

WILMINGTON MANOR  
CARE HOME (BUPA),  
DA2

## Plant Noise Assessment

Reference: 12685.RP01.PNA.1

Prepared: 31 August 2023

Revision Number: 0

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# Plant Noise Assessment



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Revision	Comment	Date	Prepared By	Approved By
1	Updated receptors	31 August 2023	Robert Barlow	Martin Raisborough

### *Terms of contract:*

RBA Acoustics Ltd have prepared this report in accordance with our Scope of Work 12685.SW01.0 dated 14 April 2023. RBA Acoustics Ltd shall not be responsible for any use of the report or its contents for any purpose other than that for which it was provided. Should the Client require the distribution of the report to other parties for information, the full report should be copied. No professional liability or warranty shall be extended to other parties by RBA Acoustics Ltd without written agreement from RBA Acoustics Ltd.

The recommendations within this report relate to acoustics performance only and will need to be integrated within the overall design by the lead designer to incorporate all other design disciplines such as fire, structural integrity, setting-out, etc. Similarly, any sketches appended to this report illustrate acoustic principles only and will need to be developed into full working drawings by the lead designer to incorporate all other design disciplines.



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## 1. INTRODUCTION

New air source heat pumps have been installed at Wilmington Manor Care Home (BUPA), DA2. As part of the retrospective planning application, Dartford Borough Council requires consideration be given to atmospheric noise emissions from the new equipment to the nearest noise-sensitive receptors.

RBA Acoustics have been commissioned to undertake measurements of the prevailing noise conditions at the site and to determine the atmospheric noise emission limits in accordance with Dartford Borough Council's requirements. This report presents the results of the noise measurements, associated criteria and provides the required assessment.

A summary of acoustic terminology is included in Appendix A.

## 2. SITE DESCRIPTION

The Wilmington Manor Care Home site is located in a residential area and is situated approximately 170 metres south of the A2 dual carriageway. Two new outdoor air source heat pumps have been installed at ground floor level on the north-western corner of the Wilmington Manor Care Home building and are housed within a slatted wooden enclosure.

The nearest noise sensitive receptor to the new items of plant are the houses approximately 17m south-west of the plant enclosure. Around the site and near the noise sensitive receptor, road traffic noise from the A2 was observed to be the most dominant noise source at the time of installing and collecting the environmental noise survey.

The site is shown in relation to its surroundings in the site plan in Figure 1 (Appendix E).

## 3. ENVIRONMENTAL NOISE SURVEY

### 3.1 Survey Methodology

Monitoring of the prevailing background noise was undertaken over the following 48-hour period:

11:00 Tuesday 18 April 2023 to 11:00 Thursday 20 April 2023.

As the survey was unattended it is not possible to comment with certainty regarding meteorological conditions throughout the entire survey period. However, based on observations during the site visits and weather reports for the area, conditions were generally considered suitable for obtaining representative noise measurements, being predominantly dry with wind speeds that fluctuated between light and moderate.

Although wind speeds were slightly higher than usually desired for surveying, this is unlikely to have a notable effect on the lowest background noise levels, which would typically be measured in periods where wind speeds lapsed.

Measurements were made of the  $L_{A90}$ ,  $L_{Amax}$  and  $L_{Aeq}$  noise levels over sample periods of 15 minutes.

### 3.2 Measurement Location

To determine the existing noise climate around the site measurements were undertaken at the following location:

## Edge of Plant Enclosure

A microphone was installed on a boom attached the edge of the plant enclosure, approximately 2m above ground level. Measurements were undertaken in free-field conditions, given the reasonable distance from reflective surfaces (excluding the ground). The new ASHP units were not operational during the survey period.

At this position, both the equivalent continuous noise level and background noise level were considered to be dominated by road traffic noise from the A2.

It is understood that there were some maintenance works occurring just outside of the enclosure on both Tuesday 18 & Wednesday 19 April and RBA was informed that these works occurred from 08:00-15:00 hours on each day. Whilst on site, noise from works was highly intermittent above the prevailing noise climate and is therefore unlikely to have a significant effect on the average noise levels. Critically, given the non-continuous nature of the works, this is considered to have negligible effect on the background noise levels over a 15-minute period, which is the parameter to be used to set criteria in this assessment.

The measurement position is also illustrated on the site plan attached in Figure 1 and photograph in Figure 2 (Appendix E).

### 3.3 Instrumentation

For information regarding the equipment used for the measurements please refer to Appendix B.

The sound level meter was calibrated both prior to and on completion of the survey with no significant calibration drift observed.

### 3.4 Results

The noise levels measured are shown as time-histories on the attached Graphs 1-2 (Appendix E). The lowest  $L_{A90}$  and the period averaged  $L_{Aeq}$  noise levels measured are summarised in Table 1.

Table 1 – Measured Levels

Measurement Period	Lowest $L_{A90,15min}$ (dB)	$L_{Aeq}$ (dB)
Daytime (07:00 – 23:00)	53 (59*)	61
Night-time (23:00 – 07:00)	45 (49*)	56

\* Modal-average value also shown, for reference only.

## 4. PLANT NOISE CRITERIA

Based on previous advice from Dartford Borough Council, we understand that the general guidance is to use BS 4142 as an assessment method. The Council also advise that the rating level of the noise from the cumulative sound emissions of the plant shall be at least 5dBA lower than the existing  $L_{A90}$  background noise level at any given time of operation. The noise levels shall be measured or predicted 1m externally to any window at the nearest residential façade.

We have set the criteria based on the lowest measured  $L_{A90}$  (as opposed to the modal or mean-average  $L_{A90}$ ) in order to represent a worst-case assessment.

In line with the above requirements, we would propose items of mechanical services be designed so that noise emissions from the plant do not exceed the following levels when assessed at the nearest noise sensitive location:

- Daytime (07:00 to 23:00)                      48 dBA
- Night-time (23:00 to 07:00)                40 dBA

In line with BS 4142: 2014, should the proposed plant be identified as having intermittent or tonal characteristics, a further penalty should be subtracted from any of the above proposed noise emission limits.

It should be noted that the above requirements are applied at the nearest residential adjacencies and alternative criteria should be incorporated if there are also commercial properties affected by the proposed plant installations.

## 5. PLANT NOISE ASSESSMENT – EXTERNAL RECEPTORS

This assessment has been based on the information as observed by RBA on-site at the time of surveying and is described in the following sections.

### 5.1 New Plant Items

The following plant is proposed for the scheme:

Table 2 – Plant Types

Ref.	Manufacturer/Model/Duty	Plant Type
2No. ASHP	Bosch CS5000AW 22 O	Air source heat pump

### 5.2 Plant Locations

The plant is located externally on the north-western edge of the Wilmington Manor Care Home building, approximately 17m from the nearest noise-sensitive receptor. The equipment positions are indicated on the site plan in Figure 1 and photograph in Figure 2 in Appendix E.

### 5.3 Plant Noise Levels

Following correspondence with the manufacturer of the units, information regarding the noise levels of the proposed plant has been provided and are presented as overall A-weighted sound power levels in Table 3 below.

Table 3 – Plant Noise Levels

Unit	Overall Sound Power Level (dBA)		
	Normal Load Duty	High Load Duty	Maximum Load Duty
1No. ASHP	58	61	66

The A-weighted third-octave band sound power levels have also been provided and are shown in Appendix D. Review of the third-octave band data provides no indication of any tonal characteristics associated with the proposed plant. From our experience assessing plant of this type, we would not associate any intermittent or impulsive characteristics with the operation of ASHPs and therefore, we would not suggest that any feature corrections in line with BS 4142 would be necessary for this assessment.

### 5.4 Location of the Nearest Noise-Sensitive Receptors

Based on observations made on site and discussions with the design team we understand the nearest noise-sensitive receptors to the proposed plant to be the houses approximately 17m south west of the plant enclosure.

The receptors are shown in the site plan and photograph in Figures 1-2 in Appendix E.

## 5.5 Calculation of Noise Levels at Nearest Noise-Sensitive Receptors

Our calculation method for predicting noise levels from the proposed plant at the nearest noise-sensitive receptors, based on the information above, is summarised below.

- Source Term SWL
- Hemispherical Radiation
- Distance Attenuation
- Reflections

As a worst-case assessment, we have:

- Assumed that both units will operate at maximum load duty throughout the entire daytime and night-time periods. This is a very onerous assumption, particularly during the night-time, as it is unlikely that both units will be required to operate at maximum load duty for an extended period.
- Not assumed there to be any screening offered by the plant enclosure, given that it is not imperforate and does not fully obscure the units.

Calculation sheets are attached for further information in Appendix C.

The results of the calculations indicate the following noise levels at the nearest affected residential windows:

Table 4 – Predicted Noise Levels

Operating Period	Noise Level (dBA) at Receptor	
	Prediction	Criterion
Daytime (07:00 – 23:00)	38	48
Night-time (23:00 – 07:00)	38	40

Noise from the proposed plant installations is within the criteria for both daytime and night-time, even when making a number of worst-case assumptions regarding background noise level, plant operational levels and lack of screening.



## 6. PLANT NOISE ASSESSMENT – OWN BUILDING

### 6.1 Background Information

Further to submission of our Plant Noise Assessment Report Rev 0 in support of the retrospective planning application for the location of the plant, the following response has been received from Dartford Borough Council:

*“The implemented works by virtue of its location, proximity to the host building and in the absence of supporting information (for example noise impact assessment) it cannot be demonstrated that the proposed development would not result in significant harm to the residential amenities of the host building Wilmington Manor Nursing Home in terms of noise and disturbance, contrary to Policies DP2, DP5 and DP7 of the adopted Dartford Development Policies Plan (2017) and Policies M1 and M11 of the Pre-Submission (Publication) Dartford Local Plan.”*

The host building, as referred to above, is the Wilmington Manor care home itself, the building in which the plant is proposed to serve.

It is not typical to assess noise from new building services plant at the windows of the host building, particularly a building that is used for commercial enterprise, for the following reasons:

- The host building directly benefits from the operation of the equipment.
- The equipment will inevitably be located in close proximity to the windows of the host building meaning that achieving the standard requirements of the Local Authority in terms of noise emission, will inevitably be difficult.
- Any noise impact will be managed by the operator of the host building at their own expense. This may include relocation of noise sensitive users further from the installed equipment, provision of upgraded glazing to prevent noise break-in, provision of alternative ventilation / cooling to avoid the need to open windows.

The final point above is an important one, as any expense incurred as a result of mitigating the impact of noise will be the responsibility of the host building. This is in contrast to any noise impact at existing receptors where it would be unreasonable for the affected receptor to incur costs to mitigate noise that is unrelated to their own properties / building.

### 6.2 Location of the Nearest Noise-Sensitive Receptors

Following discussions with the project team we understand that the whole of the Wilmington Manor first floor is used for residential purposes. As such, the nearest noise-sensitive windows of the host building to the installed plant are approximately 3m away.

The receptors are shown in the site plan and photograph in Figures 1-2 in Appendix E.

### 6.3 Calculation of Noise Levels at Nearest Noise-Sensitive Receptors

The results of the calculations (prediction methodology as referred to previously) indicate the following noise levels outside the nearest affected residential windows:

- **Predicted Level**                      **51dBA**

As referred to above, alternative criteria should be adopted when considering noise from building services plant affecting the host building. It is not considered appropriate to simply adopt the same planning criteria as would be adopted at existing external receptors. Predictions have therefore been undertaken to determine resulting noise levels internally within the closest residential bedrooms to the installed plant.

#### *Closed Windows*

Noise break-in through a closed window has been calculated based on the methodology described in BS8233. A worst-case sound reduction of  $R_w$  30dB for the window has been adopted which is typical of a 4mm single glazed unit. This results in the following internal noise level within the residential bedroom due to noise from the installed plant:

- **Predicted Internal Level (Window Closed)**    **21dB**

The predicted level with the window closed is comfortably below the internal noise level criteria typically adopted for new residential buildings ( $L_{Aeq}$  35dB during the daytime and  $L_{Aeq}$  30dB during the night-time) as referred to in BS8233 and WHO.

#### *Opened Windows*

Noise break-in through an open window has also been calculated based on the methodology described in BS8233. A standard reduction of 15dB from outside to inside has been adopted. This results in the following internal noise level within the residential bedroom due to noise from the installed plant:

- **Predicted Internal Level (Window Open)**    **36dB**

The predicted level with the window open just above the internal noise level criteria typically adopted for new residential buildings ( $L_{Aeq}$  35dB during the daytime and  $L_{Aeq}$  30dB during the night-time) as referred to in BS8233 and WHO.

Given the worst case assumptions described previously (i.e. both units will operating at maximum load duty throughout the entire daytime and night-time) we would consider the predicted level to be acceptable. It should also be noted that the occupants of the closest affected rooms would also have the opportunity to close the window.

## 6.4 Management

As described in Section 6.1 and 6.3, should occupants of the residential bedrooms of the host building consider noise from the installed plant to be disturbing (and our calculations conclude that this only likely when both units are operating at full duty and with the windows to the bedrooms opened for ventilation) then it will be the responsibility of the operator and building management to provide an appropriate response.

This could either be a commercial response (such as relocating the affected occupant or providing financial compensation) or by providing alternative means of ventilation to the affected rooms to avoid the need to open windows.

This would typically be addressed by the operator / management as opposed to being a requirement for planning.

## 7. VIBRATION CONTROL

In addition to the control of airborne noise transfer, it is also important to consider the transfer of noise as vibration to adjacent properties (as well as to any sensitive areas of the same building).

Following liaison with KJ Tait and Kestrel Mechanical Services Ltd, we understand that the units are slightly elevated from the ground and mounted on a Big Foot cradle-type system. Due to the fact that the units are on a ground-bearing slab and a notable distance to nearby receptors, we would consider this mounting to be acceptable in terms of vibration mitigation.

## 8. CONCLUSION

RBA Acoustics have undertaken noise monitoring at Wilmington Manor Care Home (BUPA), DA2. The measured noise levels are presented within this report. The resultant noise levels have been used to determine the required criteria for atmospheric noise emissions from the proposed plant installations.

The results of the assessment indicate atmospheric noise emissions from the proposed plant are within the criteria required by Dartford Borough Council at the worst affected external receptors to the installed plant. As such, the proposed plant installations should be considered acceptable in terms of noise.

Assessments have also been made, as requested by the Local Authority, of noise levels at the worst affected locations of the host buildings. These predictions have established that acceptable internal noise levels due to operation of the plant are achieved with the windows closed. With the windows opened for ventilation, the resultant internal noise levels are marginally higher than those typically adopted for new residential dwellings (assuming the worst-case operating conditions of the plant).

Recommendations have been made with regards mitigating the impact of internal noise with windows open, however it should be at the discretion of the Operator / Building Management as to how to manage or address this possible impact.

# Appendix A – Acoustic Terminology

A-weighting (e.g. dB(A))	A correction applied across the frequency bands to take into account the response of the human ear, and therefore considered to be more representative of the sound levels people hear.
DeciBel (dB)	Unit used for many different acoustic parameters. It is the logarithmic ratio of the level being assessed to a standard reference level.
$L_{eq}$	The level of a notional steady sound which, over a stated period of time, $T$ , would have the same acoustic energy as the fluctuating noise measured over that period. Typically used to represent the average or ambient noise level.
$L_{Aeq,T}$	The A-weighted level of a notional steady sound which, over a stated period of time, $T$ , would have the same acoustic energy as the fluctuating noise measured over that period. Typically used to represent the average or ambient noise level.
$L_{An}$ (e.g. $L_{A10}$ , $L_{A90}$ )	The sound level exceeded for $n\%$ of the time. E.g. $L_{A10}$ is the A-weighted level exceeded for 10% of the time and as such can be used to represent a typical maximum level. Similarly, $L_{A90}$ is the level exceeded for 90% of the measurement period, and is often used to describe the underlying background noise.
$L_{Amax,T}$	The instantaneous maximum A-weighted sound pressure level which occurred during the measurement period, $T$ . It is commonly used to measure the effect of very short duration bursts of noise, e.g. sudden bangs, shouts, car horns, emergency sirens etc. which audibly stand out from the ambient level.
NR	Noise Rating – A single figure term to describe a measured noise level which considers the frequency content of the noise, generally used for internal noise level measurements (particularly mechanical services plant).

## Appendix B – Instrumentation

The following equipment was used for the measurements.

Table B1– Equipment Calibration Details

Manufacturer	Model Type	Serial No.	Calibration	
			Certificate No.	Expiry Date
Norsonic Type 1 Sound Level Meter	Nor140	1407476	U39224	19 October 2023
Norsonic Pre Amplifier	1209	22340		
Norsonic 1/2" Microphone	1225	358242	39223	
Norsonic Sound Calibrator	1255	125525265	U39222	19 October 2023

# Appendix C – Plant Calculations

Table C1 – Calculation for 2No. units at receptor

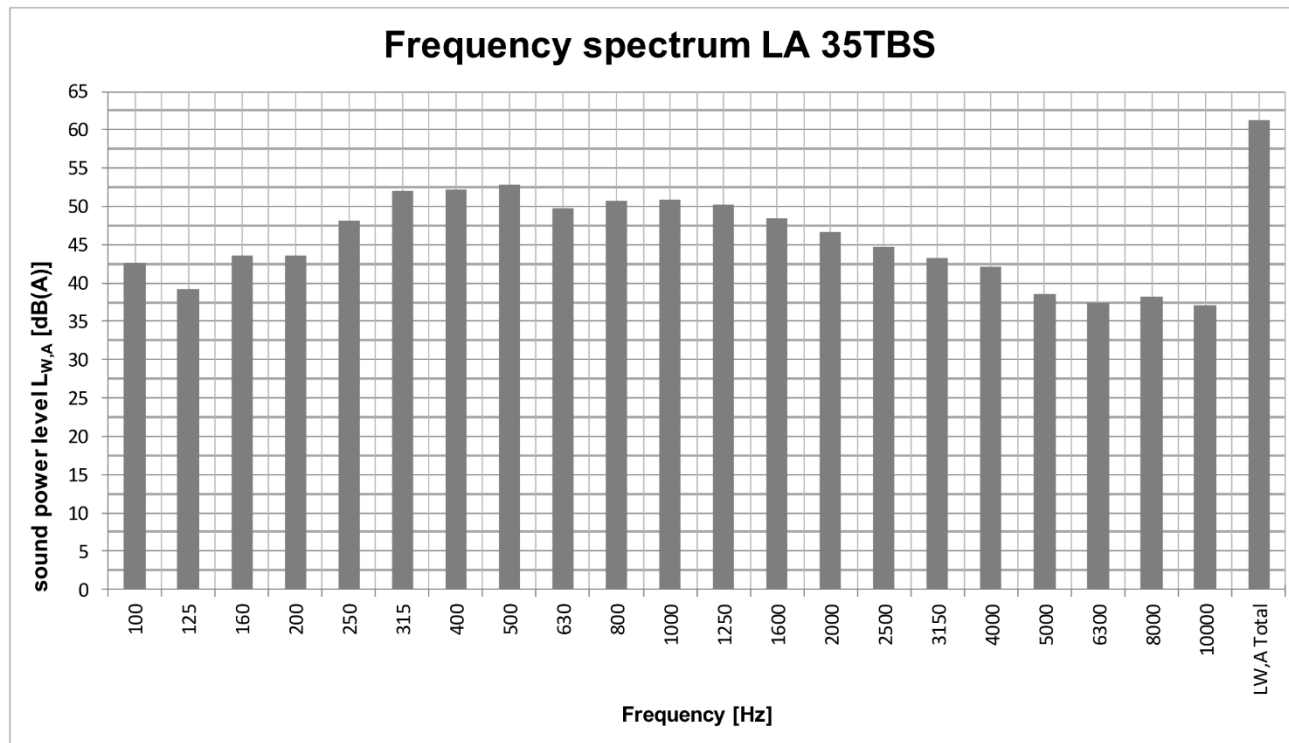
Parameter	dBA
$L_w$ (at maximum load duty)	66
2No. units	+3
Conversion to $L_p$	-11
Quarter-spherical radiation (reflections from ground and Care Home wall)	+5
Distance losses @ 17m	-25
Noise level at receiver	38

## Appendix D – Unit Sound Power Level Data

## Schallanalyse LA 35TBS

### Schalleistungspegel LA 35TBS

Frequenz [Hz]	L <sub>W,A</sub> [dB(A)]
100	42,6
125	39,2
160	43,6
200	43,6
250	48,1
315	52,1
400	52,2
500	52,9
630	49,8
800	50,7
1000	50,9
1250	50,3
1600	48,4
2000	46,6
2500	44,8
3150	43,3
4000	42,1
5000	38,6
6300	37,4
8000	38,2
10000	37,1
<b>L<sub>W,A</sub> Total</b>	<b>61,2</b>





## Appendix E – Graphs and Site Plans

Wilmington Manor Care Home (Bupa), DA2

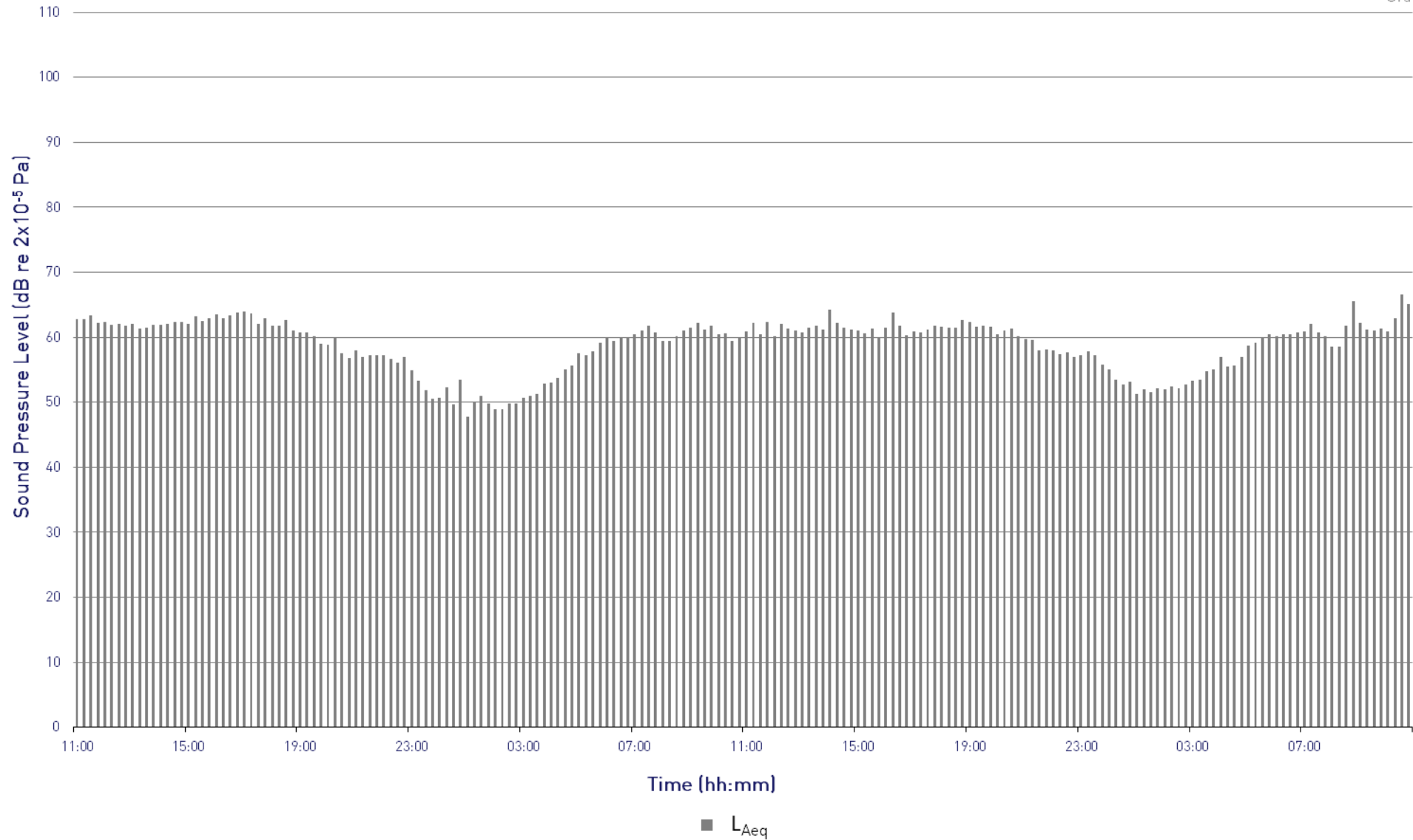
L<sub>Aeq</sub> Time History

Measurement Position 1 - Edge of Plant Enclosure



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Graph 1



Wilmington Manor Care Home (Bupa), DA2

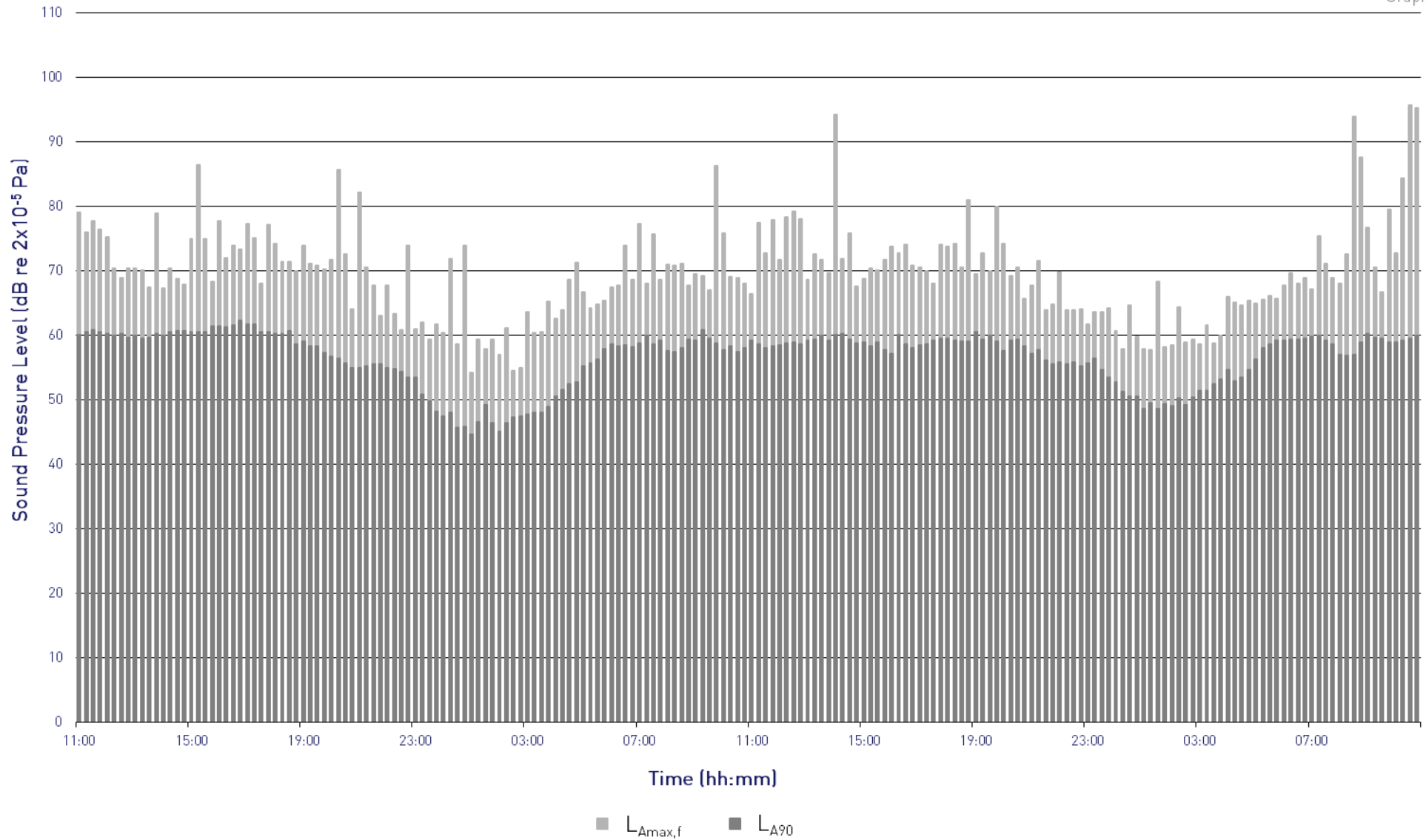
$L_{Amax,f}$  and  $L_{A90}$  Time History

Measurement Position 1 - Edge of Plant Enclosure

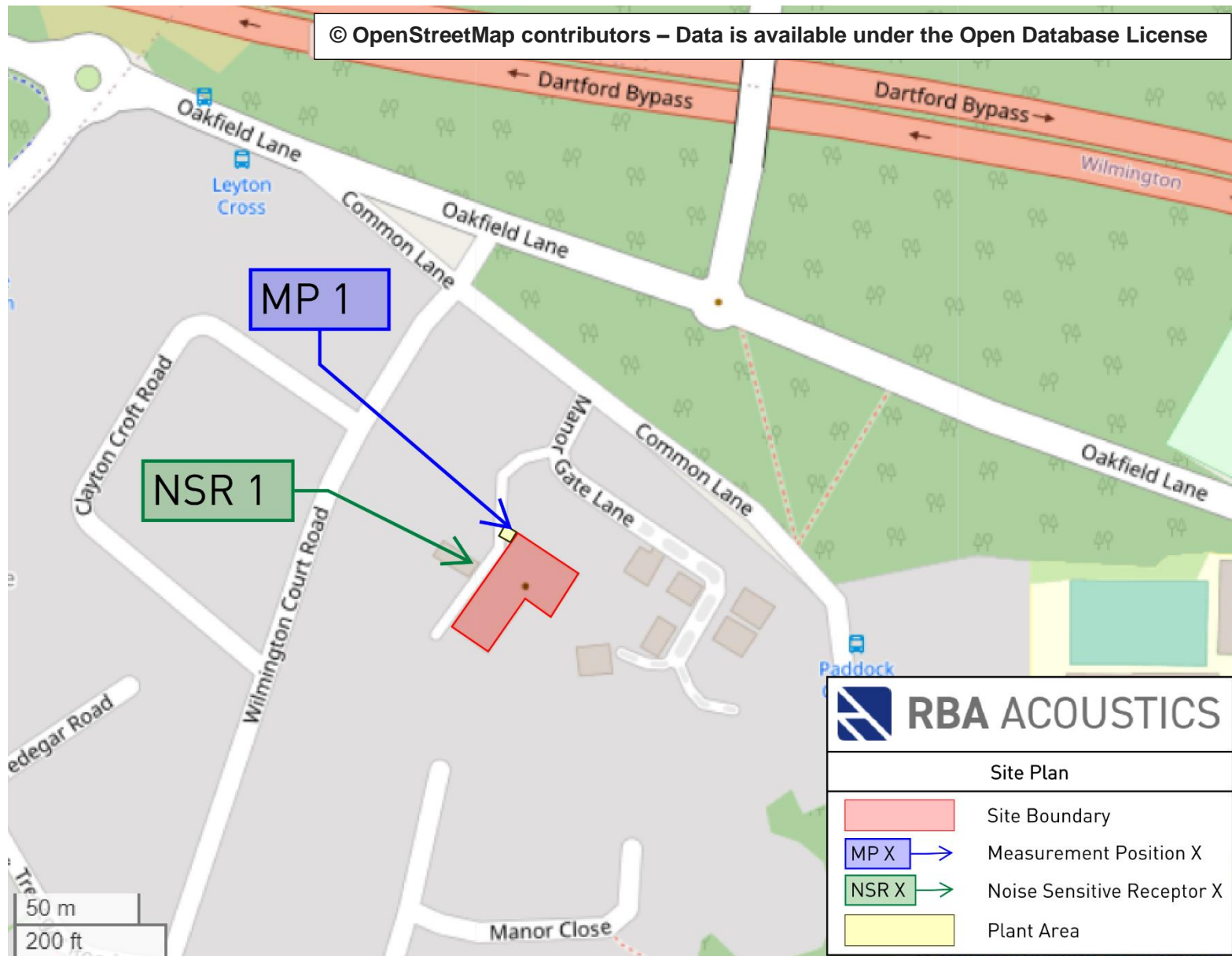


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Graph 2



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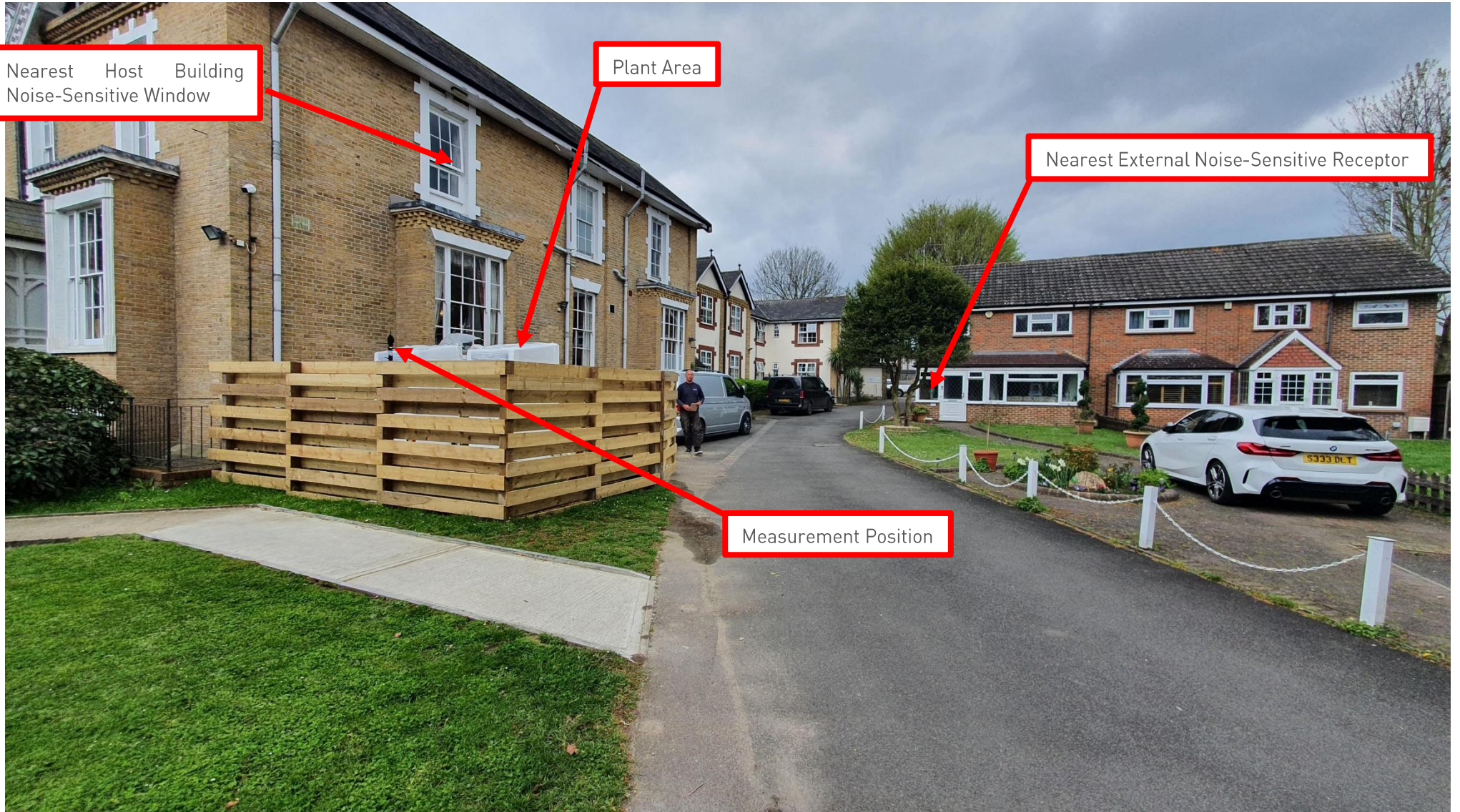


Wilmington Manor Care Home (BUPA), DA2  
Site Plan  
Project 12685

Figure 1  
31 August 2023  
Not to Scale







Nearest Host Building  
Noise-Sensitive Window

Plant Area

Nearest External Noise-Sensitive Receptor

Measurement Position

Wilmington Manor Care Home (BUPA), DA2  
Photograph of Measurement Position, Noise-Sensitive Receptors and Plant Area  
Project 12685

Figure 2  
31 August 2023  
Not to Scale



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