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YMCA, Welwyn Garden City

Environmental noise assessment for proposed residential flats and Hostel.

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Contents

1.0	Executive Summary	1
2.0	Introduction	1
3.0	Assessment methodology	3
4.0	Noise Survey	8
5.0	Predicted noise levels	10
6.0	Assessment	11
7.0	Conclusions	14
8.0	Glossary of terms	15
Appendices		
	Appendix A: Aerial view.....	
	Appendix B: Proposed site layout.....	
	Appendix C: Survey results	
	Appendix D: SoundPLAN Contours and Building envelope calculations	

1.0 Executive Summary

- 1.1 The proposal is to redevelop the existing buildings, currently comprising of flats, hostel rooms and offices. The new building will include the same uses with an altered layout. The proposal does not change the use of the site and it is understood that there has not previously been any known issues with either noise from surrounding uses or from noise emitted from the site.
- 1.2 The assessment of internal noise levels within the development and appropriate insulation values for façade constructions have been undertaken by comparing the rating level of sound from the industrial and commercial sound sources (where applicable) with internal criteria from BS8233:2014 (Guidance on sound insulation and noise reduction for buildings).
- 1.3 The example glazing and ventilation solution will ensure acceptable internal noise levels.
- 1.4 All garden areas would, overall, be within the guidelines set out in BS8233:2014 and the WHO Guidelines (World Health Organisation – Guidelines for Community Noise).
- 1.5 The criteria for fixed mechanical plant are as follows, this is in line with the NPPF (National Planning Policy Framework) and national policy:

"The rating level of noise emitted from all fixed plant and machinery shall not exceed the background sound level by more than 5dB when measured or calculated at 1 metre from the façade of the nearest noise sensitive property. The measurements and assessment shall be made according to BS 4142:2014."

Suggested rating noise level for mechanical servicing criteria

Day (0700 to 2300) - LAeq1hour	Night (2300 to 0700) - LAeq15min
41+5 = 46 dB	35 + 5 = 40 dB

- 1.6 The criterion above is in line with recommended Government Policy. The criteria recommended in the pre application response is not considered to be reasonable and is inconsistent with the advice of the NPPF on the avoidance of "significant" impacts.

2.0 Introduction

- 2.1 Sharps Gayler LLP (SGL) has been commissioned to provide an acoustic assessment relating to a redevelopment of a hostel and residential area on Peartree Lane, in Welwyn Garden City (YMCA - Young Men's Christian Association). This report will assess the sound insulation requirements of the building external envelope necessary to achieve appropriate internal noise level criteria.
- 2.2 Currently the site is used as a hostel/residential unit providing a home and support for local people who might be homeless.
- 2.3 The proposal is to redevelop the existing buildings, retaining the current usage but with an altered layout.
- 2.4 The area to north west is a large carpark area which appears to be a storage yard for the highway agency. To the north east is a vehicle repair workshops, including body work/respraying (daytime only). The

- remaining site boundaries are adjacent to residential uses. Peartree Lane is at the front of the development.
- 2.5 The proposed development is not to alter the use of the site in any way, simply to update and provide improved facilities. In relation to noise, therefore, the proposal does not bring about any areas for concern when compared to the existing situation.
- 2.6 This report provides details of an environmental noise survey undertaken to assess the existing noise climate at the rear and front of the site, including noise from commercial properties surrounding the site. This forms the basis of assessing the acoustic requirements of the building, in order to achieve acceptable internal noise levels and recognized noise criteria for residential/hostel use.
- 2.7 The follow advice has been given from the pre application:
- There is also the potential of noise pollution, due to the amount of traffic along Peartree Lane and from the neighbouring commercial/industrial units. This may result in detrimental harm upon the amenity of the proposed development. As a result, there may be a requirement for a specific noise insulation and ventilation scheme to comply with the noise levels found within BS8233 and to prevent overheating in the summer if residents need to keep windows closed to maintain reasonable internal noise levels. Outdoor amenity areas must meet the 55dB WHO Guidelines for Community Noise Level.*
- Please note, that in terms of the noise generated from the commercial/industrial units, levels seen by occupants as reasonable would be lower than that accepted for traffic noise. A full BS4142 assessment of noise from commercial/industrial premises which may impact on the proposed development would be required. In addition to this, if any new plant and equipment is to be installed, such as commercial kitchen extracts and air conditioning units, then these items will need to be 10dB below the background at the nearest residential properties (5dB if no tonality is present).*
- 2.8 An aerial view of the site is attached at Appendix A (showing survey locations) and a proposed site layout is attached at Appendix B.
- 2.9 Section 3.0 of this report discusses available guidance for the assessment of noise in relation to the proposed development.
- 2.10 Section 4.0 of this report sets out the findings of a noise surveys undertaken on the site.
- 2.11 Section 5.0 of the report summarises the predicted noise levels at the facades of the proposed development
- 2.12 Section 6.0 sets out the assessment in terms of BS4142 and the required sound insulation of the building envelope, BS8233.
- 2.13 Section 7.0 provides SGL's assessment conclusions.

3.0 Assessment methodology

National Planning Policy Framework (NPPF)

- 3.1 The NPPF, released on 24th July 2018 (and updated in February 2019), indicates (Paragraph 170 e)) 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, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability."

- 3.2 Paragraph 180 of the document advises that "Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life⁶⁰;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason...

⁶⁰ See Explanatory Note to the Noise Policy Statement for England (Department for Environment, Food & Rural Affairs, 2010)."

- 3.3 The NPPF cross refers to the explanatory notes of the Noise Policy Statement for England, discussed below, but does not provide prescriptive advice on how to achieve its principal objectives these being: reducing adverse impacts to a minimum and avoiding significant adverse impacts on health and quality of life. Therefore, it is necessary to also consider advice in other guidance documents.

The Noise Policy Statement for England (NPSE)

- 3.4 As can be seen above, footnote 60 of the NPPF refers to the Noise Policy Statement for England (NPSE), prepared by DEFRA, dated March 2010.
- 3.5 Paragraph 1.5 of the NPSE states that it applies to all forms of noise including environmental noise, neighbour noise and neighbourhood noise. In this respect the document is similar to the World Health Organisation (WHO) "Guidelines for Community Noise" – discussed below.
- 3.6 The NPSE explains that the WHO defines health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (NPSE paragraph 2.12).
- 3.7 The "Noise Policy Aims" of the NPSE (NPSE paragraphs 2.22 to 2.24) can be summarised as follows:
- 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.

- 3.8 The NPSE makes a distinction between “quality of life”, which is a subjective measure, and “health”, which refers to physical and mental well-being.
- 3.9 Impacts that may result from noise such as “annoyance” and “sleep disturbance” are both quality of life and health effects in this sense.
- 3.10 The NPSE introduces the concepts of the “no observed effect level” (NOEL); the “lowest observed adverse effect level” (LOAEL) and a “significant observed adverse effect level” (SOAEL).
- 3.11 It is the last of these criteria – the SOAEL – that is the level above which significant adverse effects on health and quality of life occur that equates to the “first aim of the NPSE” paragraph 2.6 above) and the first objective of the NPPF (paragraph 2.1 above).
- 3.12 The “second aim of the NPSE” is to mitigate and minimise adverse impacts between LOAEL and SOAEL.
- 3.13 The NPSE does not provide noise levels or limits above which SOAEL occurs. Indeed, the document advises that it is not possible to have a single objective noise-based measure that defines SOAEL (NPSE paragraph 2.22). Therefore, it is necessary to refer to other advisory documents in order to seek to define such levels. These are discussed below.

National Planning Practice Guidance (NPPG)

- 3.14 The NPPG was released on 6th March 2014 and was last updated on the 24th July 2018.
- 3.15 This document reinforces the concept of NOEL, LOAEL and SOAEL and defines a person’s perception at these different effect levels.
- 3.16 It is notable that the NPPG describes the NOEL as “noise can be heard, but does not cause any change in behaviour or attitude”, whereas at a LOAEL “noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly...” The former is described as “noticeable and not intrusive” whereas the latter is described as “noticeable and intrusive”.
- 3.17 A “significant” effect is described as “noticeable and disruptive” resulting in “a material change in behaviour and/or attitude...”
- 3.18 The NPPF, NPSE and NPPG do not ascribe noise levels to any of the effects discussed within the documents. Therefore, it is necessary to consider other guidance which attributes noise levels to health effects such as annoyance during the day or sleep disturbance at night.

World Health Organisation – Guidelines for Community Noise (WHO)

- 3.19 This document contains the most comprehensive and up to date guidance on the assessment of environmental noise.
- 3.20 The WHO Guidelines are particularly applicable in relation to the NPPF, NPSE and NPPG advice since it considers impact in terms of health effects (health being defined in its widest sense) - including

- annoyance during the day (defined as 0700 to 2300 hours) and sleep disturbance at night (defined as 2300 to 0700 hours).
- 3.21 The WHO Guidelines contain a matrix of “guideline values” for effects from noise within different environments. These guideline values are set at the lowest level that produces an adverse effect, that is, the “critical health effect”. As such the values suggested in the Guidelines are thresholds below which effects such as annoyance can be assumed to be negligible. As such the WHO guideline values are equivalent to the NPSE LOAEL.
- 3.22 Unfortunately, the WHO Guidelines do not provide advice as to what constitutes a “significant” effect; it is necessary to consider other guidance in this respect. This is discussed at paragraphs 2.25 and 2.26 below.
- 3.23 The WHO guideline values for moderate and serious annoyance during the daytime are LAeq16hrs = 50 and 55 dB, respectively. The WHO guideline values for night are LAeq8hr = 45 dB and LAMAX = 60 dB.
- 3.24 The WHO guideline values for day can be considered to be either facade levels (when assessing effects inside dwellings) or free-field levels (when assessing effects in gardens). The WHO guideline values for night are façade levels (i.e. outside bedroom windows).
- 3.25 The 2018 publication of the WHO Environmental Noise Guidelines for the European Region supersedes the Community Noise Guidelines (CNG) from 1999. However, the document makes clear that “*all CNG indoor guideline values and any values not covered by the current guidelines (such as industrial noise and shopping areas) should remain valid.*” The 2018 document addresses, individually, environmental noise from road traffic, railways and wind turbines, and individual exposure to leisure noise. As such, the advice in the 1999 CNG remains valid for many other noise sources, and for sound levels inside.

BS 8233:2014

- 3.26 BS 8233:2014 “Guidance on sound insulation and noise reduction for buildings” is specifically aimed at the acoustic design of new or refurbished buildings - residential and other noise sensitive properties. It provides guideline values for living areas and bedrooms and for external amenity areas such as gardens. The BS 8233 guideline values were based on the WHO guideline values, discussed above.
- 3.27 Table 4 of the standard provides “desirable” internal guideline values as shown in Table 1 below:

Table 1 BS 8233 guideline values

Activity	Location	07:00 to 23:00 hrs	23:00 to 07:00 hrs
Resting	Living Room	35 dB LAeq16hour	-
Dining	Dining room/area	40 dB LAeq16hour	-
Sleeping (daytime resting)	Bedroom	35 dB LAeq16hour	35 dB LAeq8hour

- 3.28 The BS 8233 “desirable” guideline values are most closely aligned with LOAEL values. The above guideline values apply to noise that is steady and without a particular character.

3.29 The advice at paragraph 7.7.3.2 of the standard is as follows:

"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 LAeq,T, with an upper guideline value of 55 dB LAeq,T which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land 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."

British Standard 4142:2014

3.30 This fourth edition of the British Standard was published in October 2014. It is entitled "Methods for rating and assessing industrial and commercial sound".

3.31 The Scope of the standard includes:

"1.1 This British Standard describes methods for rating and assessing sound of an industrial and/or commercial nature, which includes: a) sound from industrial and manufacturing processes; b) sound from fixed installations which comprise mechanical and electrical plant and equipment; c) sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and d) sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site." (emphasis added)

3.32 It can be seen that this standard is appropriate for the assessment of noise from deliveries and any mechanical plant associated with the development onto the existing sensitive receivers.

3.33 The standard assesses the likely impact from a proposed scheme by considering the difference between the "rating level" of the sound being assessed with the "background sound level" of the area.

3.34 The noise source is assessed in terms of the LAeqT statistical index – in effect the average sound energy level (see the Glossary at Section 8.0 below for a description of this index). During the day (defined as 0700 to 2300 hours), the LAeqT level must be normalised to 1 hour (i.e. LAeq1hr). BS 4142 terms this level the "specific sound level".

3.35 The specific sound level is then corrected by given decibel factors for any impulsiveness, tonality, intermittency or other character that may attract attention. These different character corrections are additive. BS 4142 calls the resultant, corrected level the "rating level".

3.36 BS4142:2014 provides an initial indication as to the likely impact on existing residents and the effects of the noise. In the case of proposed future receptors that do not exist yet, a comparison with background method has limited value.

- 3.37 However, both BS8233:2014 (para 6.5.2) and BS4142:2014 (para 1.2 3)) require that for industrial and commercial sound, the "rating level" of the noise is determined. Once the rating level has been determined, the glazing specification can be properly assessed (i.e. by comparing the rating level with the BS8233 guideline values for internal spaces). This is the approach taken to industrial noise in the assessment that follows.

Summary of assessment criteria to be employed

- 3.38 The assessment of internal noise levels within the development and appropriate insulation values for façade constructions have been undertaken by comparing the rating level of sound from the industrial and commercial sound sources (where applicable) with internal criteria from BS8233:2014.

4.0 Noise Survey

- 4.1 The environmental noise survey was carried out from 30th August to the 3rd September 2019 to determine the existing noise levels at the site at the rear and the front of the site, see aerial view for locations.
- 4.2 These measurements were taken continuously over the survey period. The external microphones were fitted with an integrated outdoor weather kit and wind shield. Measurement locations are shown at Appendix A.
- 4.3 Measurements were made in 15-minute periods and were made using Norsonic 140 sound level meters. The meters used are of Class 1 type and were field checked for calibration before and after the measurements.
- 4.4 The weather, during the survey, was good and did not affect the measurements. The meters allow simultaneous measurements of noise levels both in overall dBA values and frequency selective octave bands over predetermined time periods, using various measurement parameters. The Leq, L90 and LMAX noise levels were recorded in overall dBA values together with octave band levels.
- 4.5 For information purposes it can be noted:
- dBA is the sound level in decibels (dB) measured by the sound level meter with the A-weighting.
 - The A-weighting is a filter applied to the sound level meter to simulate the frequency response of the human ear, which is more sensitive to high frequency sound than low.
 - Leq is the equivalent continuous noise level which is a method of averaging the varying noise level over the time period into a single figure value. The Leq has the same sound energy as the fluctuating level over that period.
 - LMAX is the highest level within the measurement period.
 - L90 is the noise level exceeded for 90% of the time and is referred to as the background noise level.
- 4.6 The daytime LAeq,12Hr, evening LAeq,4Hr and night-time LAeq, 8Hr and LAMAX levels at each measurement location are shown in the following tables.

Established External noise Levels at front of the development (overlooking Peartree Lane)

Duration	dB				
	LAeqT	LAFMAX	LA10	LA50	LA90
Friday 30 th Aug - Day (0700 -1900)	58.1	84.7	61.9	54.6	47.9
Saturday 31 st Aug - Day (0700 -1900)	57.7	90.3	61.4	52.2	43.7
Sunday 1 st Sept - Day (0700 -1900)	57.2	89.5	60.7	50.6	42.6
Monday 2 nd Sept - Day (0700 -1900)	59.0	85.9	62.9	55.3	48.4
Tuesday 2 nd Sept - Day (0700 -1900)	59.3	82.8	63.1	55.0	47.1

Friday 30 th Aug - Evening (1900 - 2300)	55.2	81.8	59.3	46.7	40.2
Saturday 31 st Aug - Evening (1900 - 2300)	54.3	75.6	58.3	47.3	41.5
Sunday 1 st Sept - Evening (1900 - 2300)	56.6	91.1	58.3	46.6	40.4
Monday 2 nd Sept - Evening (1900 - 2300)	54.8	78.8	58.8	48.1	41.4
Friday 30 th Aug - Night (2300 - 0700)	49.7	80.4	48.9	37.3	34.1
Saturday 31 st Aug - Night (2300 - 0700)	46.1	72.4	44.1	37.3	34.7
Sunday 1 st Sept - Night (2300 - 0700)	51.1	82.8	50.9	38.5	34.9
Monday 2 nd Sept - Night (2300 - 0700)	50.8	85.6	49.7	38.0	34.1

Established External noise Levels at rear of the development

Duration	dB				
	LAeqT	LAFMAX	LA10	LA50	LA90
Friday 30 th Aug - Day (0700 -1900)	62.2	90.0	61.5	52.9	46.2
Saturday 31 st Aug - Day (0700 -1900)	49.5	75.9	51.4	47.1	44.0
Sunday 1 st Sept - Day (0700 -1900)	49.3	80.1	50.9	46.2	43.3
Monday 2 nd Sept - Day (0700 -1900)	57.1	94.9	60.0	53.6	48.5
Tuesday 2 nd Sept - Day (0700 -1900)	61.4	88.6	63.6	56.6	50.1
Friday 30 th Aug - Evening (1900 - 2300)	46.0	68.1	47.2	44.3	42.4
Saturday 31 st Aug - Evening (1900 - 2300)	47.8	69.5	50.1	45.0	43.0
Sunday 1 st Sept - Evening (1900 - 2300)	47.3	70.7	50.0	44.6	42.3
Monday 2 nd Sept - Evening (1900 - 2300)	47.9	74.7	50.3	46.4	43.1
Friday 30 th Aug - Night (2300 - 0700)	44.7	73.2	45.6	40.3	37.6
Saturday 31 st Aug - Night (2300 - 0700)	46.4	76.4	47.2	41.4	37.9
Sunday 1 st Sept - Night (2300 - 0700)	46.6	71.2	51.4	41.8	38.2
Monday 2 nd Sept - Night (2300 - 0700)	50.0	86.6	48.0	41.1	36.9

- 4.7 In addition to the above measurements, a sample of peak activity from the highway agency carpark/storage area has been extracted from the long-term survey. It is noted that that there was no sign of any major activity during the evening and night periods other than this sample.

Period	LAeqT	Correction
Max activity over measurement period (1 hour)	65.7	
Typical day (from overall measurements)	55.9	9.8
Typical evening (from overall measurements)	47.3	18.5
Typical night (from overall measurements)	46.9	18.8

4.8 The typical measured background noise levels have been calculated as follows:

Typical background noise level – BS4142 assessment

Location	Duration	Typical LA90
Rear	Day	46
Front	Day	41
	Night	35

4.9 Full survey results can be seen in Appendix C.

5.0 Predicted noise levels

5.1 Although the measured noise levels give the typical noise levels at the edge of the façade. A computer noise model has been produced to calculate the resultant noise levels at the façade of the entire proposal. The SoundPLAN models are shown in Appendix D.

5.2 The computer model has assumed the following:

- Road traffic on Peartree Lane to match the measured noise levels during a weekday (traffic levels not available)
- Noise from the road/storage area to use as typical noise levels for BS8233 assessment
- Noise from the storage/car workshop (maximum 1 hour measured noise levels) used for BS4142 assessment
- Noise source levels from car workshops generated from similar sites, this occurs during daytime only (used in both BS4142 and BS8233 assessment)

5.3 The dominant noise source is from Peartree Lane, with very occasional noise from the car workshops and storage area.

5.4 The predicted noise levels on each façade are as follows:

Predicted noise Levels (façade level) at windows of development – BS8233 assessment

	LAeq12hour	LAeq4hour	LAeq8hour
Facing Peartree Lane	62	59	55
Facing car workshops	55	47	47
Facing Highway agency storage/carpark area	56	43	39

5.5 The predicted noise levels at the windows of the proposed flats from industrial noise is as follows (BS4142 assessment).

Predicted noise Levels (façade level) at windows of development – BS4142 assessment

Location	LAeqT
Facing Peartree Lane	46
Facing car workshops	56
Facing Highway agency storage/carpark area	66

5.6 It should be noted that these noise levels represent the maximum noise measured over the day period from industrial type noise, as in accordance with BS4142.

6.0 Assessment

BS4142

6.1 In determining suitable plant noise criteria at the nearby sensitive receivers Sharps Gayler LLP have considered the measured background sound levels taken during the noise survey. To prevent any adverse impacts on the health and quality of life of existing noise sensitive receptors, the “rating noise level” (the predicted noise level plus any penalty for character), should not exceed the typical measured daytime and night time background sound level by more than 5 dB.

6.2 However, during the pre-application the follow condition was suggested:

Please note, that in terms of the noise generated from the commercial/industrial units, levels seen by occupants as reasonable would be lower than that accepted for traffic noise. A full BS4142 assessment of noise from commercial/industrial premises which may impact on the proposed development would be required. In addition to this, if any new plant and equipment is to be installed, such as commercial kitchen extracts and air conditioning units, then these items will need to be 10dB below the background at the nearest residential properties (5dB if no tonality is present).

6.3 This criterion, which would result in situation very much below the “no effect” level, is not therefore consistent with the NPPF to avoid significant adverse impacts and mitigate and minimise other adverse impacts.

6.4 A summary of the measured background sound levels is shown below.

Summary of surveyed background sound level for mechanical plant noise criteria

Day (0700 to 2300) - Typical LA9015min	Night (2300 to 0700) - Typical LA9015min
41 dB	35 dB

6.5 The criterion suggested by SGL as reasonable in the context of the NPPF can be secured by a suitably worded planning condition as suggested below:

"The rating level of noise emitted from all fixed plant and machinery shall not exceed the background sound level by more than 5dB when measured or calculated at 1 metre from the façade of the nearest noise sensitive property. The measurements and assessment shall be made according to BS 4142:2014."

Suggested rating noise level for mechanical servicing criteria

Day (0700 to 2300) - LAeq1hour	Night (2300 to 0700) - LAeq15min
41+5 = 46 dB	35 + 5 = 40 dB

BS4142 - Proposed residential

6.6 It is considered that the conventional use of BS4142 is not appropriate in this circumstance. This is because it is not possible to conclude the impact on existing receptors if they are not there yet. It is also logical that the conclusion of any conventional BS4142 assessment would always conclude an "adverse impact".

6.7 This is true in this case as the typical background noise level, during the day, is LA90 = 46. The measured worst case 1hour period at the rear (carpark/storage area) over the survey period was calculated as LAeqT = 63 dB (free field level), this event only happened once during the whole data set.

6.8 It is considered that the specific sound features characteristics that are neither tonal nor impulsive, nor intermittent, though otherwise are readily distinctive against the residual acoustic environment, therefore a penalty of 3 dB should be applied.

6.9 The resultant rating level is LAeqT = 66 dB. This would result in a rating level difference against the background sound level of some 20 dB.

6.10 Paragraph 8.5 of BS4142 states the following:

Introduction of a new noise-sensitive receptor

Measure the background sound at the intended location of any new noise-sensitive receptor(s) in the absence of any specific sound.

NOTE Where a new noise-sensitive receptor is introduced and there is extant industrial and/or commercial sound, it should be recognized that the industrial and/or commercial sound forms a component of the acoustic environment. In such circumstances other guidance and criteria in addition to or alternative to this standard can also inform the appropriateness of both introducing a new noise-sensitive receptor and the extent of required noise mitigation.

- 6.11 Therefore, it is proposed, as discussed above that the rating noise level should be used in accordance with BS8233 to ensure internal noise guideline levels are met.

Façade design

- 6.12 The proposed residential layout is shown in Appendix B.
- 6.13 The predicted noise levels are set out above.
- 6.14 Therefore, the worst-case noise levels at the façade of the properties are LAeqT = 66dB for daytime and LAeqT = 55dB at night. These are expressed in terms of a façade noise level.
- 6.15 An example of a façade build-up with the associated acoustic performance of the typical elements is expressed below in terms of Sound Reduction Index (R/Dn) in octave bands.

Example - construction partition performance R/Dn, dB

Partition	Octave band centre frequency Hz						
	63	125	250	500	1k	2k	4k
SAINT-GOBAIN – 6mm/12mm/8mm*	20	23	23	30	39	36	43
Brick/Block cavity	41	41	45	45	54	58	58
TrimVent S16	30	32	34	37	34	34	34

*reduction required for whole window system including frame and fitting

- 6.16 Full calculations are shown in Appendix D.
- 6.17 In summary, with the example construction set out above, the internal noise levels would be:

Day 0700-1900 hours	Night 2300-0700 hours
LAeq, 12 hour, dB	LAeq, 8 Hour, dB
34.9 (limit = 35)	21.9 (limit = 30)

- 6.18 Further advice can be given when specific designs are finalised.
- 6.19 The above octave band sound insulation values should be treated as a minimum requirement.
- 6.20 The internal noise levels will be exceeded whilst windows are open, however this is only for relatively short periods of time. The measured noise levels show that the general noise level at the rear are quiet.

Internal Noise Levels

- 6.21 It is concluded that with the construction methods set out above would result in internal noise level below the limits set-out in BS8233:2014 with standard construction methods. This is with windows closed.
- 6.22 If windows are open, then there would a general reduction of 15 dB through a partial open window. It is not reasonable to expect that the BS8233 internal noise levels should be met with windows open. There is a degree of "choice" if someone would prefer to have the windows open, providing more ventilation but be subjected to higher internal sound levels. Therefore, it is recommended that if the internal noise level, with windows open, consistently exceed the BS8233 values by more than 10 dB alternative ventilation should be supplied. This does not occur within the development.

Amenity areas

- 6.23 The predicted LAeq16hr daytime noise level, within the amenity area (garden) is within the BS8233:2014 values of LAeq16hr = 50 to 55 dB. Therefore, serious annoyance during the day would be negligible and at a "low observed adverse effect level" within these spaces.

7.0 Conclusions

- 7.1 Internal noise level criteria have been proposed in line with the standards set out in BS 8233:2014 (assessed using a rating noise level as per BS4142) and the World Health Organisation Guidelines. Calculations of internal noise levels have been undertaken, assuming above construction methods.
- 7.2 Measurements and calculations have shown that the internal criteria proposed will be achieved with the recommended mitigation measures in place.
- 7.3 The glazing and ventilation solution will ensure acceptable internal noise levels.
- 7.4 All garden areas would, overall, be within the guidelines set out in BS8233:2014 and the WHO Guidelines.
- 7.5 The criteria for fixed mechanical plant are as follows, this is in line with the NPPF and national policy:

"The rating level of noise emitted from all fixed plant and machinery shall not exceed the background sound level by more than 5dB when measured or calculated at 1 metre from the façade of the nearest noise sensitive property. The measurements and assessment shall be made according to BS 4142:2014."

Suggested rating noise level for mechanical servicing criteria

Day (0700 to 2300) - LAeq1hour	Night (2300 to 0700) - LAeq15min
41+5 = 46 dB	35 + 5 = 40 dB

8.0 Glossary of terms

Ambient noise: The all encompassing sound associated with a given environment at a specified time, being usually a composite of sound from many sources, near or far.

A weighting: A frequency response provided in a sound level meter which reflects the sensitivity of human hearing to different frequencies.

A-weighted sound level: The sound level (otherwise known as sound pressure level) obtained by use of A-weighting. Decibel unit is dB. Often, the unit symbol is followed by the letter A in round brackets, i.e. dB(A).

Background noise level (bnl): The total level of noise from all other sources other than the particular source of interest. The index symbol is L90. In BS 4142 the bnl is described as "The a-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90% of a given time interval, T, measured using time weighting, Fast, and quoted to the nearest whole number of decibels".

This index is denoted LA90.

Decibel: A unit of level which denotes the ratio between two quantities that are proportionate to power; the number of decibels is 10 times the logarithm of this ratio. One decibel is one tenth of a Bel. Unit symbol for decibel: dB.

Equivalent continuous sound level: The level of a steady sound which, in a stated time period, has the same sound energy as the time-varying sound. The index symbol is LeqT. When A-weighted the symbol becomes LAeqT with the unit symbol being dB (Note: Alternatively LeqT dB(A)).

Facade noise level: The sound level at a facade (usually taken to be 1 metre from the facade (see for example BS 4142)). A facade level is taken to be 3 dB higher than the level in the absence of the facade (i.e. the equivalent free-field level) although "Calculation of Road Traffic Noise" assumes a 2.5 dB difference.

Free-field: A sound field in a homogeneous isotropic medium whose boundaries exert a negligible influence on the sound waves. In practice, a field in which the effects of the boundaries are negligible over the frequencies of interest. Often taken to be > 3.5 metres from a building facade (ref: BS 4142).

Frequency: Of a function periodic in time, the number of times the quantity repeats itself in one second. The unit of frequency is the hertz (Hz) with 1 hertz = 1 cycle per second.

Frequency weighted sound level: The root-mean-square of the instantaneous sound (pressure) level, time weighted (slow, fast, impulse or peak) and frequency-weighted with a standard frequency characteristic (the most often used being "A-weighting").

Maximum A-weighted sound level: The greatest A-weighted sound level measured on a sound level meter during a designated time interval or event. The time averaging is usually "fast" but can sometimes be "slow" (e.g. PPG 24 and measurement of aircraft noise).

Noise: Any undesired or unwanted sound.

Octave band sound level: The sound (pressure) level within an octave frequency band. Octave band centre frequencies include: 31.5 Hz, 63 Hz, 1125 Hz, 250 Hz, 500 Hz, 1000 Hz (otherwise shown as 1 KHz), etc.

Sound Reduction Index - R: laboratory measure of the sound insulating properties of a material or building element in a stated frequency band.

Sound Reduction Index - Rw: single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies.

Sound Reduction Index - Dnt: difference in sound level between a pair of rooms, in a stated frequency band, normalized to a reference reverberation time of 0.5 s for dwellings.

Sound Reduction Index - Dntw: single-number quantity that characterizes the airborne sound insulation between rooms.

Appendices

Appendix A: Aerial view

Appendix B: Proposed site layout

Appendix C: Survey results

Appendix D: SoundPLAN Contours and Building envelope calculations