



Land at Bartons Road, Havant
Brackley Investments

Noise Impact Assessment

19th April 2023
Revision 1



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Revision History

Version	Comments	Author	Date
First Issue	First issued version of the report	Chris Parker-Jones Director and Acoustic Consultant BSc (Hons) MSc MIOA	26 th June 2020
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Executive Summary and Conclusions

This document, a Noise Impact Assessment (NIA), has been written to assess the suitability of the site (Land at Bartons Road, Havant) in terms of the noise impact that the residual noise environment would have on future occupants the proposed development and the impact the development would have on existing residential properties in the surrounding area.

In summary, PJA has found that the risk of adverse impact from noise is **low**, and then, therefore, be controlled without unreasonable mitigation measures that would significantly impact on residential amenity. Aspects of the design of the development are considered to follow the suggested mitigation measures as part of a 'good acoustic design process', as defined by the ProPG (acoustic design guidelines for new residential development).

IANL targets can be met with open windows in the majority of areas, with the exception of a small number of bedrooms on the north façade upper floor (which can instead use trickle ventilators/air bricks to provide background ventilation if necessary - this does not mean that windows should be sealed shut). Noise levels are not seen to be excessive enough outside of these bedrooms to be prohibitive to opening windows to provide cooling during the hotter months of the year at the occupant's discretion.

The sound reduction requirements for the rest of the façade including the glazing are low and will be met with standard modern constructions.

Outdoor amenity noise levels in gardens/patio areas are within the suggested guidelines and are acceptable without further mitigation.

Noise from potential mechanical plant associated with the proposed development has been assessed in accordance with BS 4142:2014, setting a rating level limit of 40 dB and 30 dB L_{Aeq} for the day and night-time periods respectively which should not be exceeded at 1m outside of nearby residential windows.

Whilst the exact details of the plant has not been developed at this stage, it is anticipated that these targets will be achieved due to the distance of the building to nearby properties and the screening provided by the building shape and close-boarded fencing around some of the boundary. Any mitigation measures are likely to be common solutions which are installed as standards, i.e. the use of in-duct attenuators for intake and exhaust duct paths from extract fans or other ventilation systems. These are not considered to be excessive measures and are commonly applied to similar developments.

In conclusion, the noise assessment has determined that there is only a low risk of adverse impact (or a negligible risk in most areas) from noise. Therefore, noise should not pose a constraint to achieving planning permission for the proposed development, providing the recommendations herein are followed.

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1.0 Introduction

ParkerJones Acoustics Limited (PJA) has been instructed by Brackley Investments to undertake a Noise Impact Assessment in support of a planning application for a new 78-bed residential care home ('the proposed development') at Land at Bartons Road, Havant, Havant ('the site').

1.1 Scope of Report

This document, a Noise Impact Assessment (NIA), has been written to:

- assess the site suitability in terms of the noise impact from the residual noise environment on amenities of the future occupants of the proposed development; and
- assess noise emissions from mechanical ventilation plant and therefore whether this would adversely impact on external ambient noise levels at nearby NSRs (such as residential properties) once operational.

The objective is to ensure that the noise impact is being considered and controlled sufficiently. Therefore, where considered necessary, mitigation measures have been suggested to ensure that identified impacts are minimised.

Note that whilst every attempt has been made to ensure that this report communicates effectively to a reader who might not have much knowledge of acoustics, some parts are necessarily technical. A glossary of acoustic terminology and concepts is provided in **Appendix A**.

1.2 Regulations and Guidelines

This report takes into consideration the national planning policies including the National Planning Policy Framework (NPPF), the Noise Policy Statement for England (NPSE) and the Planning Practice Guidance on Noise (PPG-N) (summarised in **Appendix B**), which outline the purpose and long-term vision of planning policy with respect to noise.

The assessment of the impact of the existing noise environment on the future occupants of the development has been undertaken with reference to:

- the '*Professional Practice Guidance on Planning and Noise*' (ProPG) (2017), which provides guidelines regarding suitable internal ambient noise levels for residential properties; and
- BS 8233:2014 '*Guidance on sound insulation and noise reduction for buildings*', which "provides guidance on the control of noise in and around buildings" and recommends appropriate criteria and internal noise limits for different situations, including residential developments;

The assessment of the impact of noise generated by the proposed development on noise-sensitive properties in the surrounding area has been undertaken with reference to BS 4142:2014 *Methods for rating and assessing industrial and commercial sound*, which assesses the potential adverse impact of noise pollution from of a new sound source of a commercial or industrial nature (i.e. mechanical plant and other operational noise associated with the development) on nearby noise-sensitive receptors outside of the development.

2.0 Site and Development Description

The proposed development is a two-storey 78 bed regulated Care Centre (C2 use), a residential care home where residents will benefit from 24-hour nursing and personal care. Along with several wings of accommodation, facilities would include a café, hair salon, gym, and cinema, with various lounges, dining rooms, terraces and balconies.

The development would be laid centrally in the site with car parking to the east of the building. Access will be at the north-east corner of the site on to the New Estate Road which was recently constructed to link the housing development on the south boundary (currently under construction by Bellway Homes – APP/15/014235) to Bartons Road to the North. The proposed building is around 50-100m to scattered residential properties to the north/west (with another recently permitted residential development on the north side of Bartons Road), with green fields to the east.

Bartons Road is the main transport link for the site with major A-roads at least one mile away, with a railway line around 300m to the west, and the site is not believed to be under any regularly used flight paths.

Aerial views, location plans, site plans, and floorplans, are shown in **Figures 2.1 to 2.6**.

Figure 2.1 – Aerial view of the site and surrounding area



Figure 2.2 – Site location plan

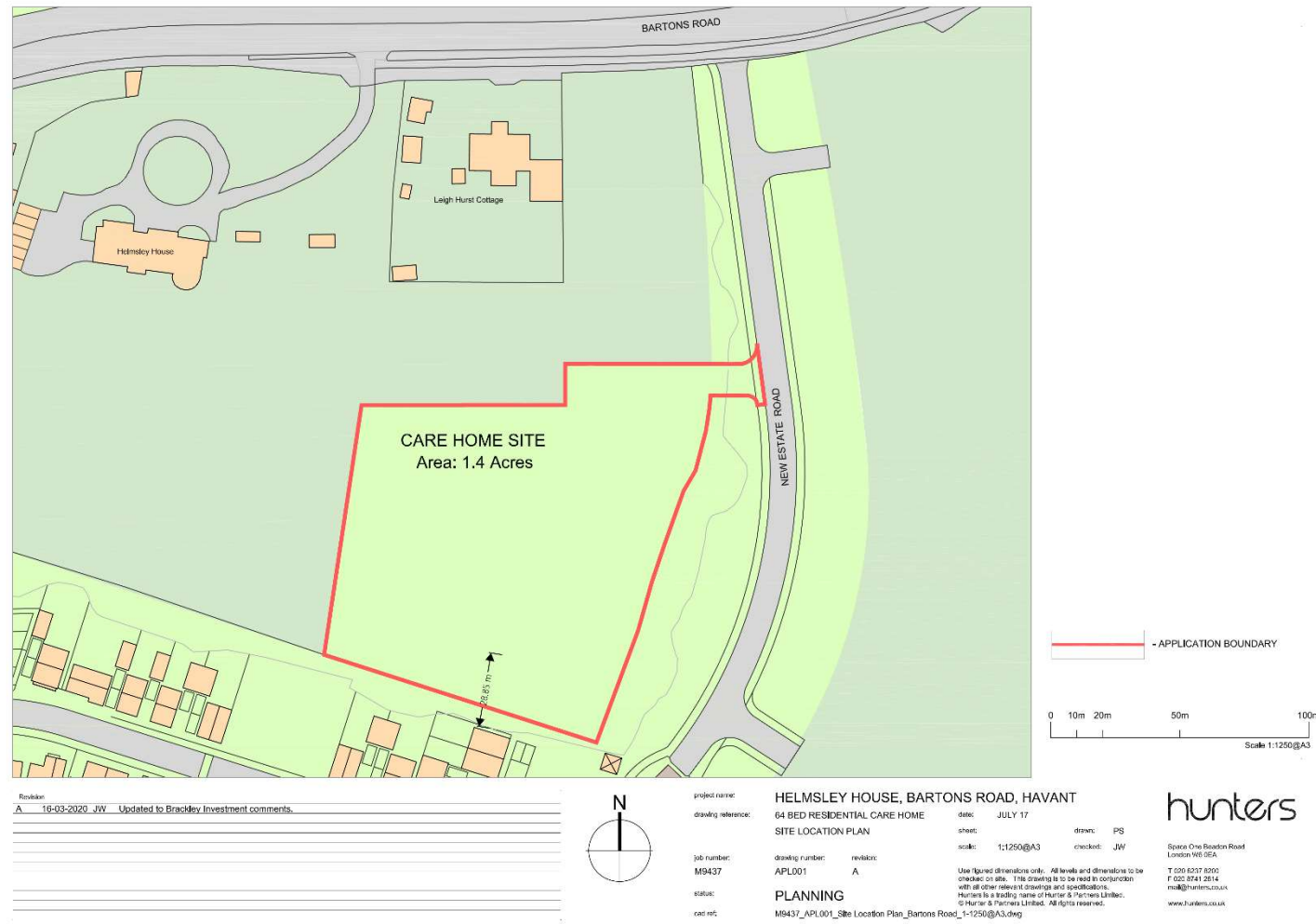


Figure 2.3 – Proposed site plan



The architectural drawings for Helmsley House include:

- Site Location Plan (1:1000):** Shows the project location within the Helmsley Estate, bounded by Barton Road to the north and Helmsley Road to the south. The site is highlighted in red.
- Indicative Views:** Five interior renderings (A-E) showing the proposed layout:
 - A:** Entrance hall with a central staircase and a large window.
 - B:** Lounge and dining area with a large window and a fireplace.
 - C:** Kitchen and breakfast room with a large window and a fireplace.
 - D:** Living area with a large window and a fireplace.
 - E:** Bedroom with a large window and a fireplace.
- Proposed Lower Ground Floor Plan:** A detailed floor plan showing the layout of the lower ground floor. The plan includes a central staircase, a large lounge and dining area, a kitchen and breakfast room, and several bedrooms. The plan is color-coded to match the indicative views.

PROPOSED UPPER GROUND FLOOR PLAN

SITE LOCATION PLAN 1:200B1

INDICATIVE VIEWS

COLOR KEY

- Lounge / Dining
- Resident Bedroom
- Office / Reception
- Service / Staff
- Circulation
- Store / L.B.s
- Resident Utility Area
- Resident Activity Area
- Medical Treatment

SCHEDULE

Floor	Bedrooms	GA
Lower Ground	14 Beds	0.9M sqm
Upper Ground	22 Beds	1.5M sqm
First Floor	22 Beds	1.5M sqm
TOTAL	78 Beds	4.0M sqm

Notes: 1. East House with 40 sqm for 40 sqm per resident.

hunters

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Figure 2.6 – Proposed first floor plans



3.0 Relevant Guidelines

3.1 The Professional Practice Guidance on Planning and Noise (ProPG)

The ProPG, published in 2017, extends on the guidance and numerical targets within BS 8233:2014 and WHO guidelines, providing new and extended recommendations where these standards (frequently used for assessing residential developments throughout the UK) are considered to fall short. Therefore, it is considered to be the most relevant and up to date design standard for assessing the noise impact on new residential developments.

A full summary of the standard (including the 'good acoustic design' process) is given in **Appendix B.4**.

3.1.1 Stage 1: Initial Site Noise Risk Assessment

The ProPG recommends that an initial site noise risk assessment should be undertaken based on indicative external noise levels on the existing site, without accounting for the impact of any new or additional mitigation measures that may subsequently be included in development proposals. Figure 1 of the ProPG relates the increasing risk of adverse effect against indicative daytime noise levels ($L_{Aeq,16hr}$) and night-time noise levels ($L_{Aeq,8hr}$) without noise mitigation. This is recreated in the table below.

Table 3.1 – The ProPG initial site noise risk assessment guidelines

Indicative external daytime noise levels $L_{Aeq,16hr}$	Indicative external night-time noise levels $L_{Aeq,8hr}$	Potential risk of adverse effect without noise mitigation
≤ 50 dB	≤ 40 dB	Negligible / No adverse effect ¹
> 50 dB and ≤ 60 dB	> 40 dB and ≤ 50 dB	Low
> 60 dB and ≤ 70 dB	> 50 dB and ≤ 60 dB	Medium
> 70 dB	> 60 dB	High
NOTES: The noise level limits are an interpretation of Figure 1 in the ProPG, which is presented as a diagram rather than a table and does not explicitly state the limits at which each risk category exists. ¹ An indication that there may be more than 10 noise events at night with $L_{Amax,F} > 60$ dB means the site should not be regarded as a negligible risk.		

3.1.2 Stage 2: Internal Ambient Noise Levels

The ProPG provides internal ambient noise level targets based upon BS 8233:2014 and WHO guidelines, as shown in the table below.

Table 3.2 – The ProPG internal ambient noise level (IANL) upper limits

Activity	Location	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Resting	Living Room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining Room/Area	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$ 45 dB $L_{Amax,F}$ ¹
¹ a threshold by which 'good acoustic design' is achieved by not exceeding this threshold more than 10 times a night			

The ProPG indicates that the guidance can be relaxed by up to 5 dB where development is considered necessary or desirable, despite high external noise levels.

Whilst it is desirable to achieve the recommended IANLs with windows open, an assessment can be made with closed windows and open ventilators (i.e. trickle vents) which provide "*whole dwelling ventilation*" (as defined by Building Regulations Approved Document F). Closed windows do not mean sealed shut/un-openable windows, as occupants would favour the ability to open the windows (especially during the hotter months of the year) even if the resultant internal acoustic conditions aren't as satisfactory.

3.1.3 Stage 2: Outdoor Amenity Noise Levels

The ProPG also provides guidance for outdoor amenity noise levels based upon WHO and BS 8233:2014 guidelines. This applies to gardens, balconies, roof terraces, and patio areas.

If outdoor 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. Noise levels should ideally not be above the range **50 – 55 dB $L_{Aeq,16hr}$** .

It does, however, accept that this can't be achieved in all situations, in which the development should be designed to achieve the lowest practicable noise levels in these outdoor amenity spaces. The impact can partially be offset by the residents having access to a relatively quiet alternative outdoor amenity space as part of the property, group of residential properties, or a public space in the nearby area.

3.2 BS 8233:2014

BS 8233:2014 'Guidance on Sound Insulation and Noise Reduction for Buildings' suggests appropriate criteria and limits for different situations. It is primarily intended to guide the design of new buildings, or refurbished buildings undergoing a change of use. This includes internal noise criteria for residential developments. The limits with BS 8233:2014 mirror those in the WHO's 'Guidelines for Community Noise and Night Noise Guidelines for Europe' document.

3.2.1 Internal Ambient Noise Levels

Residential Rooms

Table 4 of BS 8233:2014 provides internal ambient noise level limits for dwellings from "steady external noise sources", based upon "normal diurnal fluctuations in external noise", and should be "the noise level in the space during normal hours of occupation but excluding any noise produced by the occupants and their activities". For brevity, this table is not displayed in this section, as it is superseded by the ProPG.

Care Home - Communal Areas

The table below presents guidance in BS 8233:2014 with respect to non-domestic shared spaces, such as offices, staffrooms, kitchens, corridors and communal areas for residents, which is reproduced from Tables 2 and 6 of the standard.

Table 3.3 – Typical internal ambient noise level ranges in non-domestic buildings

Objective	BS 8233:2014 location	Development location	Design range, $L_{Aeq,T}$ dB
Study and work requiring concentration	Staff/meeting room, training rooms	Staff rooms	35 - 45
Speech or telephone communications	Cafeteria, canteen, kitchen	Kitchens used by staff only	50 - 55
	Corridor, circulation space	Corridors and stairwells	45 - 55
Listening	Place of worship, counselling, meditation, relaxation	Communal areas for residents of the care home	30 - 35

BS 8233:2014 states that "a moderate noise level might provide masking for acoustic privacy in shared spaces without causing disturbance", so both the upper and lower noise levels (in the table above) should be considered.

Natural Ventilation

Whilst it is desirable to achieve the recommended IANLs with windows open, this is not stipulated as a mandatory requirement within the guidance of BS 8233:2014 which states "if relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the

resulting noise level. If applicable, any room should have adequate ventilation (e.g. trickle ventilators should be open) during the assessment."

In Annex G.1 of BS 8233:2014 it suggests that "if partially open windows were relied upon for background ventilation, the insulation would be reduced to approximately 15 dB". This figure of between 10 and 15 dB is also reflected in several other guidelines, though studies by Napier University¹ show that a higher reduction can be achieved depending on the opening area, the window type and the direction in which the window opens relative to the dominant noise source. For an initial assessment, PJA considers that the level of noise reduction for a partially open window (for ventilation) would be approximately 15 dB.

3.2.2 External Amenity Ambient Noise Levels

BS 8233:2014 indicates that in external areas used for amenity space, it is desirable that external noise levels do 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.

Although in many areas, i.e. next to a strategic transport network, a compromise between elevated noise levels and the convenience of living in these locations may be acceptable. In such a case, the development should be designed to 'achieve the lowest practicable levels' in these external amenity spaces but should not be prohibited.

3.3 BS 4142:2014

BS 4142:2014 'Methods for rating and assessing industrial and commercial sound' is intended to be used to assess the potential adverse impact of sound of an industrial and/or commercial nature, at nearby noise-sensitive receptor (NSR) locations within the context of the existing sound environment.

The method is based upon assessing the predicted noise emissions from plant against the existing background sound levels at NSRs. The predicted emissions are termed as a 'rating level', which is the specific sound level from plant, plus 'penalties' which account for whether the noise has distinguishing characteristics such as tonality, intermittency, impulsivity, or is generally distinguishable from the ambient noise environment. Such features may attract attention and be considered annoying, hence sounds with these qualities should be penalised over sounds at the same specific noise level which is less intrusive.

Appendix B.5 explains the methodology in further detail.

1 Napier University. NANR116: 'Open/Closed Window Research' Sound Insulation through Ventilated Domestic Windows. (2007)

4.0 Noise Impact on the Proposed Development

4.1 Methodology

This section details the impact the existing noise environment would have on the proposed development, including the implications this has on the ventilation strategy and the construction types required within the façade to reduce external noise ingress to an acceptable level for the future occupants.

The following summarises the main steps of action in the assessment method:

- Firstly, the existing ambient noise environment at the site is assessed.
- A 3D noise map model is then used to predict average noise levels at the site and surrounding area, with the proposed development then added into the model to predict external noise levels incident on the building's facade once it is in place.
- Noise ingress into living spaces are then assessed against the IANL limits of the ProPG, to determine the sound reduction requirements of the building envelope, and determine whether background ventilation can be provided by open windows, trickle ventilators, or mechanical ventilation (to meet IANL limits).
- Noise levels in external amenity areas are assessed in line with the ProPG targets, advising on possible noise mitigation measures where necessary.
- Finally, an overall assessment of the risk of noise impact on future occupants and therefore the suitability of the site for residential development is made, including any recommended noise mitigation measures.

4.2 Environmental Noise Climate

4.2.1 Noise Survey

PJA has attended the site to conduct an environmental noise survey between Thursday the 23rd and Tuesday the 28th of March 2023. The results of the survey have been used to quantify the typical residual noise levels that would be incident on the site and subsequently the proposed development on a day-to-day and night-by-night basis.

A fixed monitoring position was located on the edge of the site boundary close to Normandy Way, as denoted in Figure 2.1.

The sound level meter was set to log noise levels over continuous 5-minute averaging periods with a 1-second time history rate. The monitoring equipment was left unattended for the majority of the survey with the exception for a short period around the installation and collection.

The following noise indices were recorded (amongst others):

- $L_{Aeq,T}$: The A-weighted equivalent continuous noise level over the measurement period T. This parameter is typically considered as a good representation of the average ambient sound level;
- $L_{AFmax,T}$: The maximum A-weighted noise level during the measurement period T and the best representation of short high noise levels 'events' – i.e., emergency services sirens;

- $L_{A90,T}$: The A-weighted noise level that is exceeded for 90% of the measurement period T. This parameter is often considered as the 'average minimum level' and is therefore used in determining the representative background noise level – or noise levels from continuous noise sources such as plant; and
- $L_{A10,T}$: The A-weighted noise level that is exceeded for 10% of the measurement period T. This parameter is often considered as the 'average maximum level' and a good representation of traffic noise contributions.

Appendix C contains further information on the methodology of the survey; including the equipment used; photographs from site; and the weather conditions.

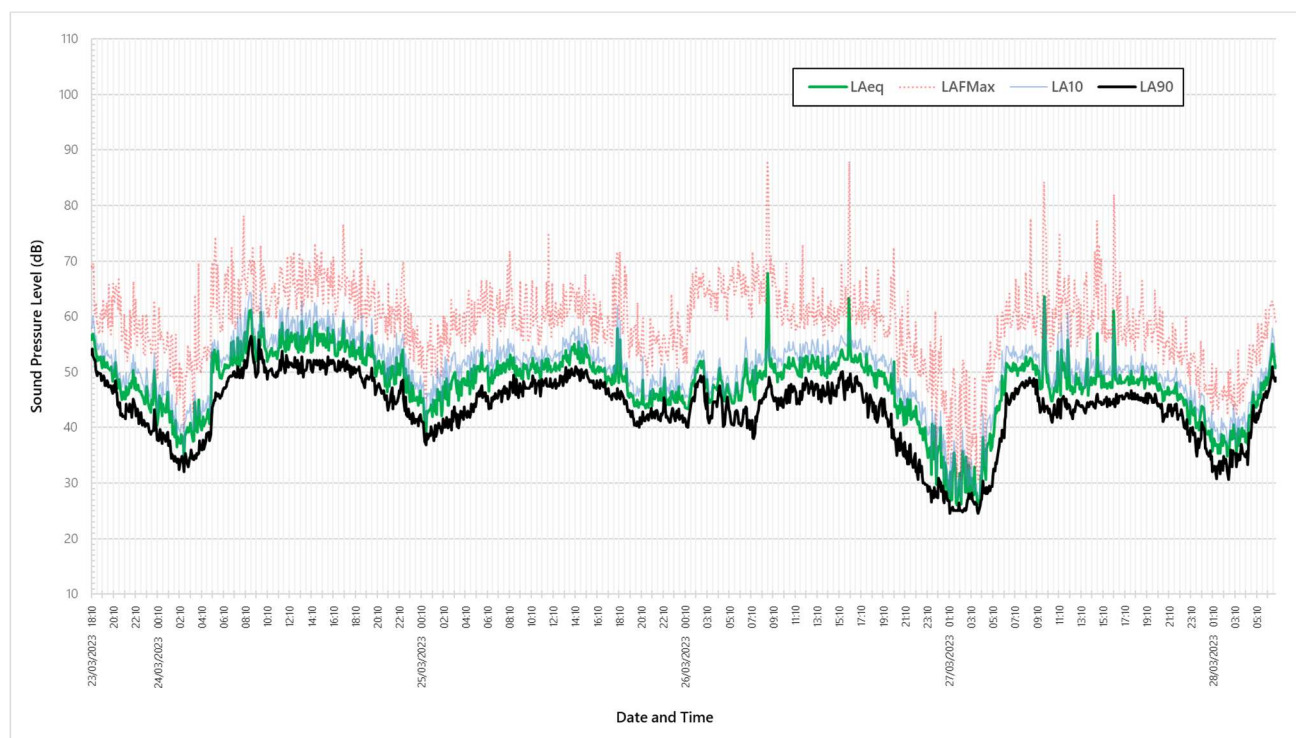
A graph of the measured noise levels at the monitoring position is given in **Figure 4.1** overleaf, with a summary provided in **Table 4.1**.

Noise levels follow a typical diurnal pattern associated with distant road traffic being the dominant and most consistent noise source.

Table 4.1 – Summary of measured noise levels

Period	Logarithmic Average $L_{Aeq,T}$ (dB)	10 th Highest $L_{AFmax,5min}$ (dB)	Median $L_{A90,5min}$ (dB)	Median $L_{A10,5min}$ (dB)
Daytime (07:00 – 23:00) T = 16-hours				
Thursday 23rd March; 18:10 – 23:00	51	65	46	51
Friday 24th March; 07:00 – 23:00	55	71	50	57
Saturday 25th March; 07:00 – 23:00	51	68	47	52
Sunday 26th March; 07:00 – 23:00	52	70	45	53
Monday 27th March; 07:00 – 23:00	50	73	45	51
Night-time (23:00 – 07:00) T = 8-hours				
Thursday 23rd March / Friday 24th March; 23:00 – 07:00	47	68	38	46
Friday 24th March / Saturday 25th March; 23:00 – 07:00	48	63	42	50
Saturday 25th March / Sunday 26th March; 23:00 – 07:00	48	68	43	49
Sunday 26th March / Monday 27th March; 23:00 – 07:00	42	59	28	38
Monday 27th March / Tuesday 28th March; 23:00 – 07:00	45	59	36	43

Figure 4.1 – Graph of measured noise levels



4.2.2 Previous Noise Surveys

At the time of writing the first issue of this report in June 2020, PJA was unable to attend site to conduct a baseline noise survey due to UK wide 'lockdown' associated with the COVID-19 pandemic. Therefore, any noise survey conducted during this period would be unrepresentative, due to the vastly decreased levels of road and rail traffic.

As a survey was not possible, PJA took an alternative approach to quantifying the environmental noise climate at the site and surrounding area. A comprehensive 3D noise map model was produced for the site and the wider surrounding area, as discussed in **Section 4.3**.

The model parameters were configured to predict noise levels based on a review of other planning applications in the area which have had noise surveys conducted within the last few years, including permitted applications APP/19/00007 and APP/14/00863 which were for residential developments on the north side of (and closer to) Bartons Road and in the case of the latter, the railway line.

For brevity in the main body of this report, the sources of information are discussed in detail in **Appendix D**. These sources of information remain relevant to this updated report and have been accounted for in the 3D noise map model, complementing the newly obtained survey data from the site.

4.3 Noise Mapping (Predicted Noise Levels)

The intention of noise modelling/mapping for this assessment is to accurately determine the noise levels across the entire site, at each façade and each floor of the building(s) associated with the proposed development.

The model has been constructed using the CadnaA® software package, a commonly used 3-D noise mapping software which implements a wide range of national and international standards, guidelines and calculation algorithms, including those set out in ISO 9613-2:1996.

Screenshots/results from the noise model are provided in **Appendix E**.

The noise mapping has accounted for all of the information outlined in **Section 4.2** and **Appendix D** so that the noise map for the existing site can effectively be ‘calibrated’ to ensure that the results are accurate (see **Figures E.1** and **E.2**).

The proposed development has then been added into the model, with the model run to predict the façade exposure levels across the development for each floor, in terms of the $L_{Aeq,16hr}$ and $L_{Aeq,8hr}$ for the daytime and night-time periods respectively (see **Figures E.3** to **E.6**), and the external daytime $L_{Aeq,16hr}$ levels within outdoor amenity areas (see **Figure E.7**).

The main noise contributors to the site are Bartons Road and the access road to the new residential development to the south.

4.4 Stage 1: Initial Site Noise Risk Assessment

As described in **Section 3.1.1**, the ProPG recommends that an initial assessment of the risk of adverse noise impact is made without accounting for the impact of any new or additional mitigation measures that may subsequently be included in development proposals.

Figures E.1 and **E.2** in **Appendix E** indicate predicted ambient noise levels which in comparison to the levels in **Table 3.1** would indicate a **low risk of adverse impact**.

4.5 Stage 2: Internal Ambient Noise Levels

4.5.1 Noise Mitigation

ProPG suggests that a 'good' acoustic design process should explore other methods of mitigating noise which doesn't wholly rely on using the building envelope (see **Appendix B.4** of this report). The table below analyses the feasibility of the suggested mitigation measures for this site.

Table 4.2 – Analysis of noise mitigation measures as part of a 'good' acoustic design process as defined by the ProPG

Mitigation Method	Analysis
Maximising the spatial separation of noise source(s) and receptor(s).	The site is already around 90m from Bartons Road and 40m from the new access road at it's the closest point. The site is well-positioned given the availability of land around it that is closer to Bartons Road and is much further from this road (and the railway) than other planning applications for large scale residential developments in the area.
Investigating the necessity and feasibility of reducing existing noise levels and relocating existing sources.	The main noise sources are existing roads, thus reducing the level of traffic or relocating these would be unfeasible in this case.
Using existing topography and existing structures (that are likely to last the expected life of the noise-sensitive scheme) to screen the proposed development site from significant sources of noise.	The site benefits from some screening from Bartons Road from a scattering of residential properties and boundary walls/fences to the north. As per above, this is a good location for the site given the abundance of land to the north and east which have less screening from existing structures.
Incorporating noise barriers as part of the scheme to screen the proposed development site from significant sources of noise.	As the initial site risk assessment suggests that the risk of adverse impact is 'low', it is not considered necessary to install purpose-built noise attenuating barriers.
Using the layout of the scheme to reduce noise propagation across the site.	The building is located around 40m from the access road with car parking spaces as a buffer.
Using the orientation of buildings to reduce the noise exposure of noise-sensitive rooms.	The shape of the building allows around 75% of the facades to bedrooms to be situated facing away from Bartons Road or with little or no line of sight to it.
Using the building envelope to mitigate noise to acceptable levels.	See the following section.

4.5.2 Building Envelope

To assess the required sound reduction performance for the building envelope, façade exposure levels have been defined as referenced in **Figure 4.2** and **Table 4.3**.

Figure 4.2 – Façade exposure levels

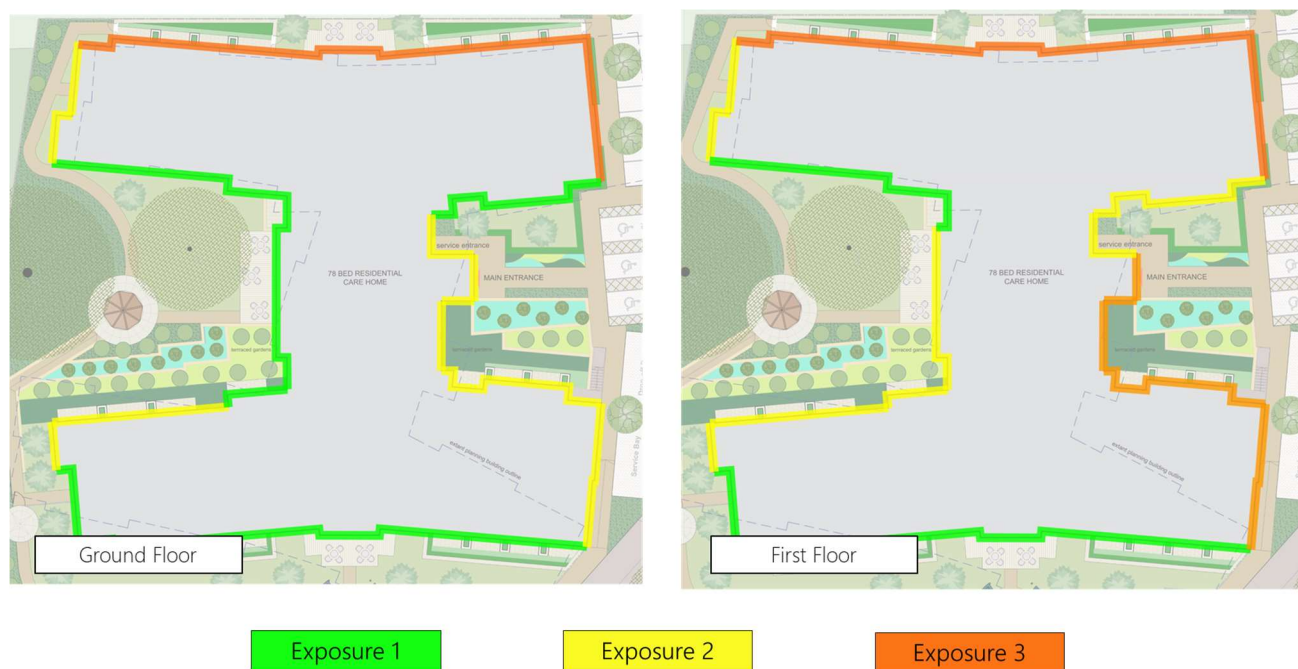


Table 4.3 – Exposure levels defined to assess noise ingress through the building envelope

Exposure	External Ambient Noise Level @ 1m outside of the facade		Glazing	Ventilators
	Daytime (07:00 – 23:00) dB L _{Aeq,16hr}	Night-time (23:00 – 07:00) dB L _{Aeq,8hr}		
Exposure 1	<50	<45	Standard thermally sealed double glazing 23 dB R _w + C _{tr}	Open windows
Exposure 2	50 – 55	45 - 50		23 dB D _{n,e,w} + C _{tr} (or open windows with +5 dB relaxation ²)
Exposure 3	55 - 58			26 dB D _{n,e,w} + C _{tr}
Criteria ¹	<35	<30	-	-

1 – Based upon the criteria for bedrooms (the most noise-sensitive room type)

2 - As is accepted by the ProPG and BS 8233:2014 for desirable development

In summary, IANL targets across most of the bedroom facades (Exposure 1) can be met under normal ventilation conditions with open windows (based on a 15 dB reduction from outside to inside). In some areas (Exposure 2) the IANL targets would have to be relaxed by 1 – 5 dB to be met with open windows (though the ProPG suggests this is acceptable where development is desirable).

On the north façade – first floor, which has the most line of sight to Bartons Road, IANL targets would be met with closed windows and an alternative form of background ventilation (i.e. trickle vents, air bricks, louvres, or ducted air paths with an induct silencer). The required ratings for these ventilators are not high and can be met with most trickle ventilator/air brick products, including ‘standard’ models (rather than ‘acoustic’ models). Background ventilators may only be necessary if the development targets a higher than the standard level of air permeability under Part L of the Building Regulations.

It is not seen to be unusual for IANL targets to not be met in some areas using open windows. It should also not be assumed that windows have to be sealed shut, as many occupants will favour the ability to open their windows at will during the hotter months of the year. The external noise levels, in this case, are not considered to be particularly high and there is only a low risk of adverse impact from internal noise levels which are marginally over the criteria by having opening windows, as suggested by the *Acoustics, Ventilation, and Overheating* guide (published by the Institute of Acoustics and the Association of Noise Consultants).

The glazing requirements are low and the large majority of modern double-glazed systems will meet these requirements.

Standard constructions for external walls and roofs are all considered to be sufficient to control noise ingress at this site and will meet the minimum $R_w + C_{tr}$ targets for glazing referenced above.

A range of example glazing constructions and ventilator products such as trickle ventilators and air bricks have been provided in **Appendix F**, which are capable of achieving the required $R_w + C_{tr}$ and $D_{n,e,w} + C_{tr}$ indices.

4.6 Outdoor Amenity Noise Levels

Figure E.7 in **Appendix E** shows the predicted external daytime ambient noise level ($L_{Aeq,16hr}$) across the site.

In summary, predicted levels in most of the garden areas are in the range of 47 – 50 dB $L_{Aeq,16hr}$, within the suggested upper range of 50 – 55 dB $L_{Aeq,16hr}$.

Therefore, it is not considered that further noise mitigation will be required for these areas. It should be noted that the predicted levels do not account for any garden structures, i.e. short walls, fences, balustrades around balconies, that may provide a small screening benefit against noise emanating from Bartons Road.

4.7 Summary

In summary, PJA believes that the noise impact on future occupants at the proposed development can be controlled to an acceptable level.

IANL targets can be met with open windows in most areas, with the exception of some bedrooms on the north façade upper floor (which can instead use trickle ventilators/air bricks to provide background ventilation if necessary - this does not mean that windows should be sealed shut). The sound reduction requirements for the rest of the façade including the glazing are low and will be met with standard modern constructions.

Outdoor amenity noise levels in gardens/patio areas are within the suggested guidelines and are acceptable without further mitigation.

Therefore, this aspect of the noise assessment should not pose a constraint to achieving planning permission for the proposed development, providing the recommendations herein are followed.

5.0 Noise Impact on the Surrounding Area

The assessment of the noise impact on nearby residential noise-sensitive receptors (NSRs) concerning the operational noise produced by the proposed development has been undertaken in accordance with BS 4142:2014, which assesses the risk of adverse impact from new sound sources of an industrial nature, which in this case relates to building services plant.

5.1 Design Criteria (Maximum Plant Noise Levels)

In accordance with BS 4142:2014, the predicted rating level should be assessed against the 'representative' background sound level.

BS 4142:2014 states in general that *"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."*

PJA recognise that a rating level limit is often subject to a planning condition. Typically, this condition is based upon the rating level from plant not exceeding the representative background sound level. Therefore, PJA proposes the rating level limit given within the table below.

The background sound level is based upon the minimum values of $L_{A90,5min}$ measured during the survey.

Table 5.1 – Maximum rating level $L_{Ar,Tr}$ for all nearby residential NSRs

Noise-Sensitive Receptor	Time Period	Representative Background Sound Level $L_{A90,Tr}$ (dB)	Maximum Rating Level $L_{Ar,Tr}$ at 1m from the outside of the nearest residential window (dB)
All	Daytime (07:00 to 23:00) $T_r = 60$ -minutes	30	30
	Night-time (23:00 – 07:00) $T_r = 15$ -minutes	25	25

It is seen to be the responsibility of the developer and design team involved with the mechanical plant design to ensure that the rating levels above are not exceeded. It must be remembered that the rating level included for plus the addition of any 'penalties' which account for the characteristic features of the sound which may attract attention to it, such as tonality, impulsivity, intermittency, and any other sound characteristics that *"are readily distinctive against the residual acoustic environment"*.

In the case of a mechanical ventilation system, the noise is unlikely to be intermittent or impulsive. It could, however, be tonal (a 2 to 6 dB penalty) or be distinctive against the residual noise climate (a 3 dB penalty). Therefore, the M&E design should take this into account when specifying plant units, silencers, louvres, and any other form of noise mitigation.

5.2 Proposed Plant / Site Suitability

At this stage, the plant design has not been fully developed.

However, it is anticipated that the rating level limits can be achieved without significant mitigation, if any at all. The development is a significant distance to the nearest residential properties, and larger items of plant (if any) are likely to be located where there is not a line of sight to the nearest receptors. There is also a 1.8m high close boarded fence around the south and west boundaries which will provide some benefit in screening noise emissions.

Any mitigation that is necessary is likely to be met using common solutions which would be installed as standard (to protect the occupants of the development itself). For example, noise from inlet or exhaust duct paths can be controlled using a small in-duct silencer (noise attenuator) which is around 300 - 600mm in length. This is not an unusual requirement as such measures are included in the large majority of ventilation systems.

These are not considered to be unusual or onerous requirements. Therefore, this should not pose a constraint on the proposed development and the site is considered suitable provided the advice above is followed.

Appendix A – Acoustic Terminology and Concepts

A.1 – Glossary

Table A.1 – Glossary of acoustic terminology

Term	Description
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio of the root-mean-square pressure of the sound and a reference pressure (2×10^{-5} Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
C_{tr}	A weighting curve applied to level differences to account for low-frequency noise, typically associated with traffic noise. This is often applied as an addition to $D_{nT,w}$ and R_w ratings used to describe levels of sound insulation.
Frequency	Sound is generally assessed over the frequency range of 63 Hz to 4000 Hz (4 kHz), although humans can potentially hear between 20 Hz and 20 kHz. Frequency is often divided into ('first') octave bands for analysis, with the range above considered within 7-octave bands with centre frequencies at 63 Hz, 125 Hz, 250 Hz, 1 kHz, 2 kHz and 4 kHz. 'Third' octave bands split this further into smaller frequency bands.
$L_{Aeq,T}$	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period. This parameter is typically considered as a good representation of the 'average' overall noise level. It is referred to technically as the A-weighted equivalent continuous sound level and is a dB(A) as defined above.
$L_{A90,T}$	The A-weighted noise level that is exceeded for 90% of the measurement period T. This parameter is often considered as the 'average minimum level'.
$L_{AFmax,T}$	The maximum A-weighted noise level during the measurement period T.
R_w	Weighted sound reduction index. A single number rating of the sound insulation performance of a specific building element. R_w is measured in a laboratory. R_w is commonly used by manufacturers to describe the sound insulation performance of building elements such as plasterboard and concrete.

A.2 – Subjective Changes in Sound Level

Table A.2 – Subjective loudness from an increase or decrease in sound pressure level

Change in sound pressure level	Relative change in sound power energy (multiplier)		Change in apparent subjective loudness (for mid-frequency range)
	Decrease	Increase	
3 dB	1/2	2	'Just perceptible'
5 dB	1/3	3	'Clearly noticeable'
10 dB	1/10	10	'Half or twice as loud'
20 dB	1/100	100	'Much quieter, or louder'

Appendix B – Relevant Planning Policies and Guidelines

B.1 – National Planning Policy Framework (NPPF)

The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these are expected to be applied. The NPPF provides a framework within which local people and their council can produce their own distinctive local and neighbourhood plans. With explicit reference to noise, the NPPF states that *"Planning policies and decisions should contribute to and enhance the natural and local environment by ... preventing new and existing development from contributing to, being put at unacceptable risk from ... noise pollution"*.

B.2 – Noise Policy Statement for England (NPSE)

The NPPF refers to the Noise Policy Statement for England (NPSE), which applies to most forms of noise including environmental noise. The NPSE sets out the long-term vision of Government policy which is to *"Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development"*. It aims that *"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life."*

The use of the terms *"significant adverse"* and *"adverse"* are key phrases within the NPSE. The guidance establishes the concept of how the level of adverse effect on health and quality of life can be referenced including:

- **NOEL – No Observed Effect Level** - This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.
- **LOAEL – Lowest Observed Adverse Effect Level** - This is the level above which *adverse* effects on health and quality of life can be detected.
- **SOAEL – Significant Observed Adverse Effect Level** - This is the level above which *significant adverse* effects on health and quality of life occur.

Under the first aim of the NPSE (*"avoid significant adverse impacts on health and quality of life"*), an impact in line with SOAEL should be avoided. Under the second aim (*"mitigate and minimise adverse impacts on health and quality of life"*), where the impact lies somewhere between LOAEL and SOAEL, requiring that all reasonable steps are taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development, but does not mean that such adverse effects cannot occur.

B.3 - Planning Practice Guidance on Noise (PPG-N)

The Planning Practice Guidance on Noise (PPG-N) is part of a suite of web-based guidance which is intended to support the implementation of the policies in the NPPF and the NPSE.

It aids in expanding on the definitions from the NPSE of NOEL, LOAEL and SOAEL, by linking these terms to 'examples of outcomes', i.e. changes in behaviour and/or attitude to noise. The table below summarises the guidance from PPG-N in this regard.

Table B.1 – Noise exposure hierarchy based on the likely average response – adapted from PPG-N

Perception	Examples of outcomes	Increasing effect level	Action
NOEL - No Observed Effect Level ¹			
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
LOAEL - Lowest Observed Adverse Effect Level			
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up the volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
SOAEL - Significant Observed Adverse Effect Level			
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to a change in the 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 the 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
¹ This line is an assumption of the adverse effect level and is not explicitly referenced by PPG-N, though this appears to be a safe assumption.			

B.4 – The Professional Practice Guidance on Planning and Noise (ProPG)

The ProPG, published in 2017, is a design guide for new residential development that are exposed predominantly to airborne noise from transport sources. It was produced *"to provide practitioners with guidance on the management of noise within the planning system in England"*, though it is not an official code of practice or official interpretation of the law or government policy.

However, the ProPG extends on the guidance and numerical targets within BS 8233:2014 and WHO guidelines, as well as national planning policy, providing new and extended recommendations where these standards are considered to fall short. Therefore, it is considered to be the most relevant and up to date design standard for assessing the noise impact on new residential developments.

The ProPG *"advocates a systematic, proportionate, risk based, 2-stage, approach. The approach encourages early consideration of noise issues, facilitates straightforward accelerated decision making for lower risk sites, and assists proper consideration of noise issues where the acoustic environment is challenging..."*

...The two sequential stages of the overall approach are:

- Stage 1 – an initial noise risk assessment of the proposed development site; and
- Stage 2 – a systematic consideration of four key elements....

The approach is underpinned by the preparation and delivery of an "Acoustic Design Statement" (ADS). An ADS for a site assessed as high risk should be more detailed than for a site assessed as low risk. An ADS should not be necessary for a site assessed as negligible risk."

B.4.1 - Stage 1: Initial Site Noise Risk Assessment

The ProPG recommends that an initial site noise risk assessment should be undertaken based on indicative external noise levels on the existing site, without accounting for the impact of any new or additional mitigation measures that may subsequently be included in development proposals. Figure 1 of the ProPG relates the increasing risk of adverse effect against indicative daytime noise levels ($L_{Aeq,16hr}$) and night-time noise levels ($L_{Aeq,8hr}$) without noise mitigation. This is recreated in the table below.

Table B.2 – The ProPG initial site noise risk assessment guidelines

Indicative external daytime noise levels $L_{Aeq,16hr}$	Indicative external night-time noise levels $L_{Aeq,8hr}$	Potential risk of adverse effect without noise mitigation
≤ 50 dB	≤ 40 dB	Negligible / No adverse effect ¹
> 50 dB and ≤ 60 dB	> 40 dB and ≤ 50 dB	Low
> 60 dB and ≤ 70 dB	> 50 dB and ≤ 60 dB	Medium
> 70 dB	> 60 dB	High

Indicative external daytime noise levels $L_{Aeq,16hr}$	Indicative external night-time noise levels $L_{Aeq,8hr}$	Potential risk of adverse effect without noise mitigation
NOTES: The noise level limits are an interpretation of Figure 1 in the ProPG, which is presented as a diagram rather than a table and does not explicitly state the limits at which each risk category exists. ¹ An indication that there may be more than 10 noise events at night with $L_{Amax,F} > 60$ dB means the site should not be regarded as a negligible risk.		

B.4.2 – Stage 2: Good Acoustic Design Process

The ProPG talks about a “*good acoustic design process*”, that will be suitable in the majority of situations likely to be encountered in practice, with the aim of a more consistent approach from designers through the use of the document. In short, “good acoustic design” means that the acoustic design should:

- be considered early in the development control process;
- take an integrated approach to achieve ‘optimal’ acoustic conditions both internally and externally, which does not just focus on compliance with noise exposure standards, but aims to avoid compromises for other sustainable design objectives that may adversely affect living conditions and quality of life;
- avoid “unreasonable” and prevent “unacceptable” acoustic conditions, without overdesigning or ‘gold plating’ the new development; and
- consider the viability of alternative solutions rather than solely rely on the building envelope to provide sufficient sound insulation, which may adversely affect living conditions.

B.4.3 – Stage 2: Noise Management Measures

The ProPG recommends that the design of sealed shut/un-openable windows should be avoided where possible, as occupants would favour the ability to open the windows even if the resultant internal acoustic conditions are unsatisfactory.

Therefore, every effort should be made in the first instance to mitigate noise through alternative solutions before simply using the building envelope to mitigate noise. Supplementary Document 2 of the ProPG therefore advises that the following hierarchy of noise management measures (in descending order of preference) should be followed:

- Maximising the spatial separation of noise source(s) and receptor(s).
- Investigating the necessity and feasibility of reducing existing noise levels and relocating existing sources.
- Using existing topography and existing structures (that are likely to last the expected life of the noise-sensitive scheme) to screen the proposed development site from significant sources of noise.
- Incorporating noise barriers as part of the scheme to screen the proposed development site from significant sources of noise.
- Using the layout of the scheme to reduce noise propagation across the site.
- Using the orientation of buildings to reduce the noise exposure of noise sensitive rooms.
- (and finally) Using the building envelope to mitigate noise to acceptable levels.

Any reliance on the use of the building envelope alone to mitigate noise levels should be justified. In many cases there is “justification that the internal target noise levels can only be practically achieved with windows closed, which may be the case in urban areas and at sites adjacent to transportation noise sources”.

B.4.4 – Stage 2: Internal Ambient Noise Levels

Whole Dwelling Ventilation

The ProPG provides internal ambient noise level targets based upon Table 4 of BS 8233:2014, with a few additions in guidance. These are summarised in the table below.

The ProPG suggests that the development layout should be designed such that internal noise level targets can be achieved with open windows in as many areas as possible, on the basis that residents will value the ability to open windows at will. It is generally stated within guideline documents (including the ProPG) that an open window will typically provide up to a 15 dB(A) reduction in noise from outside to inside.

However, an assessment can be made with closed windows and open ventilators (i.e. trickle vents) which provide “whole dwelling ventilation” (as defined by Building Regulations Approved Document F).

Table B.3 – The ProPG internal ambient noise level guidelines

Activity	Location	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Resting	Living Room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining Room/Area	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$ 45 dB $L_{Amax,F}$ ¹
¹ a threshold by which ‘good acoustic design’ is achieved by not exceeding this threshold more than 10 times a night			

The following summarises the ProPG guidance which relates to the table above.

- Internal L_{Aeq} targets:
 - assume normal daytime fluctuations in external noise;
 - are based on average annual data and do not have to be achieved in all circumstances. For example, it is normal to exclude occasional events such as bonfire night or New Year’s Eve; and
 - can be relaxed by up to 5 dB where development is considered necessary or desirable, despite high external noise levels. However, most people will regard exceeding the targets by more than 5 dB on a regular basis as ‘unreasonable’ and exceeding by more than 10 dB as ‘unacceptable’.
- Internal $L_{Amax,F}$ targets:
 - are set on the basis that regular individual noise events (such as aircraft and passing trains) can cause sleep disturbance; and
 - are not an absolute limit but a threshold by which ‘good acoustic design’ is achieved by not exceeding this threshold more than 10 times a night. However, where it is not practical to achieve

this guideline, the judgement of acceptability will depend on the noise level, source, number, distribution, predictability and regularity of noise events.

Purge Ventilation

The guidelines above are generally not applicable under “*purge ventilation*” conditions (as defined by ADF), as this should only occur occasionally.

Mechanical Services

The ProPG indicates that “*where mechanical services are used as part of the ventilation or thermal comfort strategy for the scheme, the impact of noise generated by these systems on occupants should also be assessed.*” It does not, however, give an explicit set of noise level targets for any form of mechanical ventilation (continuous, extract or purge).

B.4.5 – Stage 2: Outdoor Amenity Noise Levels

The ProPG provides guidance for outdoor amenity noise levels based upon WHO and BS 8233:2014 guidelines. In summary it recommends the following as part of an outdoor amenity area noise assessment:

- If outdoor 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. Noise levels should ideally not be above the range **50 – 55 dB LAeq,16hr**.
- These guideline values may not be achievable in all circumstances where development might be desirable. In such a situation, development should be designed to achieve the lowest practicable noise levels in these outdoor amenity spaces.
- Even if outdoor amenity spaces are not an intrinsic part of the overall design, consideration of the need to provide access to a quiet or relatively quiet outdoor amenity space forms part of a good acoustic design process.
- Where, despite following a good acoustic design process, significant adverse noise impacts remain on any private outdoor amenity space (e.g. garden or balcony) then the impact may be partially offset if the residents are provided, through the design of the development or the planning process, with access to:
 - a relatively quiet facade (containing openable windows to habitable rooms) or a relatively quiet externally ventilated space (i.e. an enclosed balcony) as part of their dwelling; and/or
 - a relatively quiet alternative or additional outdoor amenity space for sole use by a household, (e.g. a garden, roof garden or large open balcony in a different, protected, location); and/or
 - a relatively quiet, protected, nearby, outdoor amenity space for sole use by a limited group of residents as part of the amenity of their dwellings; and/or
 - a relatively quiet, protected, publicly accessible, outdoor amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minutes walking distance). The local planning authority could link such provision to the definition and management of Quiet Areas under the Environmental Noise Regulations.

B.5 - BS 4142:2014

BS 4142:2014 'Methods for rating and assessing industrial and commercial sound' is intended to be used to assess the potential adverse impact of sound of an industrial and/or commercial nature, at nearby noise-sensitive receptor (NSR) locations within the context of the existing sound environment.

B.5.1 - Definitions

BS 4142:2014 provides the following definitions which are relevant at this pre-construction stage of assessment:

- **Background Sound Level, $L_{A90,T}$:** A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.
- **Rating Level, L_{A,r,T_r} :** Specific sound level plus any adjustment for the characteristic features of the sound.
- **Reference Time Interval, T_r :** Specified interval over which the specific sound level is determined. This is 60-minutes during the day (07:00 – 23:00) and 15-minutes at night (23:00 – 07:00).
- **Specific Sound Level, $L_s = L_{Aeq,T_r}$:** Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r .
- **Specific Sound Source:** Sound source being assessed.

The BS 4142:2014 definition of sound of an industrial and/or commercial nature includes "sound from fixed installations which comprise mechanical and electrical plant and equipment". The scope of BS 4142:2014 is not intended for sound from the passage of vehicles on public roads; people; and 'other sources falling within the scopes of other standards or guidance'.

B.5.2 - Specific Sound Level

The specific sound level L_s is the equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r , of 60-minutes during the day (07:00 – 23:00) and 15-minutes at night (23:00 – 07:00).

B.5.3 - Rating Level

The rating level L_{A,r,T_r} is the specific sound level L_s plus any 'penalties' which account for the characteristic features of the sound.

BS 4142:2014 provides the following with respect to the application of penalties to account for "the subjective prominence of the character of the specific sound at the noise-sensitive locations and the extent to which such acoustically distinguishing characteristics will attract attention".

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

- **Impulsivity** – A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible;
- **Intermittency** – When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied; and
- **Other Sound Characteristics** – Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied."

PJA consider the word 'perceptible' to be important, and variable depending on the context of a site. For example at a site with a relatively high background sound level of 50 dB(A), an 'impulsive' sound source with a specific sound level of 30 dB(A) at an NSR is unlikely to be perceptible and should probably not be penalised.

However, the same source at a site with a lower background level of 30 dB(A) would be perceptible, and therefore a penalty of 3 or 6 dB could be applied to the rating level, with possibly a 9 dB penalty being applied if the specific sound level were to rise from 30 to 40 dB(A). Therefore the context is important in applying rating level penalties.

B.5.4 - Background Sound Level

BS 4142:2014 states that "in using the background sound level in the method for rating and assessing industrial and commercial sound it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods."

BS 4142:2014 further states that "a representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either minimum or modal value". Hence BS 4142:2014 does not provide a 'black and white' method of obtaining the assessment level for background sound $L_{A90,T}$. Note that it is standard practice that the $L_{A90,T}$ is determinable from the results of a baseline sound survey conducted at positions representative of sound levels at the nearest or worst affected NSRs.

B.5.5 - Assessment of Adverse Impact

The assessment of adverse impact contained in BS 4142:2014 is undertaken by comparing the rating level $L_{A,r,Tr}$ to the measured representative background sound level $L_{A90,T}$ outside the sensitive receptor location.

The significance of the impact of an industrial or commercial sound source depends on both the margin by which the rating level $L_{A,r,Tr}$ exceeds the background sound level $L_{A90,T}$ and the context in which the sound occurs. It is therefore essential to place the sound in context. But in general, "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."

Appendix C – Noise Survey Details

C.1 – Survey Equipment

The monitoring equipment used for the baseline noise survey is detailed in the table below. The sound level meter was calibrated before and after the survey, with no significant drifts of greater than 0.5 dB observed. The sound level meter has been calibrated to a traceable standard within the 24 months preceding the survey, and the calibrators have been calibrated to a traceable standard within the 12 months preceding the survey. The equipment complies with the standards of as BS EN 60942:2003 Class 1 device.

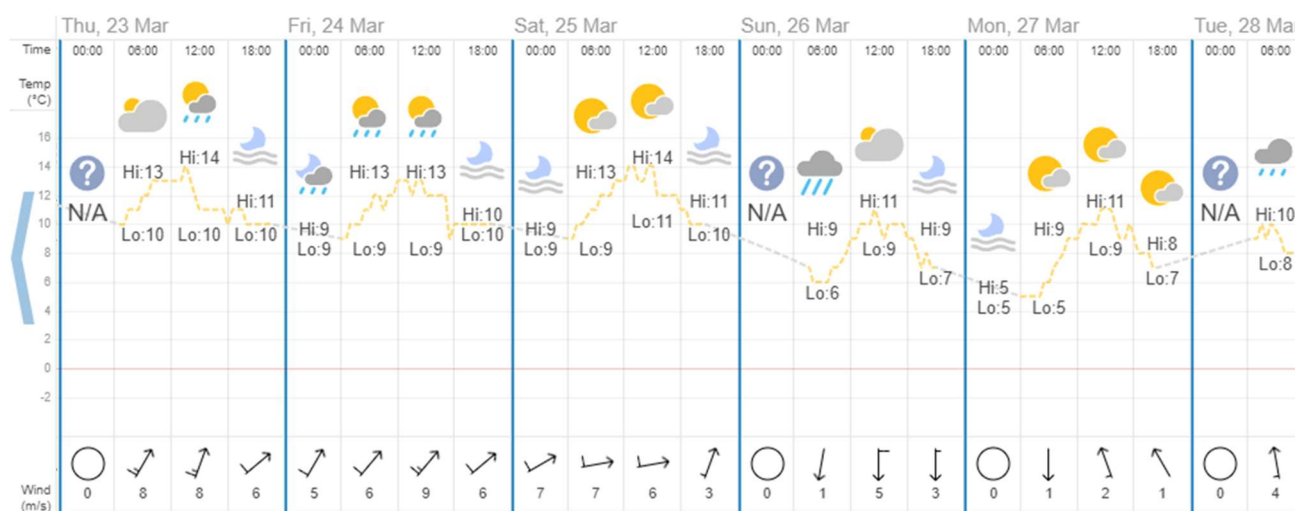
Table C.1 – Equipment used for the noise survey

Name	Serial Number	Last Calibrated	Calibration Due
SVAN 949 Class 1 Sound Level Meter	9720	Nov-21	Nov-23
SV22 Class 1 Microphone	4012386	Nov-21	Nov-23
Cirrus CRL511E Class 1 Acoustic Calibrator	035235	Nov-22	Nov-23

C.2 – Meteorological Conditions

During the survey, weather conditions were mixed, generally mild with wet and dry spells, and wind speeds between highs of up to 9 ms⁻¹ (the microphone was fitted with a weather protection kit/windshield). These weather conditions are mostly suitable for the measurement of environmental noise in accordance with BS 7445 'Description and Measurement of Environmental Noise'. High wind conditions would only result in higher noise levels and thus a more robust assessment of the impact on the proposed development, and the survey was sufficiently long to obtain baseline noise levels in suitable wind conditions to assess plant noise emissions from the development to the surrounding area. The weather data below has been sourced from <https://www.timeanddate.com/weather/@2657570/historic?month=3&year=2023>.

Figure C.1 – Meteorological conditions during the survey



C.3 – Photographs

Figure C.2 – Photographs of the monitoring position



Appendix D - Noise Survey Data from Nearby Sites

PJA has extensively reviewed planning applications for nearby sites and planning applications which are either within a short distance of the proposed site, or within similar proximity to the railway and the same roads that pass close to the proposed site. Fortunately, in the absence of a survey specific to the site in question (because of Covid-19), there are other planning applications very nearby which have had noise surveys conducted in the past few years, as recently as 2018.

Table D.1 – Relevant noise survey data from planning applications/sites in the nearby area

Planning Application	Relevant Information
APP/19/00007 Camp Field (land to the west of Havant Crematorium), Bartons Road, Havant Outline Application for access with all other matters reserved, for up to 72 new homes plus associated green infrastructure including community orchard	An application under consideration for 72 homes on north side of Bartons Road, a Noise Impact Assessment was produced by Clarke Saunders with a survey conducted over several days between Friday 22nd and Tuesday 26th March 2018. A single monitoring position was used closed to Bartons Road to represent the worst-case façade of the development, as shown in the image below. The average noise levels (corresponding to the indices referenced by the ProPG) were: - Daytime average – 68 dB $L_{Aeq,16hr}$ - Night-time average – 59 dB $L_{Aeq,8hr}$ - Night-time typical maximum – 79 dB L_{AFmax} 
APP/14/00863 Land north of Bartons Road, Havant Demolition of existing buildings and erection of 55 dwellings	Granted planning permission in 2014, this application for 55 dwellings required a noise assessment due to the proximity of dwellings to both Bartons Road and the railway line. A noise survey was conducted by Clarke Saunders between Thursday 20th and Monday 24th March 2014. A single monitoring position was used closed to Bartons Road to represent the worst-case façade of the development, as shown in the image below. The average noise levels (corresponding to the indices referenced by the ProPG) were: Position 1 (Bartons Road)

Planning Application	Relevant Information
	- Daytime average – 64 dB $L_{Aeq,16hr}$ - Night-time average – 56 dB $L_{Aeq,8hr}$ - Night-time typical maximum – 74 dB L_{AFmax} Position 2 (Railway) - Daytime average – 62 dB $L_{Aeq,16hr}$ - Night-time average – 58 dB $L_{Aeq,8hr}$ - Night-time typical maximum – 84 dB L_{AFmax} 
APP/18/00453 Land south of Bartons Road, Havant Erection of 175 dwellings	This development directly on the south boundary of the site in question is currently under construction. No noise concerns were raised during the planning process and a Noise Impact Assessment was not conducted.

Appendix E – Noise Mapping

The noise predictions within this report have been undertaken using the proprietary software CadnaA® by DataKustik, a 3-D noise mapping package which implements a wide range of national and international standards, guidelines and calculation algorithms, including those set out in ISO 9613-2:1996.

The noise model accounts for the topography of the land based on data available from the Ordnance Survey. All of the objects within the model (buildings, roads, barriers, foliage, etc) have been imported from OpenStreetMap. The heights of the buildings and roads have been based upon Google Earth Pro, using the 3D view to be able to measure the elevation heights at the tops of objects, and then inserting this manually into the model. Lastly, the scaled site plan, floor plan, and elevation for the proposed development have been accounted for in the model.

The noise model has been used to predict the resulting daytime (16-hour) and night-time (8-hour) L_{Aeq} noise levels across the site, and the typical L_{Amax} levels from train passing's.

The noise map model has assumed:

- downwind propagation, i.e. a wind direction that assists the propagation of sound from source to receptor, as a worst-case.
- a ground absorption factor of 0 on roads and buildings, 1 on greenfield land, and 0.5 on mixed ground;
- a maximum reflection factor of two where buildings and barriers are assumed to have a 'smooth' reflective façade, as a worst-case;
- that noise sources do not have strong radiation patterns and therefore radiate equally in all directions;
- receptor heights representing the worst-case ground or first-floor window depending upon the scenario being assessed; and
- atmospheric sound absorption based upon a temperature of 10°C and a humidity level of 70%, as per Table 2 of ISO 9613-2:1996.

The images on the following pages contain screenshots of the model setup and the results of the mapping.

Figure E.1 – Existing site - Predicted $L_{Aeq,16hr}$ external ambient noise levels – Daytime (07:00 – 23:00)

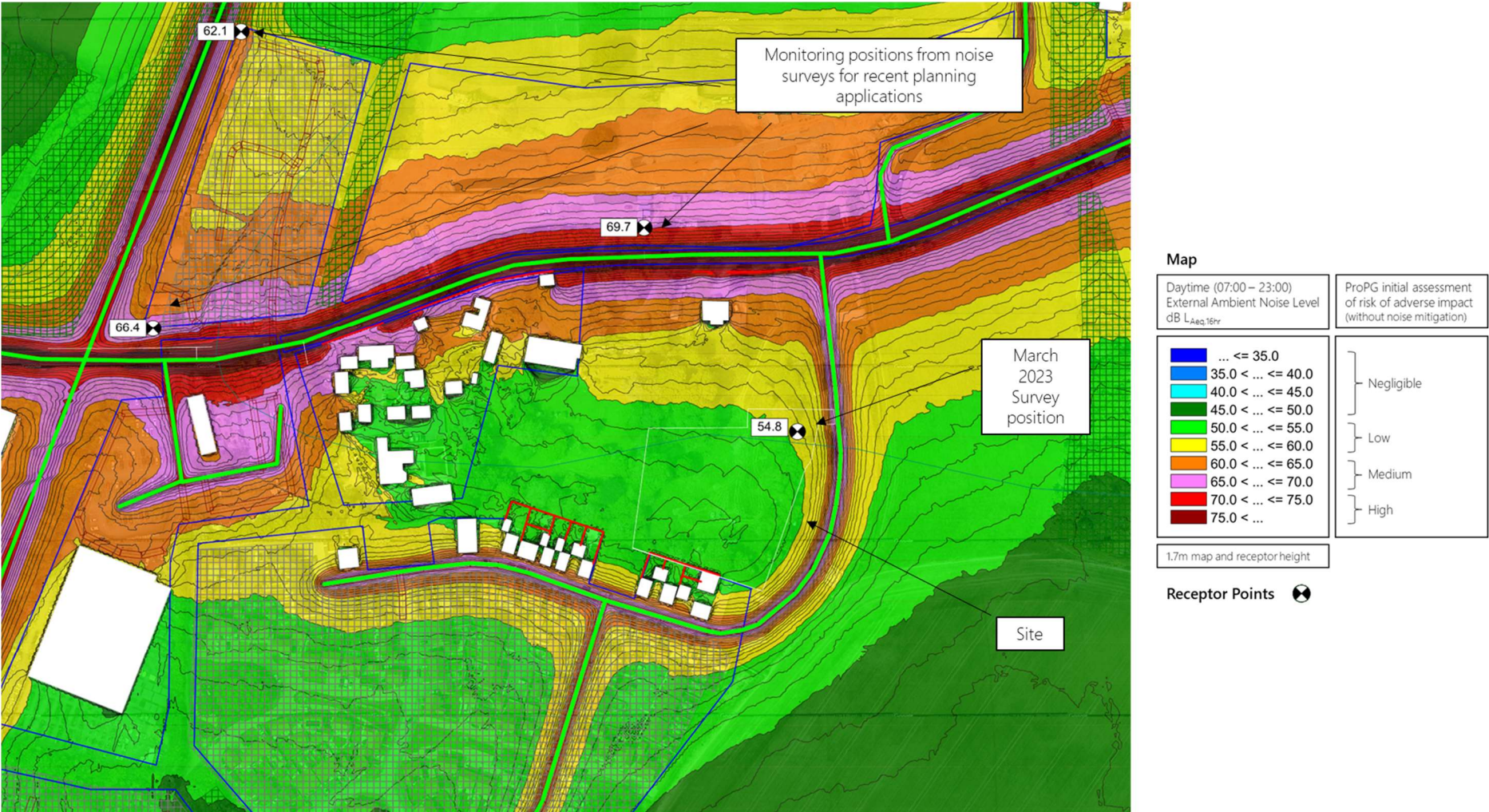


Figure E.2 – Existing site - Predicted $L_{Aeq,8hr}$ external ambient noise levels – Night-time (23:00 – 07:00)

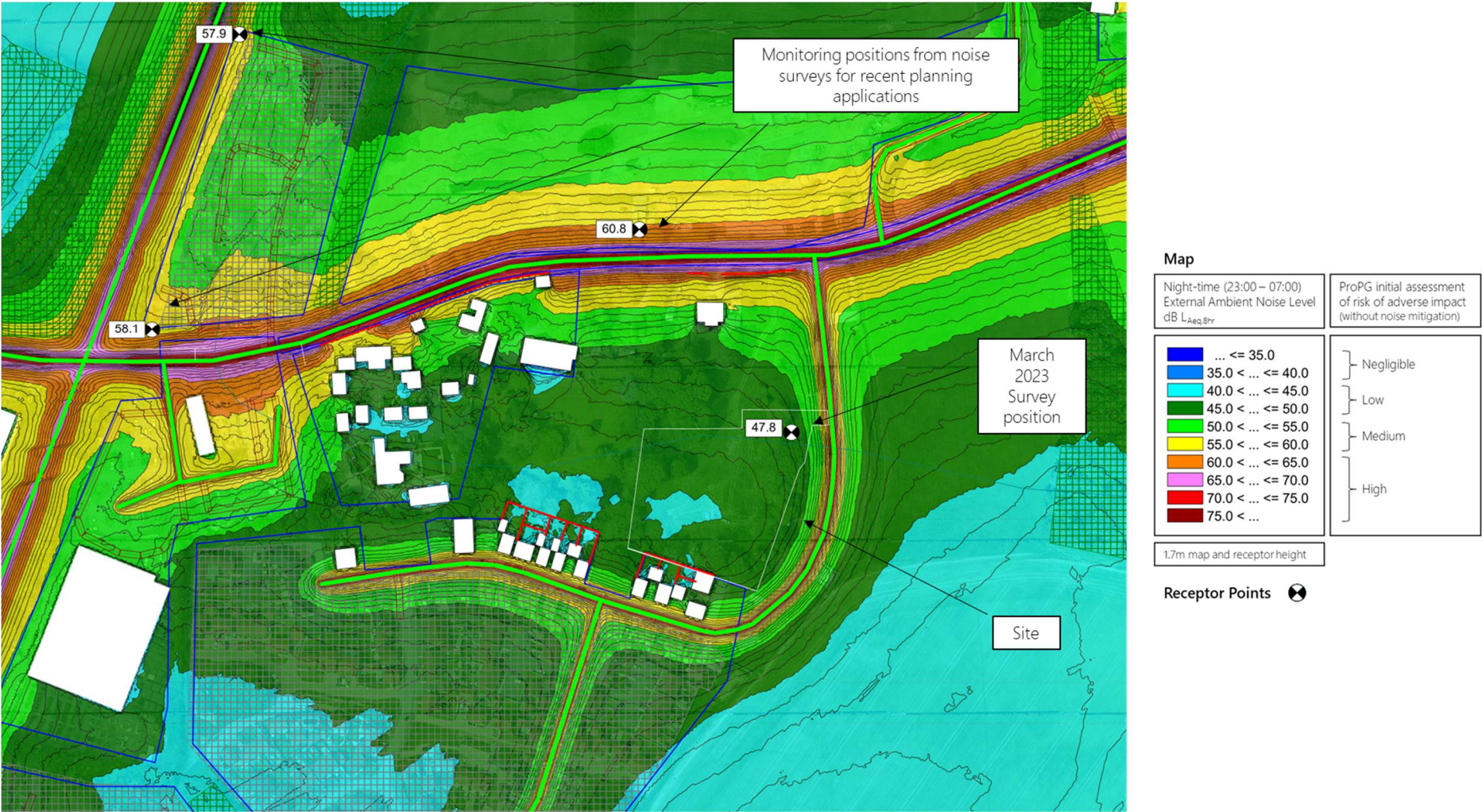


Figure E.3 – Predicted façade $L_{Aeq,16hr}$ exposure levels – Daytime (07:00 – 23:00) – Ground floor

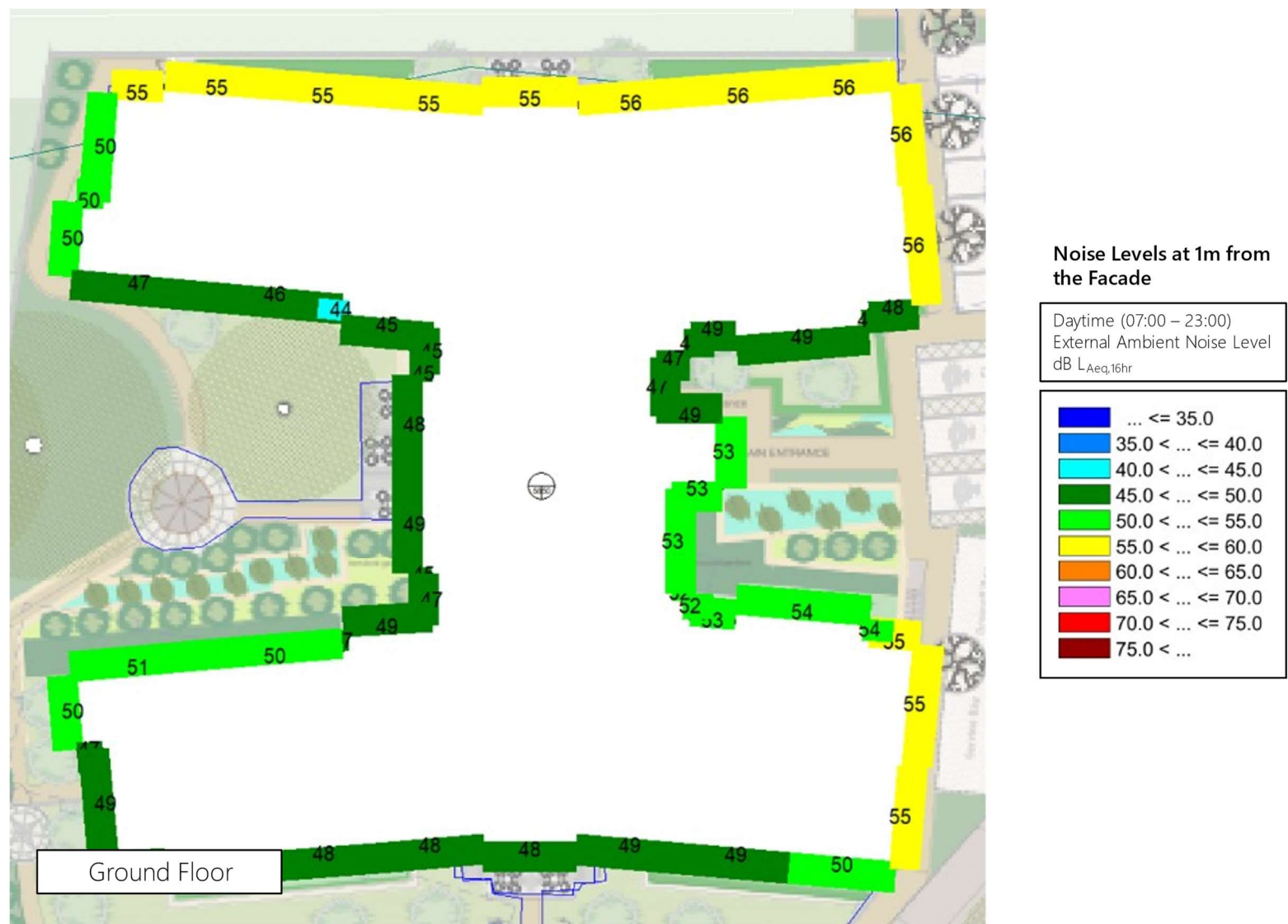


Figure E.4 – Predicted façade $L_{Aeq,16hr}$ exposure levels – Daytime (07:00 – 23:00) – First floor

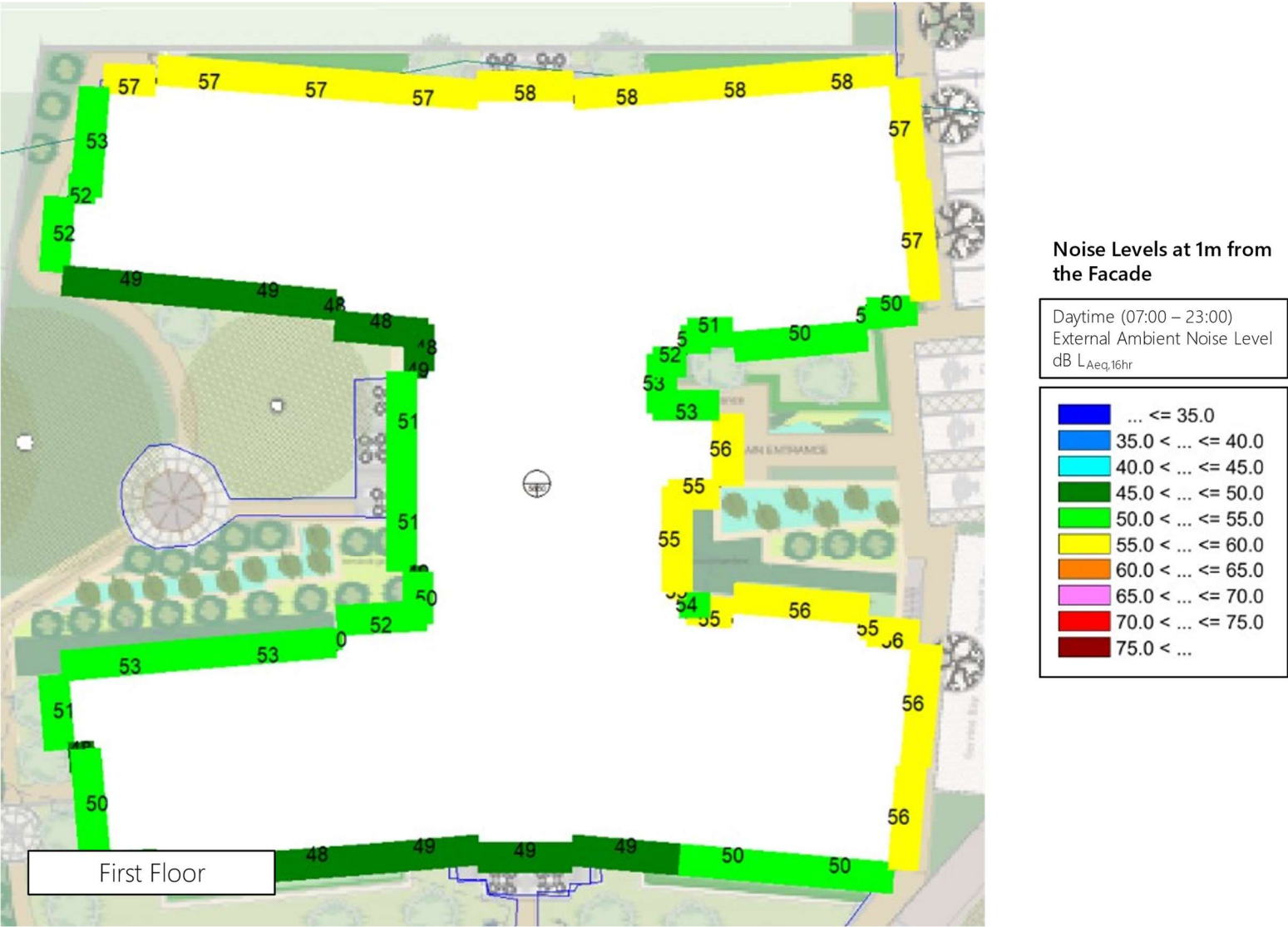


Figure E.5 – Predicted façade $L_{Aeq,8hr}$ exposure levels – Night-time (23:00 – 07:00) – Ground floor

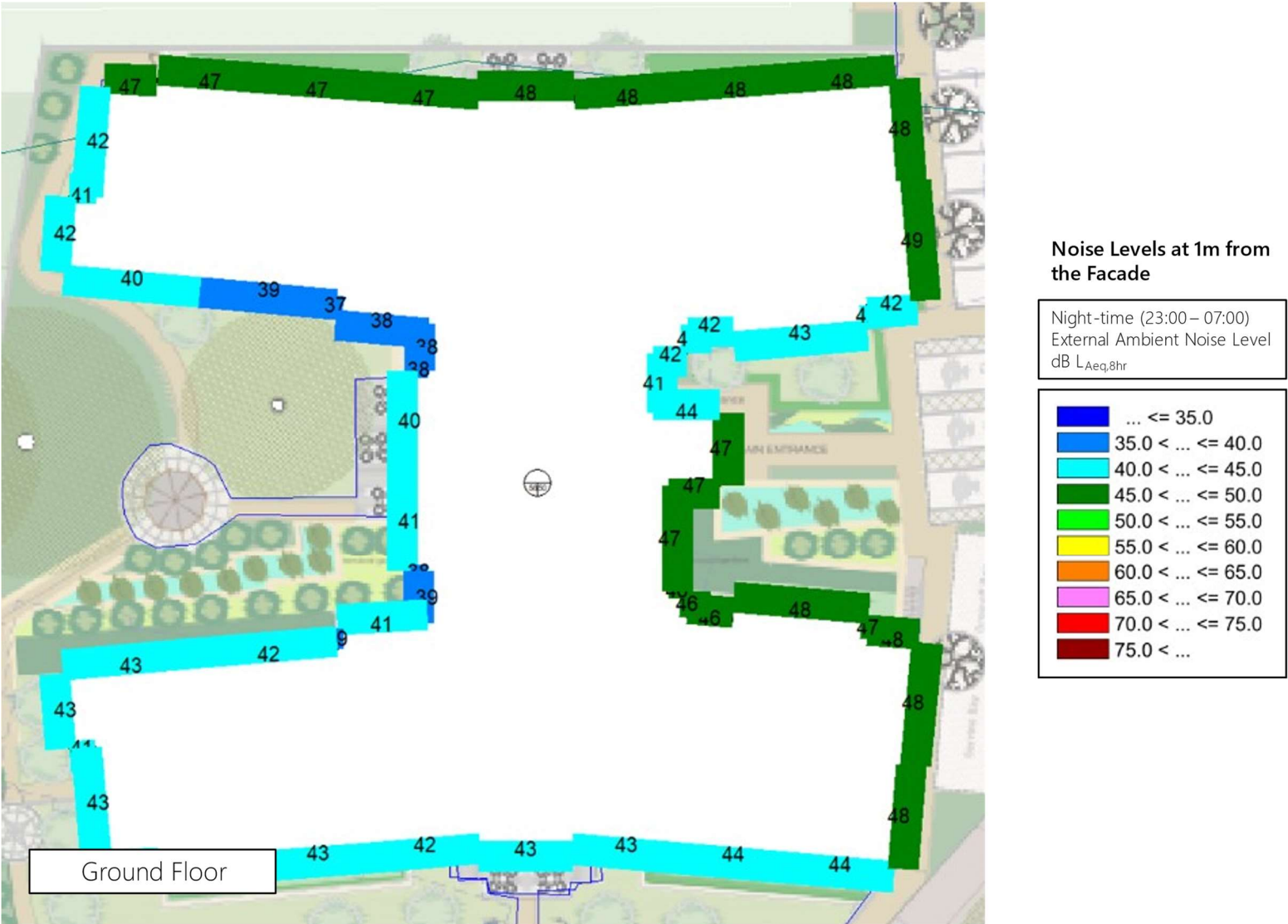


Figure E.6 – Predicted façade $L_{Aeq,8hr}$ exposure levels – Night-time (23:00 – 07:00) – First floor

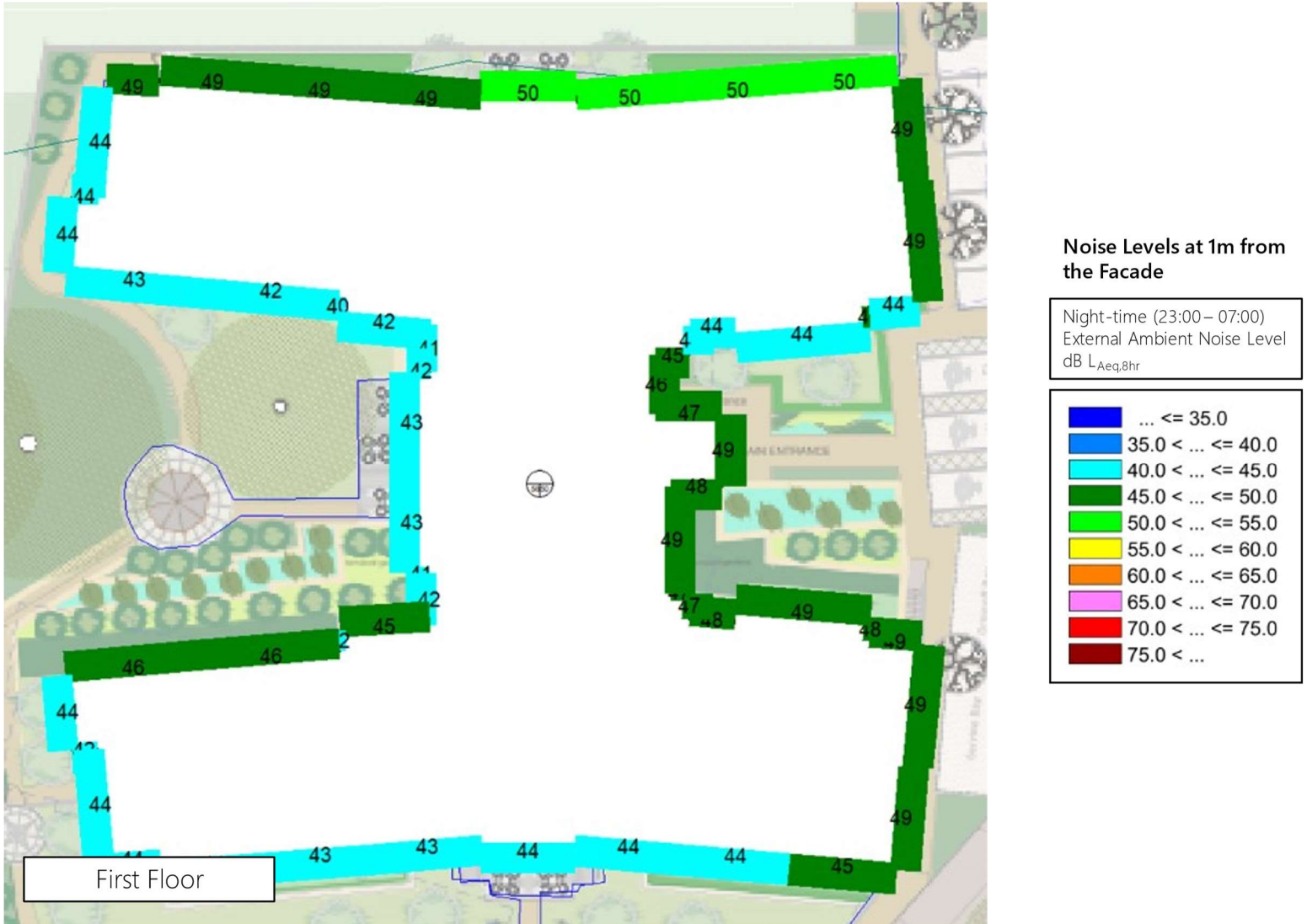
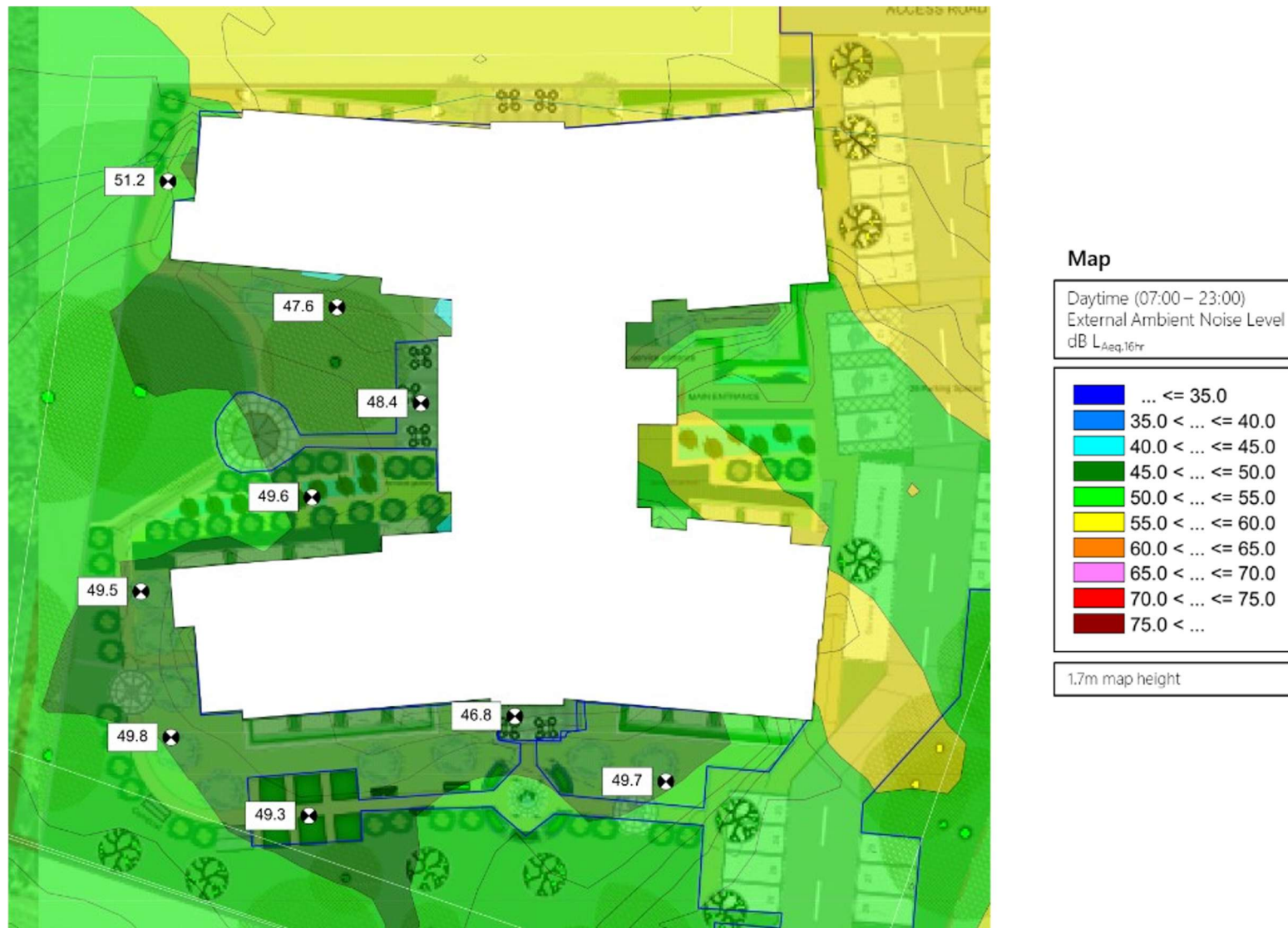


Figure E.7 – Predicted $L_{Aeq,16hr}$ in outdoor amenity areas – Daytime (07:00 – 23:00)



Appendix F – Example Façade Constructions

F.1 - Glazing

Table F.1 – Example new double/triple glazing constructions and associated sound reduction indices

Single / Double / Triple	Configuration	Manufacturer	R _w + C _{tr} (dB)
Double	4 (12) 4	Saint Gobain	27
Double	4 (12) 6	Saint Gobain	29
Double	5 (12) 4	Saint Gobain	29
Double	4 (16) 8	Saint Gobain	30
Double	4 (12) 6.8P	Pilkington	30
Double	4 (10) 10	Saint Gobain	31
Double	6 (25) 4	Saint Gobain	31
Double	8 (18) 6	Saint Gobain	32
Double	8.8L (12) 8.8P	Pilkington	32
Double	4 (6) 10	Saint Gobain	33
Triple	4 (12) 4 (12) 8.4S	Saint Gobain	33
Double	4 (16) 8.8P	Pilkington	33
Double	10 (15) 6	Saint Gobain	34
Double	8 (6) 8.8S	Saint Gobain	34
Double	6 (16) 8.8P	Pilkington	34
Double	10 (6) 8.8S	Saint Gobain	35
Double	6 (24) 10	Saint Gobain	35
Double	6 (12) 9.5A	Saint Gobain	35
Triple	8 (12) 4 (12) 8.8P	Pilkington	35
Double	8 (12) 8.8A	Saint Gobain	36
Double	10 (12) 8.8A	Saint Gobain	37
Double	8.4A (16) 10.4A	Saint Gobain	38
Double	8.8P (16) 12.8P	Pilkington	39
Double	10 (16) 12.4A	Saint Gobain	40
Double	12.8A (15) 12.8A	Saint Gobain	41
Double	9.1P (20) 13.1P	Pilkington	42
Double	9.1P (20) 17.1P	Pilkington	43
Double	16.8A (15) 16.8A	Saint Gobain	44
Double	9.1P (20Arg) 17.1P	Pilkington	44
NOTATION A = Stadip Silence S = Stadip P = Optiphon L = Optilam Arg = Argon Cavity			
Further data at https://techhub.uk.saint-gobain-building-glass.com/acousticcalculator			

F.2 - Ventilators

For each additional ventilator, the required $D_{n,e,w} + C_{tr}$ should be increased by $10\log(n)$, where 'n' is the number of ventilators. The $D_{n,e,w} + C_{tr}$ must be assessed in the **open position**.

Table F.2 – Example ventilator products and associated sound reduction indices

Product	$D_{n,e,w} + C_{tr}$ (dB)
Duco DucoTop 60 SR (over window frame) – Corto STD	25
Duco DucoTop 60 SR (over window frame) – Corto AK	26
Duco DucoTop 60 SR (over window frame) – Grando STD	27
Duco DucoTop 60 SR (over window frame) – Corto AK+	28
Duco DucoTop 60 SR (over window frame) – Alto AK	30
Duco DucoTop 60 SR (over window frame) – Basso AK+	30
Titon Invent	30
Duco DucoTop 60 SR (over window frame) – Grando AK	31
Titon Hit & Miss HM5050	31
Duco DucoTop 60 SR (over window frame) – Medio AK+	32
Duco DucoStrip Slimline	32
Duco GlasMax – Air slot 20mm	32
Ryttons R2700 Window trickle ventilator (412mm wide)	33
Titon SF 3300 EA Vent	33
Greenwood Slotvent 3000S	33
Duco GlasMax – Air slot 10mm	34
Greenwood 2000D	35
Duco DucoTop 60 SR (over window frame) – Largo AK+	35
Duco DucoMax Corto 15	36
Duco DucoTop 60 SR (over window frame) – Grando AK+	37
Duco DucoMax Medio 25	37
Duco DucoMax Alto 25	38
Titon SF Xtra Sound Attenuator	39
Willan Fresh 100dB	40
Greenwood Airvac Acoustic Air Brick AAB-4000	40
Duco DucoMax Corto 10	41
Duco DucoMax Medio 15	42
Greenwood EHA574	42
Duco DucoMax Alto 15	43
Duco DucoMax Alto 10	45



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