Land off Main Street, Whitehaven
Noise Assessment Report

Project: Land off Main Street, Whitehaven

Client: Gleeson Homes

Project Reference: RSA354/2021

Report Date: 22 July 2021

Document History

Version	Date	Comments	Initials
1	22 July 2021	Issue for planning	RS / MP

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1. Introduction

1.1 RS Acoustic Engineering Ltd has been appointed by Gleeson Homes to undertake a noise assessment with regard to a proposed residential development on land off Main Street, Whitehaven, CA28.

1.2 It is understood that the proposals are to construct 26 new dwellings with amenity space, access road and parking.

1.3 There are existing dwellings immediately north, south and west of the site and there is a Shell petrol station and Spar shop that has been recently constructed to the south west.

1.4 The dominant source of noise at the site is road traffic flow on Main Street (B5295) and intermittent noise associated with the petrol station.

1.5 A noise assessment has been undertaken taking into consideration the guidance contained within British Standard (BS) 8233:2014 *Guidance on sound insulation and noise reduction for buildings* and BS 4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound*.

1.6 This assessment is based on the results of an environmental noise survey undertaken at the site by RS Acoustic Engineering Ltd. Continuous sound level monitoring was conducted at the site to establish the existing noise levels during the daytime and night-time period.

1.7 The measured sound level data has been used to determine the acoustic performance requirements for the building envelope construction and to determine whether it will be suitable to naturally ventilate habitable rooms via opening windows alone.

1.8 An assessment of noise intrusion through the building envelope with windows open and closed has been undertaken and the resulting sound levels determined.

1.9 An assessment of noise within garden areas has also been undertaken to determine whether noise barriers are necessary at the development site.

1.10 The survey and assessment was conducted by Mr Ryan Swales ($BSc_{(Hons)}$, MIOA), Principal Acoustic Consultant and Member of the Institute of Acoustics.

1.11 The assessment has been undertaken following consultation with the Environmental Health Department for Copeland Borough Council.

1.12 The results of the noise survey have been presented, along with the assessment criteria and a discussion of the results with respect to the appropriate guidance and targets.

1.13 Recommendations regarding sound insulation, ventilation and noise mitigation are also provided.

2. Assessment Guidance & Criteria

Professional Practice Guidance on Planning & Noise (2017)

2.1 Professional Practice Guidance on Planning and Noise (ProPG) has been produced in order to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England.

2.2 The NPPF encourages improved standards of design. This guidance document encourages better acoustic design for new residential development and aims to protect people from the harmful effects of noise.

2.3 The scope of ProPG is restricted to the consideration of new residential development that will be exposed predominantly to airborne noise from transportation sources.

2.4 The document states that an initial noise risk assessment of the proposed development site should be conducted by a competent noise practitioner at the earliest opportunity, before any planning application is submitted. The noise risk assessment should provide an indication of the likely risk of adverse effects from noise were no subsequent mitigation to be included as part of the development proposal. It should indicate whether the proposed site is considered to pose a negligible, low, medium or high risk from a noise perspective.

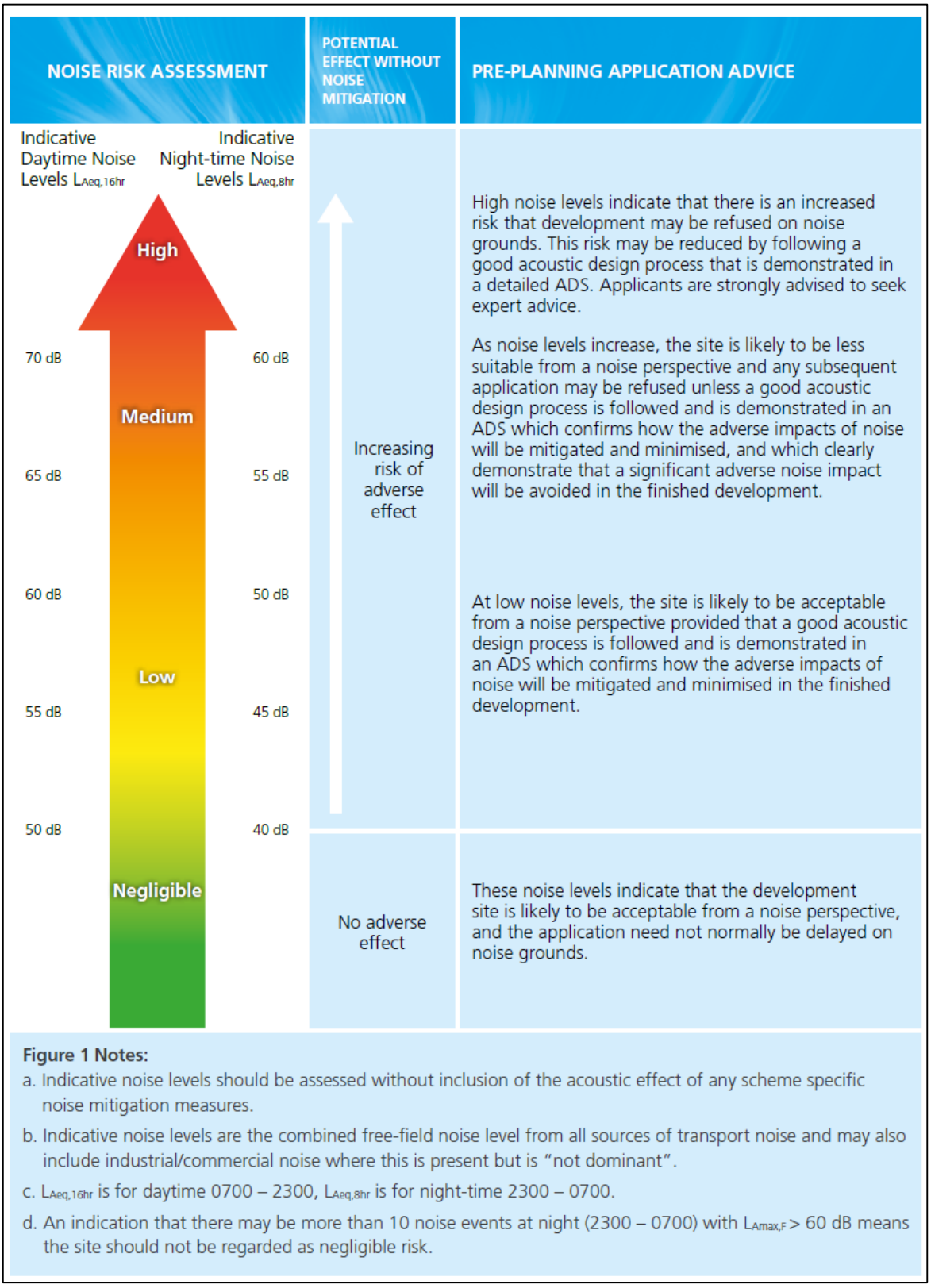
2.5 The risk assessment should not include the impact of any new or additional mitigation measures that may subsequently be included in development proposals for the site and proposed as part of a subsequent planning application.

2.6 The risk assessment may be based on measurement or prediction (or a combination) as appropriate and should aim to describe noise levels over a typical 24-hour day, either now or in the foreseeable future.

2.7 It is important that the assessment of noise risk at a proposed residential development site is not the basis for the eventual recommendation to the decision maker. The recommended approach is intended to give the developer, the noise practitioner and the decision maker an early indication of the likely initial suitability of the site for new residential development from a noise perspective and the extent of the acoustic issues that would be faced.

2.8 Figure 2.1 overleaf summarises the initial site noise risk assessment.

Figure 2.1 - Initial site noise risk assessment



Internal noise level guidelines

2.9 The recommended ProPG internal noise level guidelines are presented in Table 2.1. The guidelines reflect and extend current practice contained in BS 8233:2014.

Table 2.1 – ProPG internal noise level guidelines

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	---
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	---
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$ 45 dB $L_{Amax,F}$

2.10 Where the local planning authority accepts that there is a 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, special care must be taken to design the accommodation so that it provides good standards of acoustics, ventilation and thermal comfort without unduly compromising other aspects of the living environment.

2.11 In such circumstances, internal noise levels can be assessed with windows closed but with any façade openings used to provide "*whole dwelling ventilation*" in accordance with Building Regulations Approved Document F (e.g. trickle ventilators) in the open position.

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

External noise and amenity areas

2.13 The ProPG external amenity area noise assessment reflects and extends the advice contained within BS 8233:2014 and is summarised as follows:

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

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

(iii) 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 external amenity spaces.

(iv) Whether or not external amenity spaces are an intrinsic part of the overall design, consideration of the need to provide access to a quiet or relatively quiet external amenity space forms part of a good acoustic design process.

(v) Where, despite following a good acoustic design process, significant adverse noise impacts remain on any private external amenity space (e.g. garden or balcony) then that impact may be partially off-set 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 external 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, external 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, publically accessible, external 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.*

British Standard 8233:2014: Guidance on sound insulation and noise reduction for buildings

2.14 BS 8233 provides guidance regarding acoustic criteria and noise levels appropriate for various types of space that have different functions.

2.15 With regard to dwellings, appropriate internal ambient sound levels are given for bedrooms, living rooms and dining rooms (habitable rooms). The guidelines take into consideration the effect of internal noise on sleep and also the effect of noise on resting, listening and communicating.

2.16 The internal sound level targets presented in Table 2.2 have been reproduced directly from Table 4 of BS 8233.

Table 2.2 – Indoor ambient noise levels for dwellings

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

2.17 Note 7 of the standard also suggests that in some circumstances it may be appropriate to relax the indoor ambient noise level targets by up to 5 dB:

Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

2.18 Note 5 also states:

If relying on closed windows to meet the guide values, there needs to be appropriate alternative ventilation that does not compromise the facade insulation or the resulting noise level. If applicable, any room should have adequate ventilation (e.g. trickle ventilators should be open) during assessment.

2.19 With regard to outdoor living areas (gardens), the following guidance is given:

For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognised that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure

development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.

World Health Organisation: Guidelines for community noise (1999)

2.20 To help avoid sleep disturbance within bedrooms, the now superseded guidance document recommends that the night-time internal ambient sound level should not exceed 30 dB $L_{Aeq,T}$ and the maximum sound level should not typically exceed 45 dB $L_{AFmax,T}$.

2.21 The corresponding values directly outside of bedroom windows are therefore 45 dB $L_{Aeq,8hour}$ and 60 dB $L_{AFmax,T}$. This is based on the assumption that a partially open window provides approximately 15 dB of sound attenuation (from external noise).

2.22 With regard to sleep disturbance and maximum L_{AFmax} sound levels, the study undertaken by Vallet & Vernet (1991) suggests that for good sleep, indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10-15 times per night.

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

2.23 BS 4142 (amended June 2019) describes methods for rating and assessing sound of an industrial and/or commercial nature, such as sound from manufacturing processes and fixed mechanical plant/machinery.

2.24 Outdoor sound levels are used to assess the likely effect on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

2.25 BS 4142 is not intended to be applied to the derivation of indoor sound levels arising from sound levels outside, or the assessment of indoor sound levels.

2.26 The standard has three different methods (subjective, objective and reference) of applying a penalty to tonal, impulsive and intermittent noises, as separate entities.

2.27 The current standard no longer indicates significance of noise impacts as giving rise to a '*likelihood of complaint*' but rather as an '*indication*' of varying degrees of '*adverse impact'*.

2.28 BS 4142:2014 states that a difference of around +10 dB or more (excess of rating level above the background sound level) is likely to be an indication of a significant adverse impact, depending on the context.

2.29 A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

2.30 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.

2.31 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.

2.32 With regard to determining the background sound level at the site, the standard provides the following guidance:

Where possible, measure the background sound level at the assessment location(s). If this is not possible measure at an alternative location where the residual sound is comparable to the assessment location(s). A detailed justification for considering this should be reported.

Ensure that the measurement time interval is sufficient to obtain a representative value of the background sound level for the period of interest. This should comprise continuous measurements of normally not less than 15 min intervals, which can be contiguous or disaggregated.

2.33 The standard also provides the following general commentary on background sound level:

The background sound level is an underlying level of sound over a period, T, and might in part be an indication of relative quietness at a given location. It does not reflect the occurrence of transient and/or higher sound level events and is generally governed by continuous or semi-continuous sounds.

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.

Among other considerations, diurnal patterns can have a major influence on background sound levels and, for example, the middle of the night can be distinctly different (and potentially of lesser importance) compared to the start or end of the night-time period for sleep purposes. Furthermore, in this general context it can also be necessary to separately assess weekends and weekday periods.

Since the intention is to determine a background sound level in the absence of the specific sound that is under consideration, it is necessary to understand that the background sound level can in some circumstances legitimately include industrial and/or commercial sounds that are present as separate to the specific sound.

Care is necessary in circumstances where background sound levels are low to ensure that self-generated and electrical noise within the measurement system does not unduly influence reported values, which may be the case if the measured background sound levels are less than 10 dB above the noise floor of the measuring system.

Consultation with Copeland Borough Council

2.34 The Environmental Health Department for Copeland Borough Council was contacted in June 2021 in order to discuss the development proposals, design criteria and assessment methodology.

2.35 With regard to acoustic design criteria, it was confirmed that habitable rooms should achieve the indoor ambient noise level targets as given within BS 8233:2014.

2.36 It was agreed that it would be prudent to conduct further background sound level measurements at the development site, since the survey data and background sound levels for the adjacent parcel of land (associated with the new petrol station) was approximately 9 years old (measured in October 2012).

2.37 Thomas Greer (EHO) stated that his primary concern was the noise emitted from the petrol pumps, particularly during the night-time period. It is understood that the air/water pump cannot operate during the night-time hours.

2.38 It was also agreed that it would be appropriate for the nearest habitable rooms facing the petrol station to have a suitable alternative method of ventilation (in addition to opening windows), if there was a likelihood of disturbance and complaint from future residents (particularly during the night-time period).

2.39 There was no particular concern regarding other sources of plant noise, since the building services plant associated with the retail building (e.g. condenser units for refrigeration and air-conditioning) was located further south on the opposite side of the building to the development site. During the survey, noise from this particular plant was observed to be inaudible.

3. Environmental Noise Survey

Survey methodology

3.1 Continuous sound level monitoring was conducted over a 17-hour period at the southern boundary line, directly adjacent to the new Shell petrol station.

3.2 Measurements were performed from 23:00 hours on Wednesday 14th through to 16:00 hours on Thursday 15th July 2021.

3.3 A measurement interval of 15-minutes was used during the survey and measurements were considered to be subject to reflections from the adjacent building (as opposed to free-field). The microphone was fixed to boundary fencing at a height of approximately 1.5 metres from the ground.

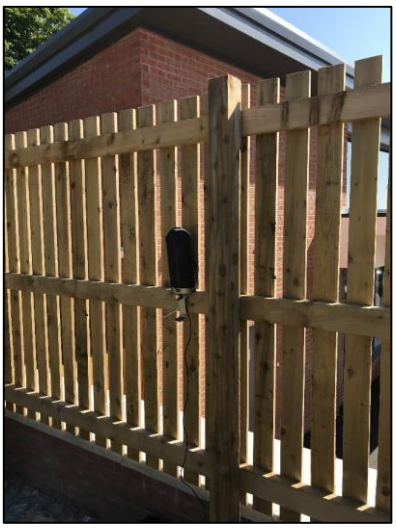
3.4 Sample measurements were also conducted at the site boundary during the night-time period in order to capture the specific sound level generated by a petrol pump.

3.5 The site location, surrounding area and survey measurement positions are shown in Figure 3.1 and Figure 3.2.

3.6 The proposed site layout, floor plans and elevations are presented in Appendix A.

Figure 3.1 - Site location and survey measurement positions (Source: Google Maps)

Figure 3.2 - Photographs showing survey measurement positions



Survey equipment

3.7 The survey was conducted using the following equipment:

- Casella CEL-633A sound level meter, microphone type CEL-251 and pre-amplifier type CEL-495.
- Brüel & Kjaer 2260 sound level meter, with microphone type 4189 and pre-amplifier type ZC0032.
- CEL-120/1 Acoustic calibrator.

3.8 Calibration of the sound level meter and microphone used for the measurements are traceable to UKAS accredited laboratories (calibration certificates are available upon request).

3.9 The calibration of both sound level meter and microphone was checked using a 1 kHz tone at 94 dB prior to and following the measurements performed. The drift in calibration was less than 0.1 dB.

Weather conditions

3.10 The weather conditions during the survey were generally dry and fine with a light cloud cover. Wind speed measurements taken on-site were typically 1 to 2 m/s^{-1}.

3.11 The air temperature during the survey ranged between 14°C and 22°C. The overall weather conditions were considered suitable to obtain representative measurements.

Measured indices

3.12 Although a wide range of statistical sound level data was recorded during the survey, the L_{Aeq}, L_{A90} and L_{AFmax} indices are of most interest here:

- $L_{Aeq,T}$ - The A-weighted equivalent continuous sound pressure level over a period of time, T. Representative of the 'average' sound pressure level over a given period (commonly used to describe the 'ambient' sound level).
- $L_{A90,T}$ - The A-weighted sound pressure level that is exceeded for 90% of the measurement time interval, T. L_{A90} is often used to describe the 'background' sound level.
- $L_{AFmax,T}$ - The A-weighted 'maximum' sound pressure level that occurred during a given period, T (commonly used for the assessment of occasional loud noises).

3.13 Sound pressure level measurements are taken with an A-weighting (denoted by a subscript 'A', e.g. L_{Aeq}) to approximate the frequency response of the human ear.

Results summary

3.14 Table 3.1 presents a summary of the measured sound pressure levels from the continuous monitoring position. Measured values have been rounded to the nearest whole number.

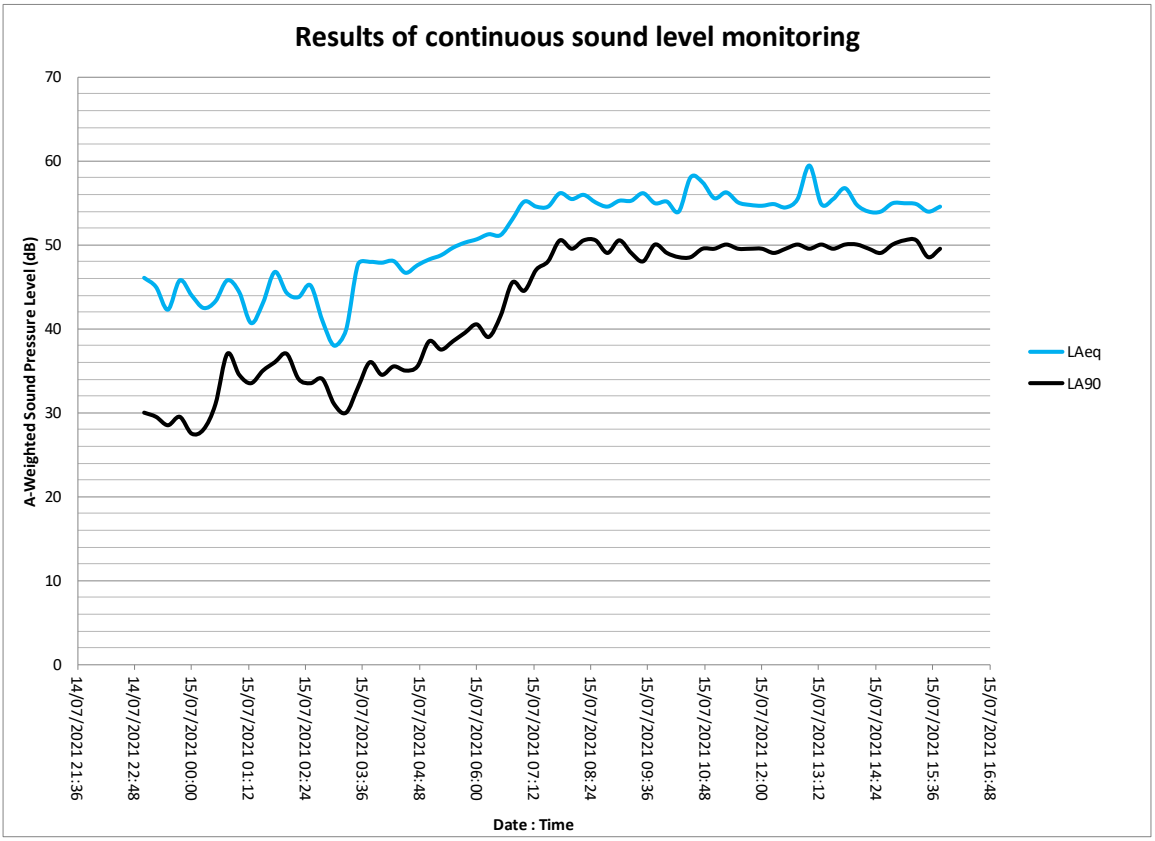
Table 3.1 – Summary of continuously measured sound pressure levels

Date	Period	Duration, T (hours)	$L_{Aeq,T}$ dB	Typical $L_{A90,T}$ dB[1]	10th Highest $L_{AFmax,T}$ dB[2]
Wednesday 14/07/2021 to Thursday 15/07/2021	Night-time (23:00-07:00)	8	47	30	64
	Daytime (07:00-23:00)	9	56	50	---

[1]Considered to be the representative background sound level from a statistical analysis (most commonly occurring)
[2]The 10th highest value from 32 measurement periods

3.15 The results of the sound level monitoring are also presented graphically in Figure 3.3.

Figure 3.3 - Graph showing results of continuous sound level monitoring



4. Assessment & Discussion

Initial site noise risk assessment

4.1 The measured sound pressure level was 56 dB $L_{Aeq,9hour}$ during the daytime and 47 dB $L_{Aeq,8hour}$ during the night-time.

4.2 On this basis, the initial noise risk assessment indicates that the development site is Low Risk.

Building envelope construction and acoustic performance

4.3 External walls are expected to be of a brickwork/cavity/blockwork construction. The sound insulation performance of such a construction is typically in the region of 45 to 55 dB R_w+C_{tr}.

4.4 A tiled roof construction with mineral wool (loft) insulation and an internal plasterboard finish typically provides a sound insulation performance in the region of 39 to 43 dB R_w+C_{tr}.

4.5 Standard double glazing typically provides a sound insulation performance in the region of 25 to 30 dB R_w+C_{tr}.

- 6 mm glass / 16 mm - 20 mm cavity / 4 mm glass (28 - 30 dB R_w+C_{tr})
- 6 mm glass / 16 mm - 20 mm cavity / 6 mm glass (27 - 29 dB R_w+C_{tr})
- 4 mm glass / 16 mm - 20 mm cavity / 4 mm glass (25 - 27 dB R_w+C_{tr})

4.6 Laminated (acoustic) double glazing as is commonly used within dwellings provides a sound insulation performance in the region of 31 to 37 dB R_w+C_{tr}.

- 6 mm glass / 16 mm - 20 mm cavity / 10.8 mm acoustic laminate (35 - 37 dB R_w+C_{tr})
- 6 mm glass / 16 mm - 20 mm cavity / 8.8 mm acoustic laminate (33 - 35 dB R_w+C_{tr})
- 6 mm glass / 16 mm - 20 mm cavity / 6.8 mm acoustic laminate (31 - 33 dB R_w+C_{tr})

4.7 As an example, Pilkington Optiphon is a high performing acoustic laminate that can be used within double glazed systems.

- www.pilkington.com/en-gb/uk/products/product-categories/noise-control/pilkington-optiphon/

4.8 The glazing is expected to be the weakest element with regard to the building envelope sound insulation (excluding ventilator units).

4.9 With standard double glazing, the ‘composite’ sound insulation of the building envelope is expected to be in the region of 31 to 34 dB R_w+C_{tr}.

4.10 The quantity R_w is the weighted sound reduction index expressed in dB. It is a single number quantity for rating airborne sound insulation. The ‘C_{tr}’ term is added to the single number rating R_w to take account of the characteristics of particular sound spectra (e.g. road traffic).

4.11 The acoustic performance of a particular construction may differ slightly between manufacturers and therefore the sound insulation performance should be verified where possible.

4.12 To achieve the optimum performance, external windows should be well sealed around the frame when installed. Large gaps between the frame and the brickwork and poorly sealed frames can notably reduce performance.

Noise ingress with windows closed

4.13 Table 4.1 presents the calculation results for a habitable room (bedroom 1) within plot no's 8 and 9 (type 301) on the southern boundary line.

4.14 Standard double glazing consisting of 4 mm glass / 16 – 20 mm cavity / 4 mm glass has been assumed for habitable rooms.

4.15 The calculation takes into account the typical sound insulation performance of each building element, surface area and internal room dimensions.

4.16 The daytime L_{Aeq} sound pressure level has been used for this assessment (56 dB $L_{Aeq,9hour}$).

4.17 The octave band sound levels and the typical reverberation time for a habitable room have also been taken into consideration.

Table 4.1 – Noise ingress calculation results

Title: Main Street (Bedroom 1) **Noise Break In (ISO 12354- 3)**												
Formula/Comment	***Single Value***		***63***	***125***	***250***	***500***	***1000***	***2000***	***4000***	***8000***	***Rw***	***(C,C_{tr})***
				23.8	22.4	30.1	38.8	41.5	36.6			
L_{in}				26.2	30.6	22.9	14.2	6.5	6.4			
Materials												
4mm glass/16 - 20 mm cavity/4mm glass		2.9		21.0	17.0	25.0	35.0	37.0	31.0		**29**	**(-1,-4)**
Brickwork / blockwork cavity wall		15.5		40.0	44.0	45.0	51.0	56.0	60.0		**51**	**(-1,-4)**
Tiled roof, rockwool insulation, plasterboard		14.0		28.0	34.0	40.0	45.0	49.0	50.0		**44**	**(-2,-5)**
$L_{out,s}$												
$L_{out,2m}$	**Add Element**			50.0	53.0	53.0	53.0	48.0	43.0		**56**	
$L_{out,free\ field}$				47.0	50.0	50.0	50.0	45.0	40.0		**53**	
Element 1				23.8	22.4	30.1	38.8	41.5	36.6			
Plane façade	ΔL_{fs}	32.3		0.0	0.0	0.0	0.0	0.0	0.0			
Visible	X_{fs}	0.0		23.8	22.4	30.1	38.8	41.5	36.6			
$L_{p,out,2m}$				50.0	53.0	53.0	53.0	48.0	43.0		**56**	
$L_{p,in}$				26.2	30.6	22.9	14.2	6.5	6.4		**25**	**dBA**

4.18 The calculation results indicate a daytime internal sound level of approximately 25 dB $L_{Aeq,T}$ with standard thermal double glazing.

4.19 The daytime sound level target of 35 dB $L_{Aeq,16hour}$ will therefore be easily achieved with windows closed.

4.20 The dwellings nearest to the road (plot no's 1 to 5) will experience ambient sound levels approximately 5 dB $L_{Aeq,T}$ higher than those measured at the continuous monitoring position, however the daytime target will still be achieved.

4.21 Since the night-time L_{Aeq} sound level is approximately 9 dB lower than the daytime sound level, the night-time target of 30 dB $L_{Aeq,8hour}$ will also be achieved throughout the site.

4.22 With regard to the maximum L_{AFmax} internal sound levels, for the majority of the night-time period the recommended target of 45 dB L_{AFmax} will also be achieved.

- 64 dB $L_{AFmax,T}$ – 25 dB R_w+C_{tr} = 39 dB $L_{AFmax,T}$ internally.

4.23 On the basis of this assessment, additional noise mitigation for habitable rooms is considered unnecessary (i.e. installing acoustically laminated double glazing and/or thick heavy panes of glass).

Noise ingress with windows open

4.24 The level of sound attenuation through an open window is dependent on the type and size of window, the extent of opening, the angle of sound incidence and the characteristics of the noise source in question.

4.25 It is considered reasonable to assume a sound attenuation performance of approximately 15 dBA for a partially open window. Partially open windows are expected to provide background ventilation only (as opposed to rapid/purge ventilation).

4.26 The measured daytime sound pressure level was 56 dB $L_{Aeq,9hour}$ and the night-time sound pressure level was 47 dB $L_{Aeq,8hour}$. However, this was at the monitoring position set-back from the main road.

Front elevation of plot no's 1 to 5

4.27 The ambient $L_{Aeq,T}$ sound pressure level is expected to be approximately 5 dB higher at the front elevation directly adjacent to Main Street (plot no's 1 to 5).

4.28 When assessing noise ingress through an open window, it is appropriate to correct the measured sound levels by approximately -3 dB, in order to give an equivalent free-field sound pressure level.

4.29 The corresponding free-field sound pressure level is therefore 58 dB $L_{Aeq,9hour}$ during the daytime and 49 dB $L_{Aeq,8hour}$ during the night-time.

4.30 On this basis, the resulting internal sound pressure level is approximately 43 dB $L_{Aeq,9hour}$ during the daytime and approximately 34 dB $L_{Aeq,8hour}$ during the night-time.

- 58 dB $L_{Aeq,9hour}$ – 15 dB = 43 dB $L_{Aeq,9hour}$
- 49 dB $L_{Aeq,8hour}$ – 15 dB = 34 dB $L_{Aeq,8hour}$

4.31 The recommended 35 dB $L_{Aeq,16hour}$ daytime and 30 dB $L_{Aeq,8hour}$ night-time sound level target will therefore be exceeded with windows open.

4.32 The recommended night-time sound level target of 45 dB $L_{AFmax,T}$ will also be exceeded with windows open.

4.33 It should be noted that BS 8233 suggests that in some circumstances, it may be appropriate to relax the indoor ambient noise level targets by up to 5 dB:

Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

4.34 However, the relaxed daytime target level will be slightly exceeded with windows open.

4.35 BS 8233 states that where occupants rely on closed windows to meet the internal noise limits, there needs to be appropriate 'alternative' ventilation that does not compromise the facade sound insulation or resulting internal sound level.

4.36 The standard also provides the following comment with regard to ventilation:

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

4.37 It is therefore recommended that an alternative means of ventilation is provided to habitable rooms on the front elevation of plot no's 1 to 5.

4.38 As a minimum mitigation measure, it is recommended that sound attenuating (acoustically rated) ventilator units are installed to habitable rooms, since it will allow occupants to keep windows closed during noisy periods whilst maintaining background ventilation.

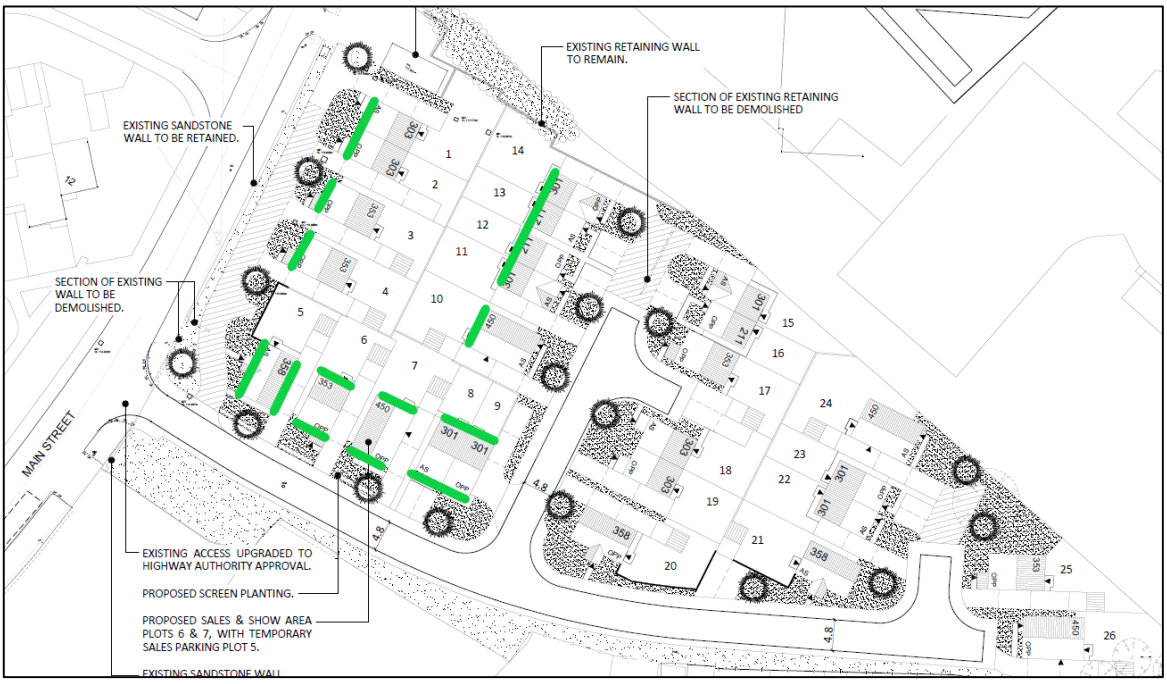
4.39 Bathrooms, toilets and circulation areas should not require any specific noise mitigation.

4.40 Alternatively, a mechanically assisted ventilation system could be used to serve the worst-case habitable rooms.

4.41 Taking into consideration the existing ambient sound levels, it is considered appropriate for openable windows to provide rapid/purge ventilation.

4.42 Figure 4.1 shows the proposed site layout and the dwellings/elevations where alternative ventilation is recommended (elevations are highlighted in green).

Figure 4.1 – Site layout showing elevations with recommended alternative ventilation



4.43 The rear elevations to plot no's 1 to 5 will be acoustically screened from passing road traffic and therefore the resulting internal sound level will be notably lower than the front elevation.

4.44 It is anticipated that the ideal daytime and night-time sound level targets will be achieved with windows open on the rear elevation. Standard (non-acoustic) hit-and-miss trickle vents could be installed to habitable rooms in order to provide background ventilation when windows are closed.

Rear elevation of plot no's 6 to 14

4.45 The resulting internal sound pressure level is expected to be approximately 38 dB $L_{Aeq,9hour}$ during the daytime and approximately 29 dB $L_{Aeq,8hour}$ during the night-time.

4.46 The ideal sound level target will therefore be slightly exceeded during the daytime but achieved during the night-time with windows open.

4.47 As a minimum mitigation measure, it is recommended that sound attenuating ventilator units are installed to habitable rooms.

4.48 It is considered appropriate for openable windows to provide rapid/purge ventilation.

Front elevation of plot no's 6 to 9 and rear elevation of plot no.5

4.49 It is anticipated that the ideal sound level target will be slightly exceeded during the daytime but achieved during the night-time with windows open.

4.50 However, these elevations will also be impacted by noise from the adjacent petrol pumps which is discussed further in the following section.

4.51 It is therefore recommended that an alternative means of ventilation is provided to habitable rooms. It is considered appropriate for openable windows to provide rapid/purge ventilation.

Front/rear elevation to all other plots

4.52 The ideal sound level target should be achieved during the daytime and night-time with windows open.

4.53 An alternative method of ventilation such as acoustic ventilator units to habitable rooms is therefore considered unnecessary.

4.54 Standard (non-acoustic) hit-and-miss trickle vents could be installed to habitable rooms in order to provide background ventilation when windows are closed.

4.55 It is considered appropriate for openable windows to provide rapid/purge ventilation.

Garden ambient sound levels

4.56 With regard to outdoor living areas (gardens), BS 8233 provides the following guidelines:

For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognised that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.

4.57 It is appropriate to design a site so that at least one garden space to a dwelling will achieve the guideline values. It is assumed that the main garden area for resting and relaxation will generally be to the rear of the property.

4.58 During the survey, the measured daytime sound pressure level was 56 dB $L_{Aeq,9hour}$.

4.59 As previously discussed, the ambient sound level at the dwellings nearer to the main road will be slightly higher than that measured at the continuous monitoring position (4 to 5 dB $L_{Aeq,T}$ higher).

4.60 A noise barrier will therefore be required to achieve the upper guideline value within gardens.

4.61 Calculations have been undertaken in order to determine the potential sound attenuation that is achievable from an effective barrier at the rear garden boundary.

4.62 A barrier height of 1.8 metres and a receptor height of 1.2 metres above ground (a tall person sitting down) have been assumed in the calculations.

4.63 Table 4.2 presents a results summary for the barrier calculation. Octave-band sound level data has been used in the calculation since barrier attenuation is frequency dependent.

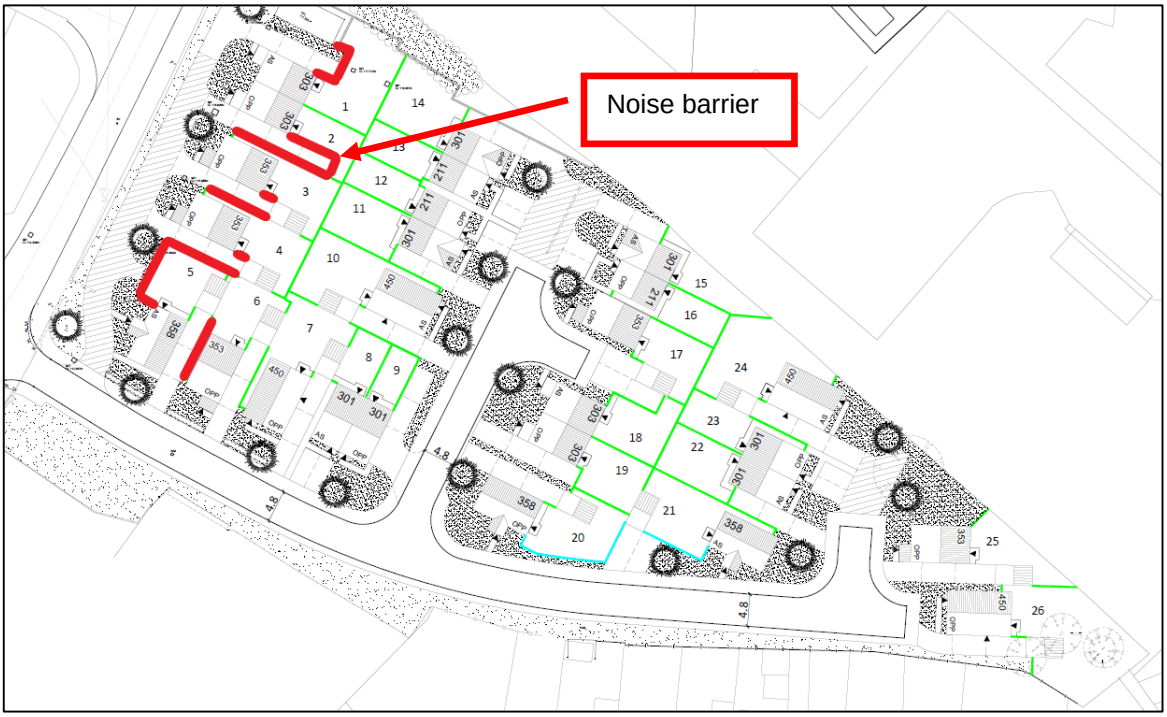
Table 4.2 – Predicted sound attenuation for a 1.8 metre high noise barrier

Frequency (Hz)	125	250	500	1000	2000	4000	L_{Aeq} dB
Source sound level L_{eq} dB	50	53	53	53	48	43	**56**
Barrier attenuation dB	6	7	9	11	13	16	---
Receptor sound level L_{eq} dB	44	46	44	42	35	27	**50**

4.64 The results indicate that approximately 6 dBA of sound attenuation can be achieved with an effective barrier and therefore the guideline values of 50 to 55 dB $L_{Aeq,T}$ can be achieved within the rear garden areas.

4.65 The boundary treatment plan in Figure 4.2 shows the recommended barrier location (barriers highlighted in red).

Figure 4.2 - Boundary treatment plan showing noise barriers



4.66 An effective barrier can be constructed from a close-boarded timber fence, a masonry/brickwork wall or from a combination of the two different materials (e.g. brick walls with pillars and infill timber panels).

4.67 The barrier should be imperforate, sealed at the base, sealed between panels (no gaps) and have a mass per unit area of at least 10 kg/m^2. Hit and miss fencing, slatted fencing, waney lap fencing and foliage do not make effective noise barriers.

4.68 If required, further guidance can be provided with regard to barrier construction in due course.

Noise from Shell petrol station pumps

4.69 The fuel pump generated a specific sound pressure level of 38 dB $L_{Aeq,60sec}$ at the development site boundary.

4.70 It was observed that an average family sized car takes approximately 60 to 90 seconds to fill the petrol/diesel tank.

4.71 For this assessment, it is considered prudent to assume that two vehicles may fill-up with fuel in succession during a given 15-minute night-time period (as is used for the assessment of night-time noise).

4.72 On this basis, the equivalent specific sound pressure level over 15-minutes is approximately 31 dB $L_{Aeq,3min}$ (taking into consideration circa 12 minutes of inactivity).

- 10 log (180sec/900sec) = -7 dB

4.73 From observations made on-site, it is prudent to apply a correction or penalty of +3 dB to the measured sound level to account for the features or characteristics of noise emanating from the petrol pumps.

4.74 On this basis, the corresponding sound 'rating' level is 34 dB $L_{Ar,15min.}$

4.75 The typical background sound pressure level was 30 dB $L_{A90,15min}$ during the night-time period.

4.76 The sound rating level of the pump slightly exceeds the typical night-time background sound level and therefore an adverse impact is expected at plot no's 5 to 9.

4.77 With regard to significance, BS 4142 states the following:

The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs.

4.78 The standard then states that a difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

4.79 Since the typical background sound pressure level was 50 dB $L_{A90,15min}$ during the daytime period, a negligible impact is anticipated during the daytime.

4.80 Generally, the overall level of noise and the tonal characteristics are considered unlikely to cause significant disturbance and/or annoyance to residents at the new development site.

4.81 Standard thermal double glazing is expected to provide sufficient sound insulation from the petrol station in terms of noise ingress through closed windows.

4.82 However, it is recommended that the rear elevation of plot no.5 and the front elevation of plot no's 6 to 9 have an alternative means of ventilation (i.e. in addition to opening windows).

4.83 As aforementioned, sound attenuating ventilator units should be installed to habitable rooms as a minimum mitigation measure.

4.84 However, it is considered that a mechanically ventilated system would provide better noise mitigation for plot no's 5 to 9. Ventilator units may not be required where such a system is installed.

4.85 Further guidance regarding ventilation and mitigation is provided in the following section.

5. Ventilation & Noise Mitigation Options

Acoustically rated ventilator units

5.1 Manually controlled trickle ventilators (the most common type of background ventilators) can be located over the window frames, in window frames, just above the glass or directly through the wall.

5.2 Sound attenuating ventilator units can be installed to habitable rooms, in order to allow background ventilation whilst maintaining a high sound insulation performance from the facade.

5.3 At this stage, it is recommended that the ventilator unit provides a sound insulation performance of at least 34 dB $D_{n,e,w}$ (in the open position). Further guidance regarding ventilator performance can be provided in due course.

5.4 Example manufacturers of acoustically-rated ventilator units include:

- www.aereco.co.uk/products-and-systems/
- www.greenwood.co.uk/acoustic
- http://brookvent.co.uk/product/airvent-sm-acoustic/

Mechanically assisted ventilation

5.5 A further option with regard to ventilating and cooling habitable rooms whilst achieving a high facade sound insulation would be to use a mechanical ventilation system, such as a heat recovery system (MVHR) or positive input ventilation system (PIV).

5.6 Example suppliers of MVHR and PIV systems include:

- www.nuaire.co.uk/residential/positive-input-ventilation
- www.envirovent.com/specifier/products/heat-recovery-systems/
- www.envirovent.com/specifier/products/positive-input-ventilation/
- www.greenwood.co.uk/range/5/heat-recovery-mvhr.html

5.7 Appropriate dwelling ventilation rates will depend on the number of bedrooms within the dwelling and the anticipated occupancy rate (refer to Approved Document F for guidance).

5.8 Such systems can also be supplied with a ‘boost’ function in order to reduce the need to open windows for purge ventilation.

5.9 With a loft mounted motor and control unit, particular attention should be paid to the construction of bedroom ceilings and the mounting of the motor unit in order to minimise the noise transmission into adjacent rooms. It is commonplace for a double-boarded ceiling construction and acoustically enhanced loft-hatch to be used where there is a loft mounted motor/control unit.

6. Conclusion

6.1 On the basis of the measured ambient sound pressure levels, an initial site noise risk assessment indicates that the proposed development site is Low Risk.

6.2 Standard thermal double glazing and traditional building envelope constructions will provide sufficient sound insulation for habitable rooms.

6.3 A suitable glazing construction would be 4 mm glass / 16 – 20 mm cavity / 4 mm glass. The unit should achieve a sound insulation performance of at least 29 dB R_w.

6.4 It is considered unnecessary to provide additional noise mitigation to habitable rooms such as installing acoustically laminated double glazing and/or thick heavy panes of glass.

6.5 An alternative means of ventilation should be provided to habitable rooms on the front elevation of plot no's 1 to 5. As a minimum mitigation measure, it is recommended that sound attenuating (acoustically rated) ventilator units are installed.

6.6 It is recommended that the rear elevation of plot no.5 and the front elevation of plot no's 6 to 9 also have an alternative means of ventilation. It is considered that a mechanically ventilated system would provide the best noise mitigation for these particular dwellings.

6.7 It is also recommended that sound attenuating ventilator units are installed to habitable rooms on the rear elevation of plot no's 6 to 9 and 10 to 14. Such units may not be required where a full mechanical system is installed (i.e. serving the whole house).

6.8 Alternative ventilation is considered unnecessary for all other dwellings (plot no's 15 to 26).

6.9 Predictions indicate that for an effective barrier approximately 1.8 metres high, the guideline values of 50 to 55 dB $L_{Aeq,16hour}$ can be achieved within rear garden areas.

Acoustic design statement

6.10 The dominant source of noise at the site is road traffic on Main Street. Significant increases in traffic flow are not expected in the immediate future and it is worth noting that the Government has banned the sale of new petrol and diesel cars in the UK from 2030.

6.11 Consequently, road traffic noise levels are expected to reduce slightly as the number of electrified vehicles increases (since engine and exhaust noise will gradually reduce) and therefore the noise levels experienced at the proposed development site are also expected to decrease slightly.

6.12 On the basis of the measured sound levels and site layout design, appropriate mitigation measures have been identified with respect to glazing, ventilation and garden areas.

6.13 The identified mitigation measures are not considered to be particularly onerous and are typical for residential developments adjacent to busy roads.

6.14 Changes to the site layout and changes to individual property layouts are considered unnecessary.

6.15 On the basis of the measured sound levels, the proposed site is considered suitable for residential development.

Appendix A

Proposed site layout, floor plans and elevations

Figure A.1 – Proposed site layout

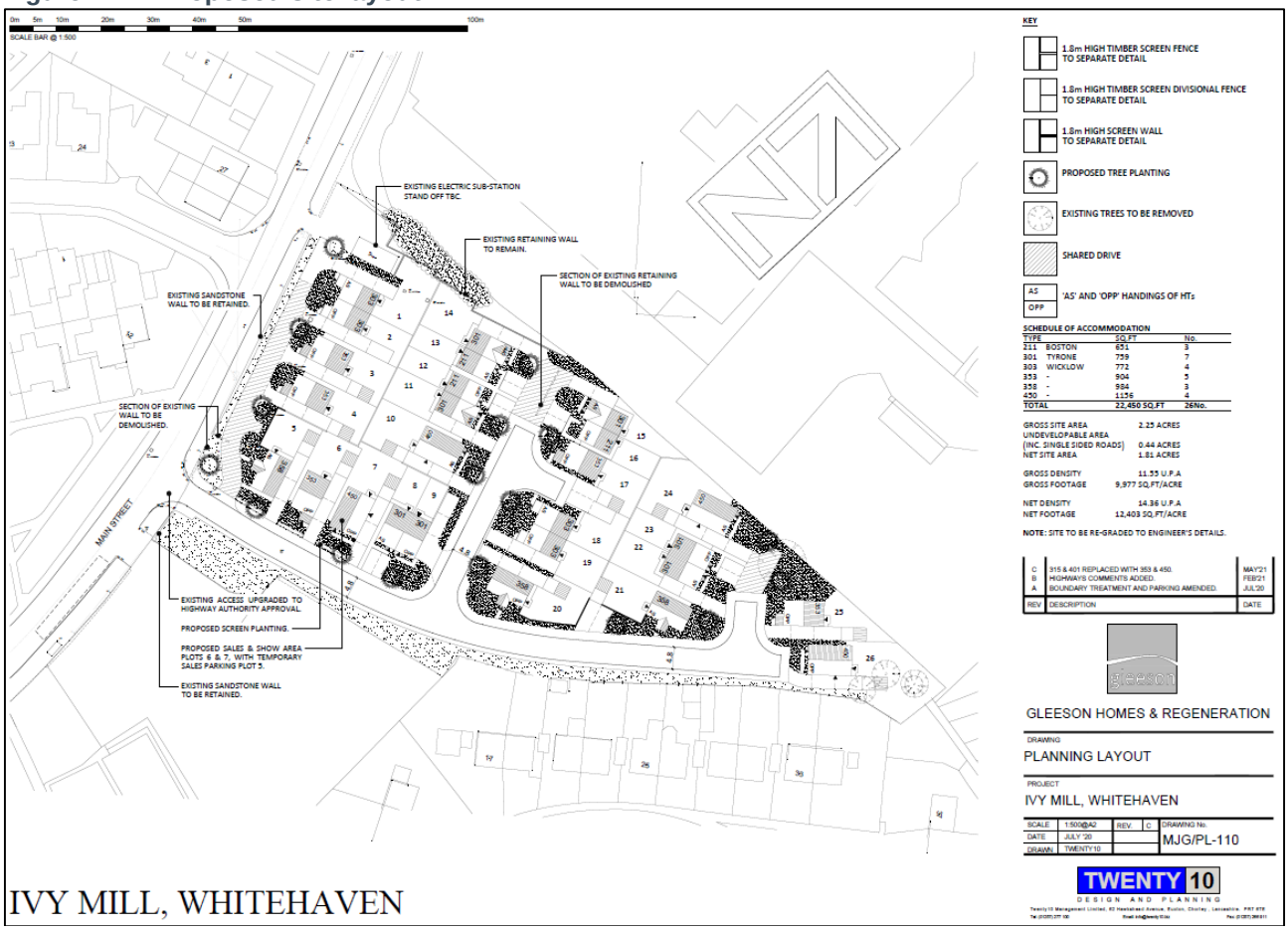
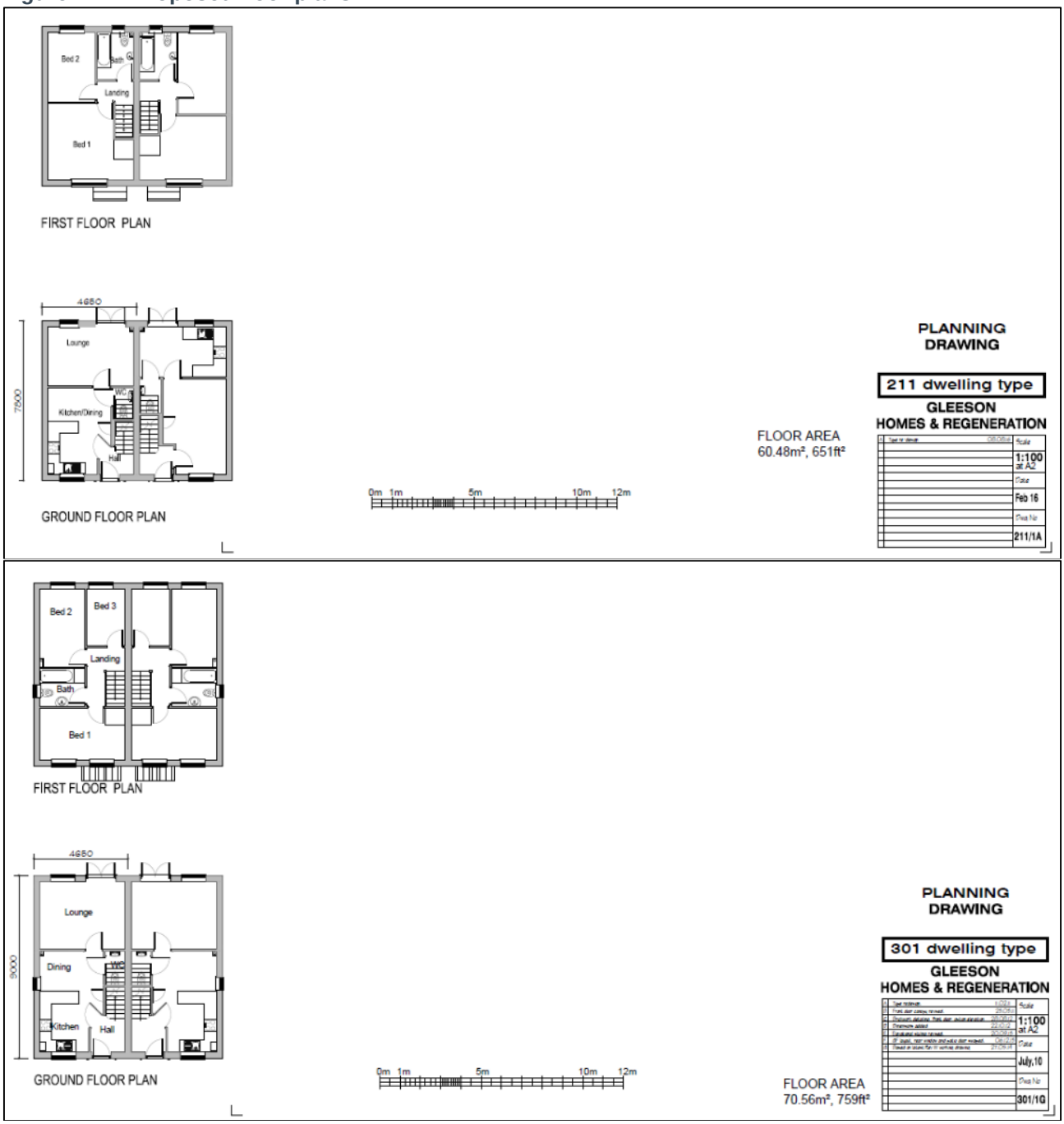
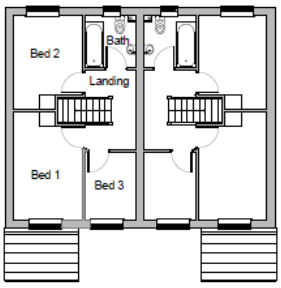
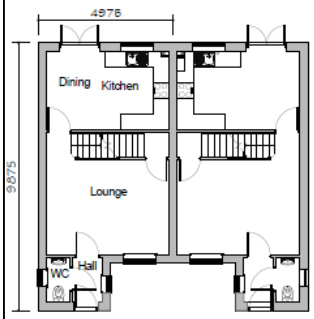


Figure A.2 – Proposed floor plans





FIRST FLOOR PLAN



GROUND FLOOR PLAN

0m 1m 5m 10m 12m

FLOOR AREA
71.71m², 772ft²

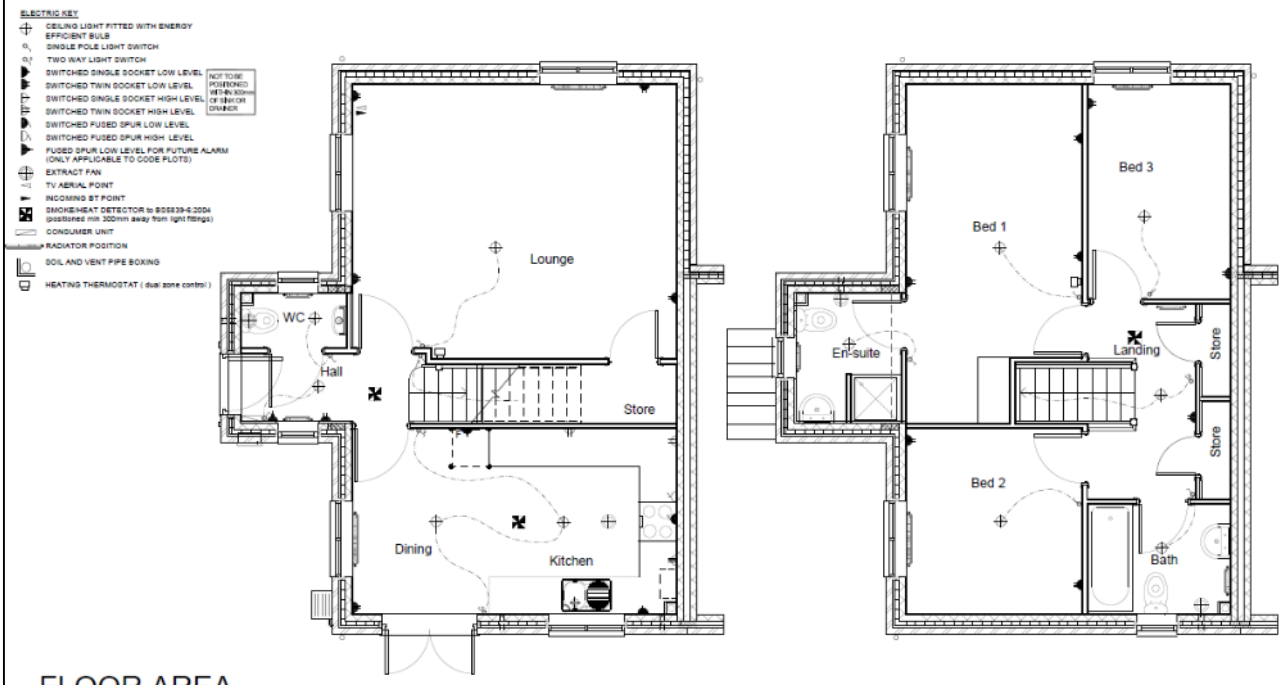
PLANNING DRAWING

303 dwelling type

GLEESON HOMES & REGENERATION

		Scale
		1:100 at A2
		Date
		July.10
		Dwg No
		303/1E

TYPE 358 (semi)
TYPE 359 (detached)

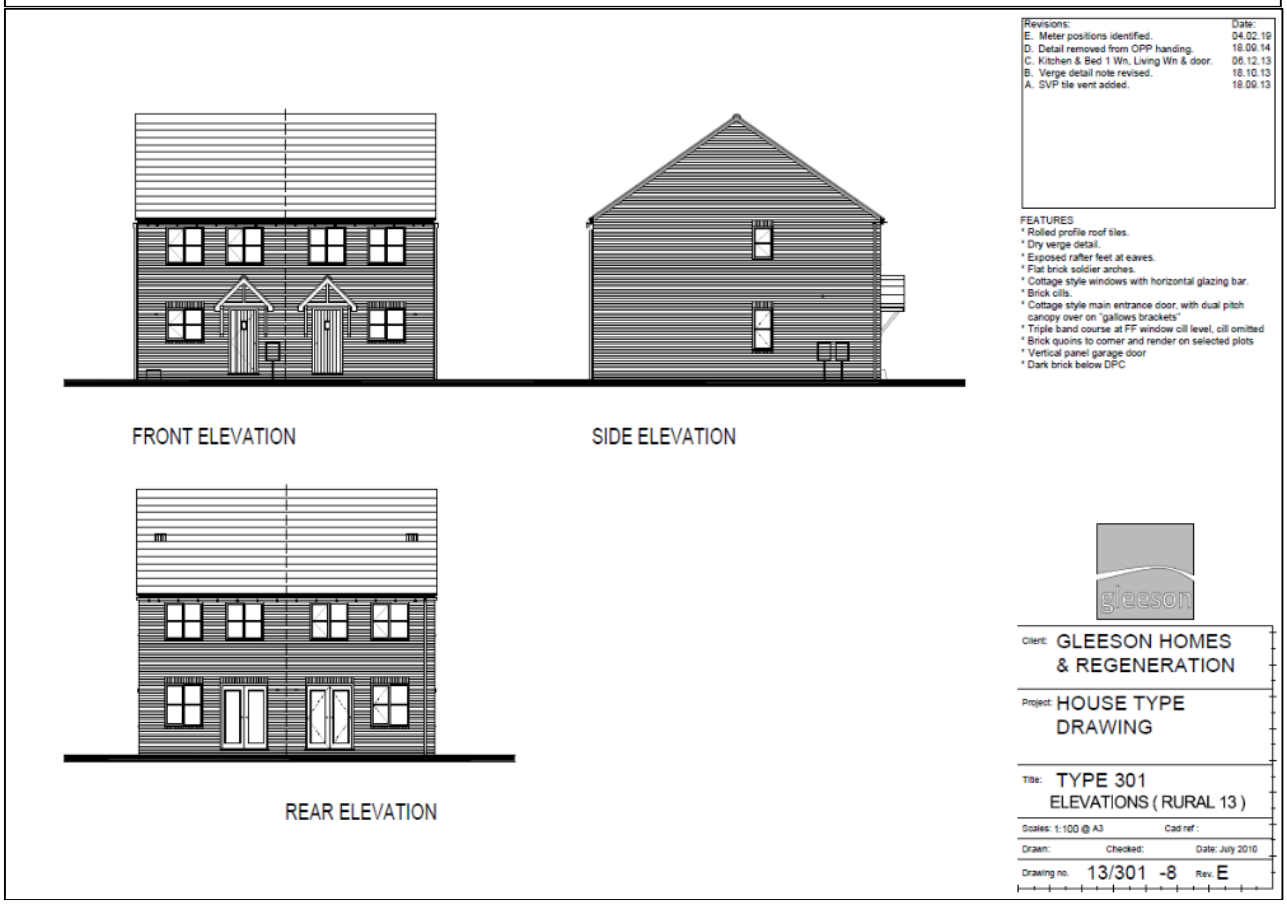


FLOOR AREA
91.44m², 984ft²

OPPOSITE HAND

issue 358/359A

Figure A.3 – Proposed elevations



FRONT ELEVATION

SIDE ELEVATION

REAR ELEVATION

Revisions:	Date:
F. Meter positions identified.	04.02.19
E. Kitchen window handed.	27.09.18
D. Airbrick note added.	01.06.15
C. Detail removed from OPP handing. Airbrick to lower roof	12.11.14
B. Verge detail note revised.	22.10.13
A. SVP tile vent added.	18.09.13

FEATURES
* Rolled profile roof tiles.
* Dry verge detail.
* Exposed rafter feet at eaves.
* Flat brick soldier arches.
* Cottage style windows with horizontal glazing bar.
* Brick cills.
* Cottage style main entrance door, with dual pitch canopy over on "gallows brackets"
* Triple band course at FF window cill level, cill omitted
* Brick quoins to corner and render on selected plots
* Vertical panel garage door
* Dark brick below DPC

gleeson

Client: GLEESON HOMES & REGENERATION

Project: HOUSE TYPE DRAWING

Title: TYPE 303 ELEVATIONS (RURAL 13)

Scales: 1:100 @ A3 Cad ref :

Drawn: Checked: Date: July 2010

Drawing no. 13/303 -9 Rev. F

FRONT ELEVATION

SIDE ELEVATION

REAR ELEVATION

Elevation when detached

SIDE ELEVATION

OPPOSITE HAND

Revisions:	Date:
A. Structural information added	26.06.20

FEATURES
* Rolled profile roof tiles.
* Dry verge detail.
* Exposed rafter feet at eaves.
* Flat brick soldier arches.
* Cottage style windows with horizontal glazing bar.
* Brick cills.
* Cottage style main entrance door, with dual pitch canopy over on "gallows brackets"
* Triple band course at FF window cill level, cill omitted
* Brick quoins to corner and render on selected plots
* Vertical panel garage door
* Dark brick below DPC

gleeson

Client: GLEESON HOMES & REGENERATION

Project: HOUSE TYPE DRAWING

Title: 358(semi) 359(detached) ELEVATIONS (RURAL 13)

Scales: 1:100 Cad ref :

Drawn: Checked: Date: Dec 2019

Drawing no. 13/358/359-9 Rev. B

Appendix B
Assessment terminology

Assessment 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 between the root-mean-square pressure of the sound field and a reference pressure ($2x10^{-5}$Pa).
dB(A)	The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq}, L_{A90} etc, according to the parameter being measured.
Acoustic environment	Sound from all sources as modified by the environment.
Ambient sound level	The totally encompassing sound in a given situation at a given time; it is usually composed of sound from many sources, near and far.
Equivalent continuous sound level - $L_{Aeq,T}$	The A-weighted equivalent continuous sound pressure level over a period of time, T. Representative of the 'average' sound pressure level over a given period (commonly used to describe the 'ambient' sound level).
Maximum sound level - $L_{AFmax,T}$	The A-weighted 'maximum' sound pressure level that occurred during a given period, T (commonly used for the assessment of intermittent loud noises).
Background sound level - $L_{A90,T}$	The sound pressure level that is exceeded for 90% of the measurement time interval, T. $L_{A90,T}$ is often used to describe the 'background' sound level.
Habitable room	Any room used or intended to be used for sleeping, cooking, living or eating purposes (enclosed spaces such as bath or toilet facilities, service rooms, corridors, laundries, hallways, utility rooms or similar spaces are excluded from this definition).
R_w	The weighted sound reduction index expressed in dB. A single number quantity for airborne sound insulation rating.
Free-field level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other significant reflective surfaces. Generally as measured outside and away from buildings (>3.5metres).