM plus 5kW | 60                                           | 58  | 51  | 52  | 50 | 44 | 38 | 31 | 54*   |

**Table 6.1 Manufacturer provided noise emissions levels**

*\*Spectral band data was not available for the unit, therefore representative data for a similar ASHP has been used, shifted to match the stated Sound Power Level of 54 dB(A) .*

The proposed plant units are to be installed on the rear and side walls and within the garden / terrace to each flat and to the rear of the change of use property, on the east facing (back) façade of the building which is shown on indicative site plan 17936-SP1.

Impact upon the most exposed of the new build flats (Flat 5) as well as the two existing properties to the north and south of the site has been considered. The proposed plant units will be generally broadband and continuous in nature and therefore no penalty has been applied. It is understood that the units will be installed with manufacturer supplied “noise reduction covers” however as no noise reduction data is available for these, they have not been considered.

The proposed plant locations are shown on indicative site plan 17936-SP1.

## 6.2 Noise Impact Assessment

The closest receiver has been identified as the windows of the proposed new build flats. The flat in the centre of the block (Flat 5) is considered to be the worst case and calculations have been based upon this. Secondary receivers on the rear facades of the existing residential properties adjacent, to the north and south have also been considered. Distances between sources and receivers are shown in Appendices B1 to B3.

Partial screening of the nearest noise sensitive receptor is provided by the building envelope.

In terms of the penalties that can be applied according to the guidance of BS 4142, condenser units would not typically be considered to be tonal noise sources, and impulsive noise would not be expected provided the units are maintained in good working order. As calculations assume constant operation within a reference period, a correction for intermittency would also not be applicable.

Taking into account all necessary acoustic corrections, the resulting noise level at the identified residential windows would be as shown in Table 6.2. Detailed calculations are shown in Appendix B.

For Receiver 1 (Flat 5) all individual noise sources surrounding the central window have been considered individually and the cumulative level calculated accordingly. For Receivers 2,3 and 4 which are offsite, the plant units have been grouped together according to distance from each given receiver.

Units are numbered according to the flat they serve and shown/ labelled on indicative site plan 17936-SP1.

| Receiver                                 | Existing Background Noise Level | Noise Level at Receiver (due to proposed plant) | BS4142 rating     |
|------------------------------------------|---------------------------------|-------------------------------------------------|-------------------|
| 1 - Proposed Flat 5                      | 33 dB(A)                        | 32dB(A)                                         | -1 dB: Low impact |
| 2 – Adjacent house to the North          |                                 | 32dB(A)                                         | -1 dB: Low impact |
| 3 -Adjacent House to the South           |                                 | 29dB(A)                                         | -4 dB: Low impact |
| 4 – Rear Façade of House on Verulam Road |                                 | 28dB(A)                                         | -5 dB: Low impact |

**Table 6.2 Noise levels and project criterion at noise sensitive receivers**

As presented in Table 6.2 and Appendix B, the proposed plant installation with acoustic enclosures would be expected to meet the requirements of the proposed criteria at all receivers.

Units would also inherently comply with the criteria stated in *Heat Pumps Professional Advice Note*.

6.3 British Standard Requirements

Further calculations have been undertaken to assess whether the noise emissions from the proposed plant unit would be expected to meet recognised British Standard recommendations, in order to further ensure the amenity of nearby noise sensitive receivers.

British Standard 8233: 2014 *‘Guidance on sound insulation and noise reduction for buildings’* gives recommendations for acceptable internal noise levels in residential properties. Assuming worst case conditions, of the closest window being for a bedroom, BS 8233: 2014 recommends 30 dB(A) as being acceptable internal sleeping conditions during night-time.

With loudest external levels of 33 dB(A), acceptable internal conditions would be met by taking the attenuation of the window itself into consideration. According to BS 8233: 2014, a typical building facade with a partially open window offers 15 dB attenuation.

It can therefore be predicted that, in addition to meeting the requirements of the set criteria, the emissions from the proposed plant would be expected to meet the most stringent recommendations of the relevant British Standard, with neighbouring windows partially open. Predicted levels are shown in Table 6.3.

| Receiver          | Recommended Target – For sleeping conditions in a bedroom, in BS 8233: 2014 | Noise Level at Receiver (due to plant installation) |
|-------------------|-----------------------------------------------------------------------------|-----------------------------------------------------|
| Inside Reciever 1 | 30 dB(A)                                                                    | 17 dB(A)                                            |
| Inside Reciever 2 |                                                                             | 17 dB(A)                                            |
| Inside Reciever 3 |                                                                             | 14 dB(A)                                            |
| Inside Reciever 4 |                                                                             | 13 dB(A)                                            |

Table 6.3 Noise levels and BS 8233: 2014 criteria inside nearest residential space

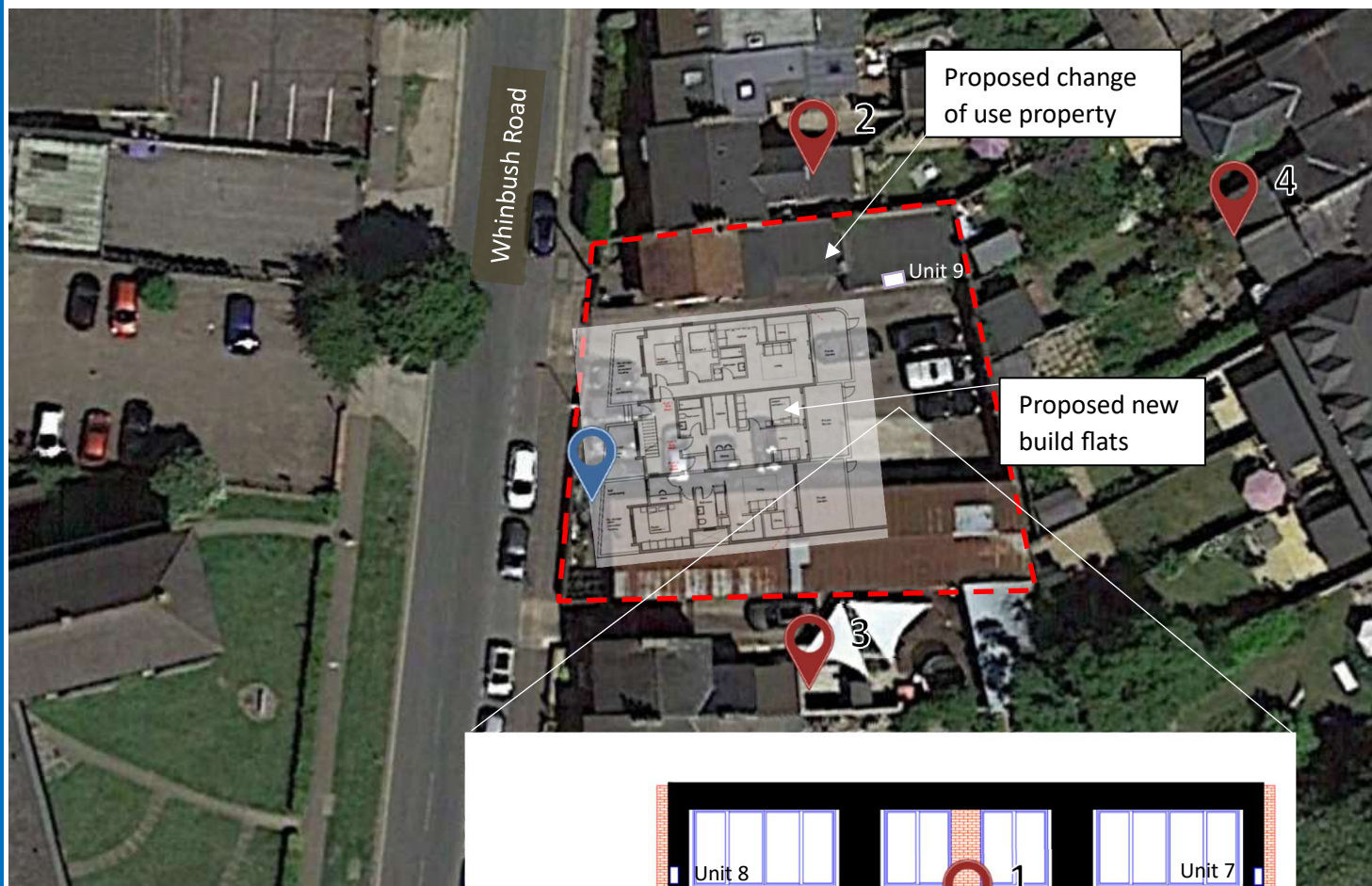
## 7.0 CONCLUSION

---

An environmental noise survey has been undertaken at 81 Whinbush Road, Hitchin, Hertfordshire. The results of the survey have enabled criteria to be set for noise emissions from the proposed plant in accordance with the requirements of the North Herts Council.

A noise impact assessment has then been undertaken using manufacturer noise data to predict the noise levels, due to the proposed plant, at the nearby noise sensitive receivers.

Calculations show that noise emissions from the proposed units should meet the requirements of North Herts Council without the need for any specialist mitigation.



*Not to scale*

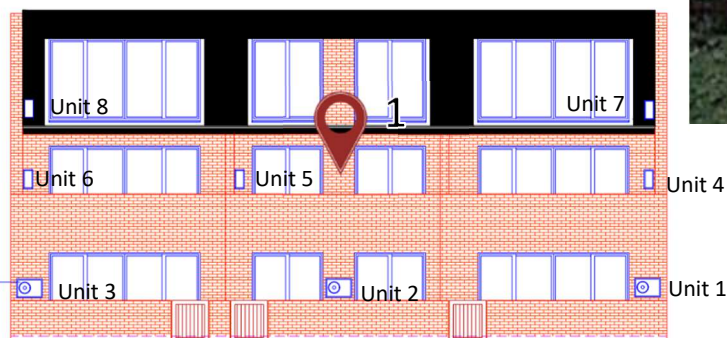
**Description:**

Indicative site plan showing noise monitoring position and nearest sensitive receiver

|                     |                  |
|---------------------|------------------|
| <b>Date</b>         | 15 April 2024    |
| <b>Reference</b>    | 17936-NIA-01-SP1 |
| <b>Project Name</b> | 81 Whinbush Road |
| <b>Image ©</b>      | Google Earth     |

**Key:**

|  |                                  |
|--|----------------------------------|
|  | Unattended Noise Survey Position |
|  | Noise Sensitive Receiver         |

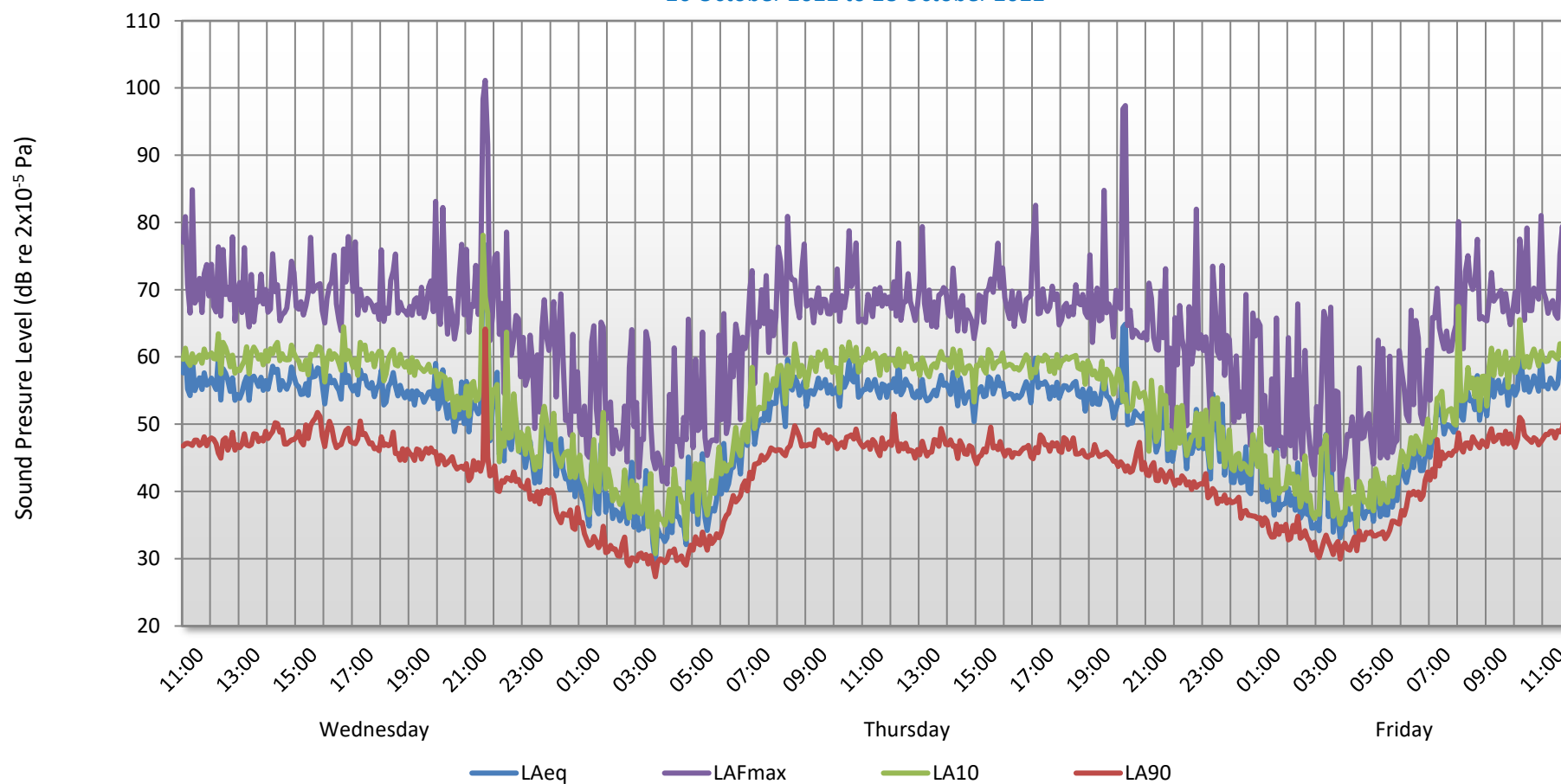


## REAR ELEVATION

# 81 Whinbush Road, Hitchin

## Position 1

Environmental Noise Time History  
26 October 2022 to 28 October 2022



## GLOSSARY OF ACOUSTIC TERMINOLOGY

### **dB(A)**

The human ear is less sensitive to low (below 125Hz) and high (above 16kHz) frequency sounds. A sound level meter duplicates the ear's variable sensitivity to sound of different frequencies. This is achieved by building a filter into the instrument with a similar frequency response to that of the ear. This is called an A-weighting filter. Measurements of sound made with this filter are called A-weighted sound level measurements and the unit is dB(A).

### **$L_{eq}$**

The sound from noise sources often fluctuates widely during a given period of time. An average value can be measured, the equivalent sound pressure level  $L_{eq}$ . The  $L_{eq}$  is the equivalent sound level which would deliver the same sound energy as the actual fluctuating sound measured in the same time period.

### **$L_{10}$**

This is the level exceeded for not more than 10% of the time. This parameter is often used as a "not to exceed" criterion for noise

### **$L_{90}$**

This is the level exceeded for not more than 90% of the time. This parameter is often used as a descriptor of "background noise" for environmental impact studies.

### **$L_{max}$**

This is the maximum sound pressure level that has been measured over a period.

### **Octave Bands**

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 10 such octave bands whose centre frequencies are defined in accordance with international standards.

### **Addition of noise from several sources**

Noise from different sound sources combines to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than one alone and 10 sources produce a 10 dB higher sound level.

### **Attenuation by distance**

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g. stream of cars) drops off by 3 dB for each doubling of distance.

## Subjective impression of noise

Sound intensity is not perceived directly at the ear; rather it is transferred by the complex hearing mechanism to the brain where acoustic sensations can be interpreted as loudness. This makes hearing perception highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a reasonable guide to help explain increases or decreases in sound levels for many acoustic scenarios.

| Change in sound level (dB) | Change in perceived loudness |
|----------------------------|------------------------------|
| 1                          | Imperceptible                |
| 3                          | Just barely perceptible      |
| 6                          | Clearly noticeable           |
| 10                         | About twice as loud          |
| 20                         | About 4 times as loud        |

## Barriers

Outdoor barriers can be used to reduce environmental noises, such as traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and its construction.

## Reverberation control

When sound falls on the surfaces of a room, part of its energy is absorbed and part is reflected back into the room. The amount of reflected sound defines the reverberation of a room, a characteristic that is critical for spaces of different uses as it can affect the quality of audio signals such as speech or music. Excess reverberation in a room can be controlled by the effective use of sound-absorbing treatment on the surfaces, such as fibrous ceiling boards, curtains and carpets.

# Appendix B

## Acoustic Calculations

17936

81 Whinbush Road, Hitchin, Hertfordshire

### Residential receivers

#### External Plant Noise Emissions Calculation

Receiver 1 (Flat 5)

| Description                                                        | Frequency, Hz |           |           |           |           |           |            |            | dB(A)     |
|--------------------------------------------------------------------|---------------|-----------|-----------|-----------|-----------|-----------|------------|------------|-----------|
|                                                                    | 63            | 125       | 250       | 500       | 1k        | 2k        | 4k         | 8k         |           |
| <b>Unit 1</b>                                                      |               |           |           |           |           |           |            |            |           |
| Manufacturer provided sound power level                            | 60            | 58        | 51        | 52        | 50        | 44        | 38         | 31         | 54        |
| Correction to Sound Pressure Level, accounting for reflections, dB | -5            | -5        | -5        | -5        | -5        | -5        | -5         | -5         |           |
| Attenuation for screening, dB                                      | -4            | -5        | -6        | -9        | -11       | -14       | -17        | -20        |           |
| Distance correction to receiver, dB (8m) <sup>[1]</sup>            | -18           | -18       | -18       | -18       | -18       | -18       | -18        | -18        |           |
| <b>Sound pressure level at receiver</b>                            | <b>34</b>     | <b>31</b> | <b>22</b> | <b>21</b> | <b>16</b> | <b>8</b>  | <b>-2</b>  | <b>-12</b> | <b>22</b> |
| <b>Unit 2</b>                                                      |               |           |           |           |           |           |            |            |           |
| Manufacturer provided sound power level                            | 60            | 58        | 51        | 52        | 50        | 44        | 38         | 31         | 54        |
| Correction to Sound Pressure Level, accounting for reflections, dB | -5            | -5        | -5        | -5        | -5        | -5        | -5         | -5         |           |
| Attenuation for screening, dB                                      | -4            | -5        | -7        | -10       | -12       | -15       | -18        | -21        |           |
| Distance correction to receiver, dB (3m) <sup>[1]</sup>            | -10           | -10       | -10       | -10       | -10       | -10       | -10        | -10        |           |
| <b>Sound pressure level at receiver</b>                            | <b>41</b>     | <b>38</b> | <b>29</b> | <b>28</b> | <b>23</b> | <b>15</b> | <b>6</b>   | <b>-5</b>  | <b>29</b> |
| <b>Unit 3</b>                                                      |               |           |           |           |           |           |            |            |           |
| Manufacturer provided sound power level                            | 60            | 58        | 51        | 52        | 50        | 44        | 38         | 31         | 54        |
| Correction to Sound Pressure Level, accounting for reflections, dB | -5            | -5        | -5        | -5        | -5        | -5        | -5         | -5         |           |
| Attenuation for screening, dB                                      | -4            | -5        | -6        | -9        | -11       | -14       | -17        | -20        |           |
| Distance correction to receiver, dB (8m) <sup>[1]</sup>            | -18           | -18       | -18       | -18       | -18       | -18       | -18        | -18        |           |
| <b>Sound pressure level at receiver</b>                            | <b>34</b>     | <b>31</b> | <b>22</b> | <b>21</b> | <b>16</b> | <b>8</b>  | <b>-2</b>  | <b>-12</b> | <b>22</b> |
| <b>Unit 4</b>                                                      |               |           |           |           |           |           |            |            |           |
| Manufacturer provided sound power level                            | 60            | 58        | 51        | 52        | 50        | 44        | 38         | 31         | 54        |
| Correction to Sound Pressure Level, accounting for reflections, dB | -5            | -5        | -5        | -5        | -5        | -5        | -5         | -5         |           |
| Attenuation for screening, dB                                      | -4            | -5        | -6        | -9        | -11       | -14       | -17        | -20        |           |
| Distance correction to receiver, dB (8m) <sup>[1]</sup>            | -18           | -18       | -18       | -18       | -18       | -18       | -18        | -18        |           |
| <b>Sound pressure level at receiver</b>                            | <b>34</b>     | <b>31</b> | <b>22</b> | <b>21</b> | <b>16</b> | <b>8</b>  | <b>-2</b>  | <b>-12</b> | <b>22</b> |
| <b>Unit 6</b>                                                      |               |           |           |           |           |           |            |            |           |
| Manufacturer provided sound power level                            | 60            | 58        | 51        | 52        | 50        | 44        | 38         | 31         | 54        |
| Correction to Sound Pressure Level, accounting for reflections, dB | -5            | -5        | -5        | -5        | -5        | -5        | -5         | -5         |           |
| Attenuation for screening, dB                                      | -4            | -5        | -6        | -9        | -11       | -14       | -17        | -20        |           |
| Distance correction to receiver, dB (8m) <sup>[1]</sup>            | -28           | -28       | -28       | -28       | -28       | -28       | -28        | -28        |           |
| <b>Sound pressure level at receiver</b>                            | <b>24</b>     | <b>21</b> | <b>12</b> | <b>11</b> | <b>6</b>  | <b>-3</b> | <b>-12</b> | <b>-22</b> | <b>12</b> |
| <b>Unit 7</b>                                                      |               |           |           |           |           |           |            |            |           |
| Manufacturer provided sound power level                            | 60            | 58        | 51        | 52        | 50        | 44        | 38         | 31         | 54        |
| Correction to Sound Pressure Level, accounting for reflections, dB | -5            | -5        | -5        | -5        | -5        | -5        | -5         | -5         |           |
| Attenuation for screening, dB                                      | -4            | -5        | -6        | -9        | -11       | -14       | -17        | -20        |           |
| Distance correction to receiver, dB (8m) <sup>[1]</sup>            | -18           | -18       | -18       | -18       | -18       | -18       | -18        | -18        |           |
| <b>Sound pressure level at receiver</b>                            | <b>34</b>     | <b>31</b> | <b>22</b> | <b>21</b> | <b>16</b> | <b>8</b>  | <b>-2</b>  | <b>-12</b> | <b>22</b> |
| <b>Unit 8</b>                                                      |               |           |           |           |           |           |            |            |           |
| Manufacturer provided sound power level                            | 60            | 58        | 51        | 52        | 50        | 44        | 38         | 31         | 54        |
| Correction to Sound Pressure Level, accounting for reflections, dB | -5            | -5        | -5        | -5        | -5        | -5        | -5         | -5         |           |
| Attenuation for screening, dB                                      | -4            | -5        | -6        | -9        | -11       | -14       | -17        | -20        |           |
| Distance correction to receiver, dB (8m) <sup>[1]</sup>            | -18           | -18       | -18       | -18       | -18       | -18       | -18        | -18        |           |
| <b>Sound pressure level at receiver</b>                            | <b>34</b>     | <b>31</b> | <b>22</b> | <b>21</b> | <b>16</b> | <b>8</b>  | <b>-2</b>  | <b>-12</b> | <b>22</b> |
| <b>Unit 9 (Change of use property)</b>                             |               |           |           |           |           |           |            |            |           |
| Manufacturer provided sound power level                            | 60            | 58        | 51        | 52        | 50        | 44        | 38         | 31         | 54        |
| Correction to Sound Pressure Level, accounting for reflections, dB | -5            | -5        | -5        | -5        | -5        | -5        | -5         | -5         |           |
| Attenuation for screening, dB                                      | -4            | -5        | -6        | -9        | -11       | -14       | -17        | -20        |           |
| Distance correction to receiver, dB (12m) <sup>[1]</sup>           | -22           | -22       | -22       | -22       | -22       | -22       | -22        | -22        |           |
| <b>Sound pressure level at receiver</b>                            | <b>30</b>     | <b>27</b> | <b>18</b> | <b>17</b> | <b>12</b> | <b>4</b>  | <b>-6</b>  | <b>-16</b> | <b>18</b> |
| <b>Cumulative Sound pressure level at receiver</b>                 | <b>44</b>     | <b>41</b> | <b>32</b> | <b>31</b> | <b>26</b> | <b>18</b> | <b>9</b>   | <b>-2</b>  | <b>32</b> |

Design Criterion

33

#### BS 8233 Assessment Calculation

| Description                                                  | Frequency, Hz |     |     |     |     |     |     |     | dB(A) |
|--------------------------------------------------------------|---------------|-----|-----|-----|-----|-----|-----|-----|-------|
|                                                              | 63            | 125 | 250 | 500 | 1k  | 2k  | 4k  | 8k  |       |
| Sound pressure level outside window                          | 44            | 41  | 32  | 31  | 26  | 18  | 9   | -2  | 32    |
| Minimum attenuation from partially open window, dB           | -15           | -15 | -15 | -15 | -15 | -15 | -15 | -15 |       |
| Sound pressure level inside nearest noise sensitive premises | 29            | 26  | 17  | 16  | 11  | 3   | -6  | -17 | 17    |

Design Criterion

30

## Acoustic Calculations

17936

81 Whinbush Road, Hitchin, Hertfordshire

### Residential receivers

#### External Plant Noise Emissions Calculation

Receiver 2

| Description                                                        | Frequency, Hz |           |           |           |           |           |           |           | dB(A)     |
|--------------------------------------------------------------------|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|                                                                    | 63            | 125       | 250       | 500       | 1k        | 2k        | 4k        | 8k        |           |
| <b>Group 1: Units 1, 4 and 7</b>                                   |               |           |           |           |           |           |           |           |           |
| Manufacturer provided sound power level                            | 60            | 58        | 51        | 52        | 50        | 44        | 38        | 31        | 54        |
| Correction to Sound Pressure Level, accounting for reflections, dB | -5            | -5        | -5        | -5        | -5        | -5        | -5        | -5        |           |
| Correction for number of units (3), dB                             | 5             | 5         | 5         | 5         | 5         | 5         | 5         | 5         |           |
| Attenuation for partial screening, dB                              | -5            | -5        | -5        | -5        | -5        | -5        | -5        | -5        |           |
| Distance correction to receiver, dB (10m) <sup>[1]</sup>           | -20           | -20       | -20       | -20       | -20       | -20       | -20       | -20       |           |
| <b>Sound pressure level at receiver</b>                            | <b>35</b>     | <b>33</b> | <b>26</b> | <b>27</b> | <b>25</b> | <b>19</b> | <b>13</b> | <b>6</b>  | <b>29</b> |
| <b>Group 2: Units 2 and 5</b>                                      |               |           |           |           |           |           |           |           |           |
| Manufacturer provided sound power level                            | 60            | 58        | 51        | 52        | 50        | 44        | 38        | 31        | 54        |
| Correction to Sound Pressure Level, accounting for reflections, dB | -5            | -5        | -5        | -5        | -5        | -5        | -5        | -5        |           |
| Correction for number of units (3), dB                             | 3             | 3         | 3         | 3         | 3         | 3         | 3         | 3         |           |
| Attenuation for partial screening, dB                              | -5            | -5        | -5        | -5        | -5        | -5        | -5        | -5        |           |
| Distance correction to receiver, dB (17m) <sup>[1]</sup>           | -25           | -25       | -25       | -25       | -25       | -25       | -25       | -25       |           |
| <b>Sound pressure level at receiver</b>                            | <b>28</b>     | <b>26</b> | <b>19</b> | <b>20</b> | <b>18</b> | <b>12</b> | <b>6</b>  | <b>-1</b> | <b>22</b> |
| <b>Group 3: Units 3, 6 and 8</b>                                   |               |           |           |           |           |           |           |           |           |
| Manufacturer provided sound power level                            | 60            | 58        | 51        | 52        | 50        | 44        | 38        | 31        | 54        |
| Correction to Sound Pressure Level, accounting for reflections, dB | -5            | -5        | -5        | -5        | -5        | -5        | -5        | -5        |           |
| Attenuation for partial screening, dB                              | -5            | -5        | -5        | -5        | -5        | -5        | -5        | -5        |           |
| Distance correction to receiver, dB (25m) <sup>[1]</sup>           | -28           | -28       | -28       | -28       | -28       | -28       | -28       | -28       |           |
| <b>Sound pressure level at receiver</b>                            | <b>22</b>     | <b>20</b> | <b>13</b> | <b>14</b> | <b>12</b> | <b>6</b>  | <b>0</b>  | <b>-7</b> | <b>16</b> |
| <b>Group 4 - Unit 9 (Change of use property)</b>                   |               |           |           |           |           |           |           |           |           |
| Manufacturer provided sound power level                            | 60            | 58        | 51        | 52        | 50        | 44        | 38        | 31        | 54        |
| Correction to Sound Pressure Level, accounting for reflections, dB | -5            | -5        | -5        | -5        | -5        | -5        | -5        | -5        |           |
| Attenuation for partial screening, dB                              | -5            | -5        | -5        | -5        | -5        | -5        | -5        | -5        |           |
| Distance correction to receiver, dB (6m) <sup>[1]</sup>            | -16           | -16       | -16       | -16       | -16       | -16       | -16       | -16       |           |
| <b>Sound pressure level at receiver</b>                            | <b>34</b>     | <b>32</b> | <b>25</b> | <b>26</b> | <b>24</b> | <b>18</b> | <b>12</b> | <b>5</b>  | <b>28</b> |
| <b>Cumulative Sound pressure level at receiver</b>                 | <b>38</b>     | <b>36</b> | <b>29</b> | <b>30</b> | <b>28</b> | <b>22</b> | <b>16</b> | <b>9</b>  | <b>32</b> |

Design Criterion

33

#### BS 8233 Assessment Calculation

| Description                                                         | Frequency, Hz |           |           |           |           |          |          |           | dB(A)     |
|---------------------------------------------------------------------|---------------|-----------|-----------|-----------|-----------|----------|----------|-----------|-----------|
|                                                                     | 63            | 125       | 250       | 500       | 1k        | 2k       | 4k       | 8k        |           |
| <b>Sound pressure level outside window</b>                          | 38            | 36        | 29        | 30        | 28        | 22       | 16       | 9         | 32        |
| <b>Minimum attenuation from partially open window, dB</b>           | -15           | -15       | -15       | -15       | -15       | -15      | -15      | -15       |           |
| <b>Sound pressure level inside nearest noise sensitive premises</b> | <b>23</b>     | <b>21</b> | <b>14</b> | <b>15</b> | <b>13</b> | <b>7</b> | <b>1</b> | <b>-6</b> | <b>17</b> |

Design Criterion

30

## Acoustic Calculations

17936

81 Whinbush Road, Hitchin, Hertfordshire

### Residential receivers

#### External Plant Noise Emissions Calculation

Receiver 3

| Description                                                        | Frequency, Hz |           |           |           |           |           |           |           | dB(A)     |
|--------------------------------------------------------------------|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|                                                                    | 63            | 125       | 250       | 500       | 1k        | 2k        | 4k        | 8k        |           |
| <b>Group 1: Units 1, 4 and 7</b>                                   |               |           |           |           |           |           |           |           |           |
| Manufacturer provided sound power level                            | 60            | 58        | 51        | 52        | 50        | 44        | 38        | 31        | 54        |
| Correction to Sound Pressure Level, accounting for reflections, dB | -5            | -5        | -5        | -5        | -5        | -5        | -5        | -5        |           |
| Correction for number of units (3), dB                             | 5             | 5         | 5         | 5         | 5         | 5         | 5         | 5         |           |
| Attenuation for partial screening, dB                              | -5            | -5        | -5        | -5        | -5        | -5        | -5        | -5        |           |
| Distance correction to receiver, dB (23m) <sup>[1]</sup>           | -27           | -27       | -27       | -27       | -27       | -27       | -27       | -27       |           |
| <b>Sound pressure level at receiver</b>                            | <b>28</b>     | <b>26</b> | <b>19</b> | <b>20</b> | <b>18</b> | <b>12</b> | <b>6</b>  | <b>-1</b> | <b>22</b> |
| <b>Group 2: Units 2 and 5</b>                                      |               |           |           |           |           |           |           |           |           |
| Manufacturer provided sound power level                            | 60            | 58        | 51        | 52        | 50        | 44        | 38        | 31        | 54        |
| Correction to Sound Pressure Level, accounting for reflections, dB | -5            | -5        | -5        | -5        | -5        | -5        | -5        | -5        |           |
| Correction for number of units (3), dB                             | 3             | 3         | 3         | 3         | 3         | 3         | 3         | 3         |           |
| Attenuation for partial screening, dB                              | -5            | -5        | -5        | -5        | -5        | -5        | -5        | -5        |           |
| Distance correction to receiver, dB (16m) <sup>[1]</sup>           | -24           | -24       | -24       | -24       | -24       | -24       | -24       | -24       |           |
| <b>Sound pressure level at receiver</b>                            | <b>29</b>     | <b>27</b> | <b>20</b> | <b>21</b> | <b>19</b> | <b>13</b> | <b>7</b>  | <b>0</b>  | <b>23</b> |
| <b>Group 3: Units 3, 6 and 8</b>                                   |               |           |           |           |           |           |           |           |           |
| Manufacturer provided sound power level                            | 60            | 58        | 51        | 52        | 50        | 44        | 38        | 31        | 54        |
| Correction to Sound Pressure Level, accounting for reflections, dB | -5            | -5        | -5        | -5        | -5        | -5        | -5        | -5        |           |
| Attenuation for partial screening, dB                              | -5            | -5        | -5        | -5        | -5        | -5        | -5        | -5        |           |
| Distance correction to receiver, dB (8m) <sup>[1]</sup>            | -18           | -18       | -18       | -18       | -18       | -18       | -18       | -18       |           |
| <b>Sound pressure level at receiver</b>                            | <b>32</b>     | <b>30</b> | <b>23</b> | <b>24</b> | <b>22</b> | <b>16</b> | <b>10</b> | <b>3</b>  | <b>26</b> |
| <b>Group 4 - Unit 9 (Change of use property)</b>                   |               |           |           |           |           |           |           |           |           |
| Manufacturer provided sound power level                            | 60            | 58        | 51        | 52        | 50        | 44        | 38        | 31        | 54        |
| Correction to Sound Pressure Level, accounting for reflections, dB | -5            | -5        | -5        | -5        | -5        | -5        | -5        | -5        |           |
| Attenuation for partial screening, dB                              | -5            | -5        | -5        | -5        | -5        | -5        | -5        | -5        |           |
| Distance correction to receiver, dB (28m) <sup>[1]</sup>           | -29           | -29       | -29       | -29       | -29       | -29       | -29       | -29       |           |
| <b>Sound pressure level at receiver</b>                            | <b>21</b>     | <b>19</b> | <b>12</b> | <b>13</b> | <b>11</b> | <b>5</b>  | <b>-1</b> | <b>-8</b> | <b>15</b> |
| <b>Cumulative Sound pressure level at receiver</b>                 | <b>35</b>     | <b>33</b> | <b>26</b> | <b>27</b> | <b>25</b> | <b>19</b> | <b>13</b> | <b>6</b>  | <b>29</b> |

Design Criterion

33

#### BS 8233 Assessment Calculation

| Description                                                         | Frequency, Hz |           |           |           |           |          |           |           | dB(A)     |
|---------------------------------------------------------------------|---------------|-----------|-----------|-----------|-----------|----------|-----------|-----------|-----------|
|                                                                     | 63            | 125       | 250       | 500       | 1k        | 2k       | 4k        | 8k        |           |
| <b>Sound pressure level outside window</b>                          | 35            | 33        | 26        | 27        | 25        | 19       | 13        | 6         | 29        |
| <b>Minimum attenuation from partially open window, dB</b>           | -15           | -15       | -15       | -15       | -15       | -15      | -15       | -15       |           |
| <b>Sound pressure level inside nearest noise sensitive premises</b> | <b>20</b>     | <b>18</b> | <b>11</b> | <b>12</b> | <b>10</b> | <b>4</b> | <b>-2</b> | <b>-9</b> | <b>14</b> |

Design Criterion

30

## Acoustic Calculations

17936

81 Whinbush Road, Hitchin, Hertfordshire

### Residential receivers

#### External Plant Noise Emissions Calculation

Receiver 4

| Description                                                        | Frequency, Hz |           |           |           |           |           |           | dB(A)     |
|--------------------------------------------------------------------|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|                                                                    | 63            | 125       | 250       | 500       | 1k        | 2k        | 4k        | 8k        |
| <b>Group 1: Units 1, 4 and 7</b>                                   |               |           |           |           |           |           |           |           |
| Manufacturer provided sound power level                            | 60            | 58        | 51        | 52        | 50        | 44        | 38        | 31        |
| Correction to Sound Pressure Level, accounting for reflections, dB | -5            | -5        | -5        | -5        | -5        | -5        | -5        | -5        |
| Correction for number of units (3), dB                             | 5             | 5         | 5         | 5         | 5         | 5         | 5         | 5         |
| Distance correction to receiver, dB (28m) <sup>[1]</sup>           | -29           | -29       | -29       | -29       | -29       | -29       | -29       | -29       |
| <b>Sound pressure level at receiver</b>                            | <b>31</b>     | <b>29</b> | <b>22</b> | <b>23</b> | <b>21</b> | <b>15</b> | <b>9</b>  | <b>2</b>  |
| <b>Group 2: Units 2 and 5</b>                                      |               |           |           |           |           |           |           |           |
| Manufacturer provided sound power level                            | 60            | 58        | 51        | 52        | 50        | 44        | 38        | 31        |
| Correction to Sound Pressure Level, accounting for reflections, dB | -5            | -5        | -5        | -5        | -5        | -5        | -5        | -5        |
| Correction for number of units (3), dB                             | 3             | 3         | 3         | 3         | 3         | 3         | 3         | 3         |
| Distance correction to receiver, dB (30m) <sup>[1]</sup>           | -30           | -30       | -30       | -30       | -30       | -30       | -30       | -30       |
| <b>Sound pressure level at receiver</b>                            | <b>28</b>     | <b>26</b> | <b>19</b> | <b>20</b> | <b>18</b> | <b>12</b> | <b>6</b>  | <b>-1</b> |
| <b>Group 3: Units 3, 6 and 8</b>                                   |               |           |           |           |           |           |           |           |
| Manufacturer provided sound power level                            | 60            | 58        | 51        | 52        | 50        | 44        | 38        | 31        |
| Correction to Sound Pressure Level, accounting for reflections, dB | -5            | -5        | -5        | -5        | -5        | -5        | -5        | -5        |
| Distance correction to receiver, dB (8m) <sup>[1]</sup>            | -31           | -31       | -31       | -31       | -31       | -31       | -31       | -31       |
| <b>Sound pressure level at receiver</b>                            | <b>24</b>     | <b>22</b> | <b>15</b> | <b>16</b> | <b>14</b> | <b>8</b>  | <b>2</b>  | <b>-5</b> |
| <b>Group 4 - Unit 9 (Change of use property)</b>                   |               |           |           |           |           |           |           |           |
| Manufacturer provided sound power level                            | 60            | 58        | 51        | 52        | 50        | 44        | 38        | 31        |
| Correction to Sound Pressure Level, accounting for reflections, dB | -5            | -5        | -5        | -5        | -5        | -5        | -5        | -5        |
| Distance correction to receiver, dB (25m) <sup>[1]</sup>           | -28           | -28       | -28       | -28       | -28       | -28       | -28       | -28       |
| <b>Sound pressure level at receiver</b>                            | <b>27</b>     | <b>25</b> | <b>18</b> | <b>19</b> | <b>17</b> | <b>11</b> | <b>5</b>  | <b>-2</b> |
| <b>Cumulative Sound pressure level at receiver</b>                 | <b>34</b>     | <b>32</b> | <b>25</b> | <b>26</b> | <b>24</b> | <b>18</b> | <b>12</b> | <b>5</b>  |

Design Criterion

33

#### BS 8233 Assessment Calculation

| Description                                                         | Frequency, Hz |            |            |            |            |            |            | dB(A)      |
|---------------------------------------------------------------------|---------------|------------|------------|------------|------------|------------|------------|------------|
|                                                                     | 63            | 125        | 250        | 500        | 1k         | 2k         | 4k         | 8k         |
| <b>Sound pressure level outside window</b>                          | <b>34</b>     | <b>32</b>  | <b>25</b>  | <b>26</b>  | <b>24</b>  | <b>18</b>  | <b>12</b>  | <b>5</b>   |
| <b>Minimum attenuation from partially open window, dB</b>           | <b>-15</b>    | <b>-15</b> | <b>-15</b> | <b>-15</b> | <b>-15</b> | <b>-15</b> | <b>-15</b> | <b>-15</b> |
| <b>Sound pressure level inside nearest noise sensitive premises</b> | <b>19</b>     | <b>17</b>  | <b>10</b>  | <b>11</b>  | <b>9</b>   | <b>3</b>   | <b>-3</b>  | <b>-10</b> |

Design Criterion

30