HOARE LEA

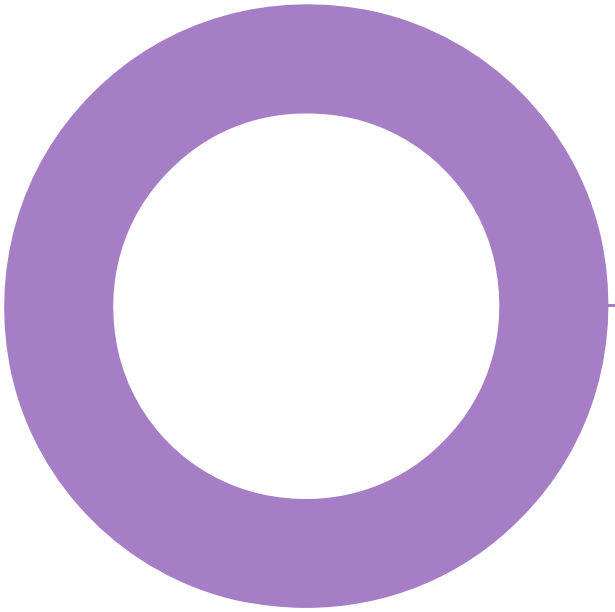
Chineham Park - Lindenwood. Chineham.

Frasers Property UK.

ACOUSTICS

NOISE ASSESSMENT REPORT

REVISION 01 – 07 DECEMBER 2023



Audit sheet.

Rev.	Date	Description of change / purpose of issue	Prepared	Reviewed	Authorised
01	15/12/2023	For issue.	LY	TH	TH

Project number: 10/15138
Document reference: REP-1015138-5A-LY-20231215-Noise Assessment Report-Rev1.docx

Contents.

Executive summary.

Hoare Lea has conducted an environmental noise survey for the proposed development at Lindenwood Chineham Park.

The following summarises the assessment procedure and findings contained within this report:

- Environmental noise monitoring was undertaken on a representative location of the proposed development site over a typical five-day period between Thursday 23rd March 2023 and Tuesday 28th March 2023. Measurements were also undertaken on Tuesday 28th November 2023 as a validation of the measurements conducted in March 2023.
- Background noise levels typical of the daytime and night-time have been measured and used to defined building services plant noise emission limits at the nearest noise sensitive receptors.
- The nearest receptors have been identified as existing residential dwellings along Aghemund Close and Meadowland.
- During the daytime and night-time, the combined building services plant noise emission contribution limit advised is 39 dB(A) and 35 dB(A) respectively, one metre from the nearest residential façade.
- The total building services noise emissions shall also not exceed 45 dB(A) at one metre from an office façade with opening windows and 60 dB(A) with a sealed façade. This assumes a partially opened window provides a 10 dB(A) noise reduction and a sealed façade will provide a minimum noise reduction of 25 dB(A).
- An assessment of the building envelope acoustic performance is provided and indicates that the ventilation strategy should allow for full mechanical ventilation of all spaces as the level differences required are above those achievable by simple means of natural ventilation. Windows may be openable for purge ventilation.
- Indicative acoustic façade requirements have been provided for guidance purposes only.

1. Introduction.

Hoare Lea LLP has been appointed by Frasers Property UK to conduct an environmental noise survey in support of the planning application for the Lindenwood site in Chineham Park. The planning application comprises the redevelopment of the site to provide a commercial development containing a mixture of office and warehouse/distribution spaces. The proposal will also include the installation of new mechanical services plant.

An environmental noise survey is required to quantify the existing ambient and background noise levels at the site in order to establish the design constraints on noise emissions from the operation of plant. The noise survey will also provide information required to establish the acoustic performance of the building façade and ventilation strategy to ensure that the office accommodation is in accordance with any Local Authority requirements and current guidance.

This report provides a description of the results from the noise survey undertaken, an assessment to determine the external noise limits for building services plant and advice regarding the building envelope and ventilation strategy.

To aid in the understanding of the assessment, definitions of technical terms used have been included in Appendix A.

2. Site description.

2.1 Existing site.

The proposal is to create a light industrial development located to the north and west of Chineham Park.

The surrounding buildings are all commercial in nature, including offices as well as industrial units. The nearest residential properties are located on Aghemund Close and Meadowland at least 450 metres away from the southeast boundary of the site.

The proposed site (indicative only) and nearest residential properties are identified in Figure 1 below.

Figure 1: Site location plan and nearest residential properties

2.2 Local noise environment.

The surrounding noise climate is predominantly formed of road traffic noise from the immediate road network around the site, in particular vehicles (including commercial vehicles) using Crockford Lane.

Daytime noise activities within the vicinity of the proposed development were observed to include the following:

- Vans and heavy goods vehicles serving the distribution depots in the vicinity;
- Plant noise from adjacent commercial units:
- Vehicle movements on the adjacent Crockford Lane;
- Distant railway pass-by's; and
- Occasional overhead aircraft.

3. Policy and guidance.

3.1 National policy.

3.1.1 Noise Policy Statement for England.

Noise Policy Statement for England (NPSE) (1) advises that noise impacts should be assessed on the basis of adverse and significant adverse effect but does not provide any specific guidance on assessment methods or numerical noise limits.

Paragraphs 2.20 and 2.22 of NPSE introduce the concepts summarised in Table 1, which can be applied when considering the significance of noise impacts, as defined by the World Health Organization.

Paragraph 2.15 of the document advises that it is not possible to have *'a single objective noise-based measure that is... applicable to all sources of noise in all situations*'. NPSE further advises in paragraph 2.22 that the sound level at which an adverse effect occurs is likely to be '*different for different noise sources, for different receptors at different times*'.

Effect Level	Description
No Observed Effect Level (NOEL)	This is the noise 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.
Lowest Observed Adverse Effect Level (LOAEL)	This is the level above which adverse effects on health and quality of life can be detected.
Significant Observed Adverse Effect Level (SOAEL)	This is the level above which significant adverse effects on health and quality of life occur.

Table 1: NPSE observed effect levels.

3.1.2 National Planning Policy Framework.

National Planning Policy Framework (NPPF) (2) sets out the Government's planning policies and how these are expected to be applied. In relation to noise and vibration, NPPF section 15 paragraphs 174, 185 and 187 are presented below:

'174. Planning policies and decisions should contribute to and enhance the natural and local environment by:

...

a. *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...'.*

'185. 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 life;*

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;*

and

c. *limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.*

'187. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.'

Planning Practice Guidance.

Online Planning Practice Guidance (PPG) (3) has been published to provide greater details in relation to the relevance of noise to the planning process following the introduction of NPPF and NPSE.

This guidance states, under the heading *'How can noise impacts be determined'*, that the following should be considered by local authorities:

- *'whether or not a significant adverse effect is occurring or likely to occur;*
- *whether or not an adverse effect is occurring or likely to occur; and*
- *whether or not a good standard of amenity can be achieved.'*

In line with NPSE, this includes identifying where noise exposure is above or below the significant observed adverse effect level and the lowest observed adverse effect level for a given situation during the operation of the Proposed Development.

Further guidance on each of the various observed effect levels set out in NPSE is provided in the table contained within the section headed *'How can it be established whether noise is likely to be a concern?'* which is reproduced below in Table 2.

It is important to note that no specific noise parameters or target noise levels are defined in the text.

Under the heading *'What factors influence whether noise could be a concern?'*, the subjective nature of noise is discussed. It is stated that the relationship between noise levels and the impact on those affected is not simple, as this depends on how various factors combine in particular situations.

Perception	Example of outcomes	Increasing effect level	Action
Not present	No effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up 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 small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum

Perception	Example of outcomes	Increasing effect level	Action
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude, or other physiological response, 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 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 change in acoustic character of the area.	Significant Observed Adverse Effect Level	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

Table 2: PPG Observed Effects.

3.2 Local policy - Amended Local Plan (June 2016).

Basingstoke and Deane Borough Council's Local Plan is their latest planning policy document and refers to noise within Policy EM10 and EM12

Policy EM10 - Delivering High Quality Development

1. Development proposals (excluding household extensions) will be permitted where they:

   e) Provide a co-ordinated and comprehensive scheme that does not prejudice the future development or design of adjoining sites; and

2. All development proposals will be required to respect the local environment and amenities of neighbouring properties in accordance with the principles set out below. Development proposals will be permitted where they:

   b) Provide a high quality of amenity for occupants of developments and neighbouring properties, having regard to such issues as overlooking, access to natural light, outlook and amenity space, in accordance with the Design and Sustainability SPD;

Policy EM12 - Pollution

Development that would result in unavoidable pollution will only be permitted where measures to adequately mitigate these polluting effects can be implemented. Development which is sensitive to pollution will only be permitted where:

a) There would be no detrimental impact on quality

c) Adequate remedial or mitigation measures are proposed and can be implemented.

6.101 Noise sources that are often relevant to development proposals and subsequent impact may include, traffic (road, rail and air), the use of mechanical (fixed or mobile) plant associated with industrial, commercial activities and premises, or other miscellaneous noise sources e.g. associated with an industrial activity. Should development give rise to, or be sensitive to, noise from one or more of the examples noted above, its impact must be assessed in line with current recognised methods and guidance.

3.3 Guidance documents.

3.3.1 British Standard 4142: 2014 Methods for rating and assessing industrial and commercial sound.

Current Government advice to Local Planning Authorities in both England and Wales makes reference to British Standard 4142:2014 (BS 4142) (4) as being the appropriate guidance for assessing commercial operations and fixed building services plant noise. The British Standard provides an objective method for rating the significance of impact from industrial and commercial operations. It describes a means of determining sound levels from fixed plant installations and determining the background sound levels that prevail on a site.

The assessment of the impacts is based on the subtraction of the pre-existing background sound level ($L_{A90,T}$) from the rating level ($L_{Ar,Tr}$).

The standard does not give a definitive method for determining the background sound level but instead, as a commentary, states that *"the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods".*

Clause 8.1.4, which discusses the monitoring duration, states *"there is no "single" background sound level as this is a fluctuating parameter. However, the background sound level used for the assessment should be representative of the period being assessed."* As a note to this clause the following commentary is given on obtaining a representative backgrounds sound level:

"To obtain a representative background sound level a series of either sequential or disaggregated measurements ought to be carried out for the period(s) of interest, possibly on more than one occasion. A representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either the minimum or modal value."

The rating level is defined objectively as the specific source noise level in question (either measured or predicted) with graduated corrections for tonality (up to +6 dB(A)), impulsivity (up to +9 dB(A)), intermittency (+3 dB(A)) and other sound characteristics (+3 dB(A)) which may be determined either subjectively or objectively, if necessary.

The background sound level is subtracted from the rating level. The following is considered evaluate the likelihood of complaint:

- A difference of around +10 dB is likely to be an indication of a significant adverse impact, depending on context;
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on context; and
- A difference of +0 dB or less is an indication of the specific sound source having a low impact, depending on the context.

This method is only applicable for external noise levels.

3.3.2 BS 8233: 2014 – Sound insulation and noise reduction for buildings.

BS 8233: 2014 provides guidance for control of noise in and around buildings and suggests appropriate criteria and limits for different situations. The criteria and limits are primarily intended to guide the design of new or refurbished buildings undergoing a change of use.

Table 4 within BS 8233 provides desirable internal ambient noise levels for spaces in residential dwellings when they are unoccupied.

Activity	Location	Daytime (0700 to 2300)	Night-Time (2300 to 0700)
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 $L_{Aeq,8hr}$

Table 3: Indoor ambient noise levels in spaces for dwellings.

Supplementary Note 2 and 4 to Table 4 within BS 8233 are copied below for reference:

'NOTE 2 – the levels shown in Table 4 are based on the existing guidelines issued by the WHO…'

'NOTE 4 – regular individual noise events (for example, schedule aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$ depending on the character and number of events per night.'

Guidance provided within the superseded BS 8233: 1999 (5) stated that *'for a reasonable standard in bedrooms at night, individual noise events (measured with F-time weighting) should not normally exceed 45 dB L_{Amax}.'* This follows current guidelines issued by the WHO.

3.3.3 The British Council for Offices (BCO) guide to specification 2019.

The British Council for Offices Guide provides guidance on sustainability, cost and value, building form, engineering systems and finishes within commercial offices. In particular, the BCO Guide provides advice within Section 8 regarding the acoustic environment within an office building, as summarised below.

External noise intrusion levels should not be more than the following ratings when measured in terms of $L_{eq,T}$.

- Open plan offices: NR 40 ($L_{eq,T}$)
- Speculative offices: NR 38 ($L_{eq,T}$)
- Cellular offices / meeting rooms NR 35 ($L_{eq,T}$)

In addition, regular individual noise events e.g. scheduled aircraft or passing trains should not normally be more than 55 dB $L_{A01,1hour}$ in open plan/speculative offices or 50 dB $L_{A01,1hour}$ in cellular offices/meeting rooms.

Flanking transmission horizontally across cladding mullions should be capable of demonstrating a weighted normalised flanking level difference of at least $D_{nF,w}$ 45 dB when tested in accordance with BS EN ISO 10848-2: 2006 (6) and rated in accordance with BS EN ISO 717-1: 2013 (7). Flanking constructions should be capable of being upgraded in the fit out up to at least $D_{nF,w}$ 53 dB without affecting warranties.

Rain noise should be controlled so it does not exceed 60 dB $L_{Aeq,T}$ in the office spaces during heavy rainfall (as defined within BS EN ISO 140-18:2006 Acoustics – Measurement of sound insulation in building elements – Part 18: Laboratory measurement of sound generated by rainfall on building elements).

3.3.4 BREEAM UK New Construction 2018.

The scheme is being assessed under BREEAM UK New Construction Non-domestic buildings 2018. Within this issue of BREEAM there are up to two credits available for acoustics as follows.

3.3.4.1 HEA 05.

For assessment category HEA 05, up to three credits are achievable where the building meets appropriate acoustic performance requirements for sound insulation, internal indoor ambient noise levels and room acoustics.

In relation to internal indoor ambient noise levels, HEA 05 states the following requirement:

"Achieve indoor ambient noise levels that comply with the design ranges given in Section 7 of BS 8233:2014."

3.3.4.2 POL 05.

A single credit is achievable under assessment category *POL 05* of BREEAM where the following is demonstrated.

1. There are no noise sensitive areas within the assessed building or within 800m radius of the assessed site.

   OR

2. Where there are noise sensitive areas within the assessed building or noise sensitive areas within 800m radius of the assessed site, a noise impact assessment compliant with BS 4142: 2014 is commissioned. Noise levels must be measured or determined for:

a. Existing background noise levels:
    i. At the nearest or most exposed noise sensitive development to the proposed assessed site.
    ii. Including existing plant on a building, where the assessed development is an extension to the building.
b. Noise rating level from the assessed building.

3. The noise impact assessment must be carried out by a suitably qualified acoustic consultant.
4. The noise level from the assessed building, as measured in the locality of the nearest or most exposed noise sensitive development, must be at least 5 dB lower than the background noise throughout the day and night.
5. If the noise sources from the assessed building area greater than the levels described in criterion 4, measures have been installed to attenuate the noise at its source to a level where it will comply with the criterion.

3.4 Proposed standards.

Given the lack of specific guidance within Basingstoke and Deane Borough Council's planning policy, it is deemed appropriate to base assessment on current guidance and British Standards. This is considered to be BS 4142: 2014 + A1: 2019, BS 8233: 2014 and the BCO Guide.

3.4.1 Building services – noise.

To ensure compliance with the requirements of BREEAM assessment category POL 05, all building services plant shall be designed to achieve the following noise emission limits.

Description of noise source	Noise emission limit
Building services plant	$L_{Ar,Tr} = L_{A90,T} - 5$ dB

Table 4: Noise emission limits for building services.

Additionally, for plant noise that is tonal, contains a specific character or is intermittent, the limits of Table 4 above need to include a character correction as defined within BS 4142: 2014.

3.4.2 Environmental noise – internal noise levels.

The development will be designed to enable achievement of the internal noise levels contained within BS 8233 and the BCO Guide to Specification. Compliance with these standards is also required to achieve the available credit for internal ambient noise levels under BREEAM HEA 05.

Location	Daytime (0700 to 2300)		
Warehouse areas	45 dB $L_{Aeq,T}$		
Open-plan office	40 dB $L_{Aeq,T}$	55 dB L_{A01}	NR 38
Cellular space (meeting room, office etc.)	35 dB $L_{Aeq,T}$	50 dB L_{A01}	NR 35

Table 5: Proposed internal noise level criteria.

4. Environmental noise survey.

An acoustic survey has been carried out at the site to establish the prevailing environmental noise conditions local to the site, so as to determine building services plant noise emission limits and to advise upon the building envelope and ventilation strategy.

4.1 Methodology.

A sound level meter was installed at the location shown in Figure 2 below on Thursday 23rd March 2023. Sound level monitoring was carried out for a period of 5 days (spanning a weekend) at the unattended logger position.

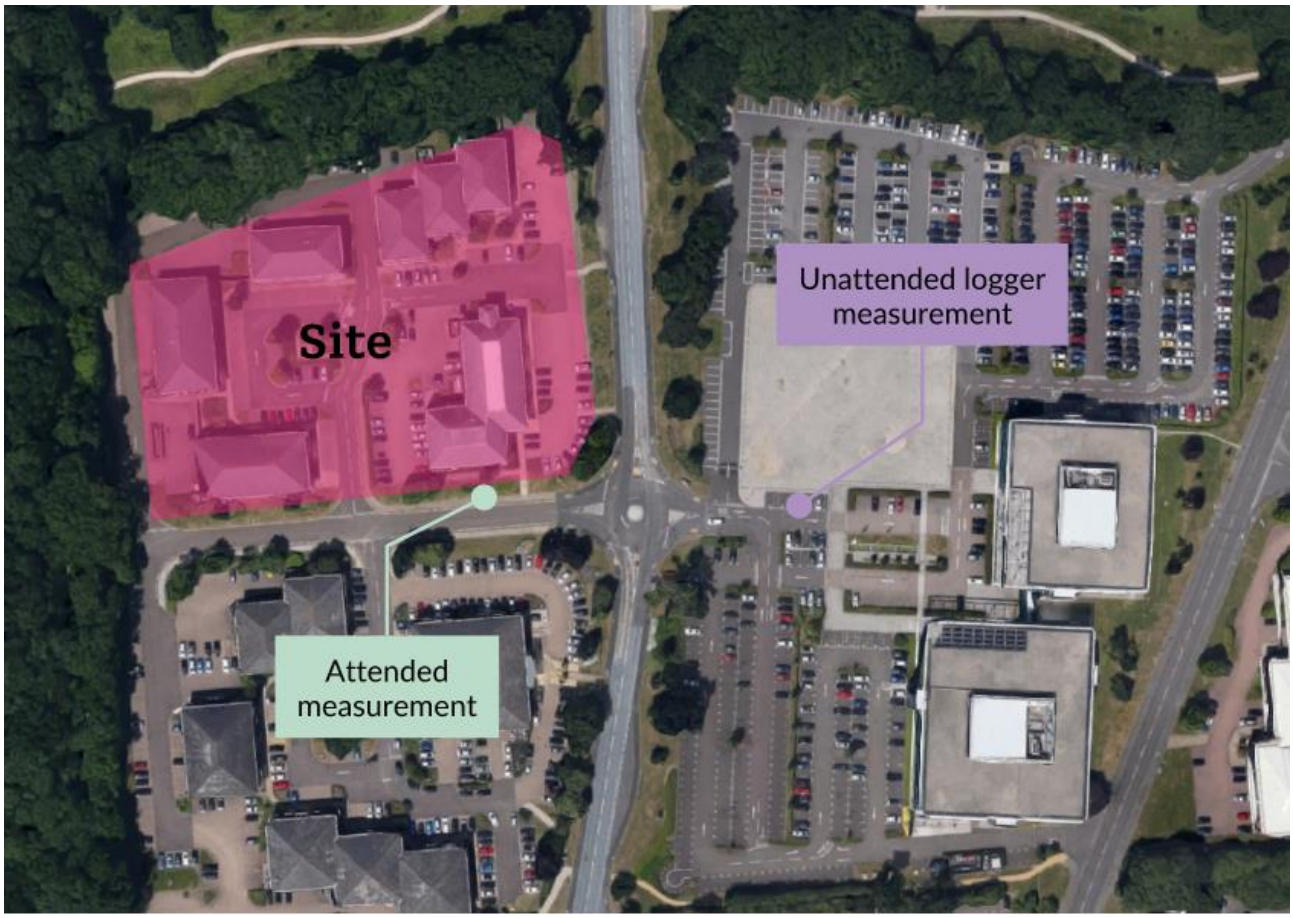


Figure 2: Acoustic survey location.

Measurements were undertaken at ground level of the existing site, with logger microphone at 1.2m height from the ground surface. These measurements were considered to be “free-field”.

Continuous concurrent 15-minute duration samples of broadband A-weighted ambient sound levels ($L_{Aeq,15min}$), maximum sound levels ($L_{Amax(fast),15min}$) and background sound levels ($L_{A90,15min}$) were recorded. All measurements were in one-third octave band resolution.

The measurement position was selected to quantify the general noise contributions around the site. Vehicles passing on Crockford Lane were observed to be the dominant source of noise when present, but distant traffic noise from Hanmore Road was also observed. Otherwise, the general sound climate is mixed, characterised by bird song, intermittent pedestrian noise, local plant, and distant traffic.

Additional attended daytime noise measurements were undertaken on Tuesday 28th November 2023 to determine the variation in background noise at the development location compared to the logger position.

These locations are shown in Figure 2 above. The measurement instrumentation used is listed in Appendix B attached and a general acoustic terminology is provided in Appendix A.

4.2 Ambient sound levels.

The typical ambient sound levels used for assessment are based on review of the data and the range of daytime and night-time ambient sound levels measured. Conservative values are used to provide adequate protection for occupants of the proposed development. Table 6 below summarises the ambient sound levels measured at the unattended location.

Measurement position	Range of daytime ambient sound levels dB $L_{Aeq,16hr}$	Range of night-time ambient sound levels dB $L_{Aeq,8hr}$	Typical daytime ambient sound levels dB $L_{Aeq,16hr}$	Typical night-time ambient sound levels dB $L_{Aeq,8hr}$
Unattended Logger Position	53-61	47-53	59	52

Table 6: Sound level measurement results at unattended logger position.

4.3 Background sound levels.

In line with the requirements of BS 4142, in order to "quantify what is typical during particular time periods", a statistical analysis of the measured background sound levels has been undertaken. The periods of interest have been taken as daytime (07:00 to 23:00) and night-time (23:00 to 07:00).

The 15-minute duration background sound values measured during the day will never be higher than the $L_{A90,1\ hour}$ for that period so represent a worst-case. The measured 15-minute values will be used in place of the 1-hour reference time interval required by BS 4142.

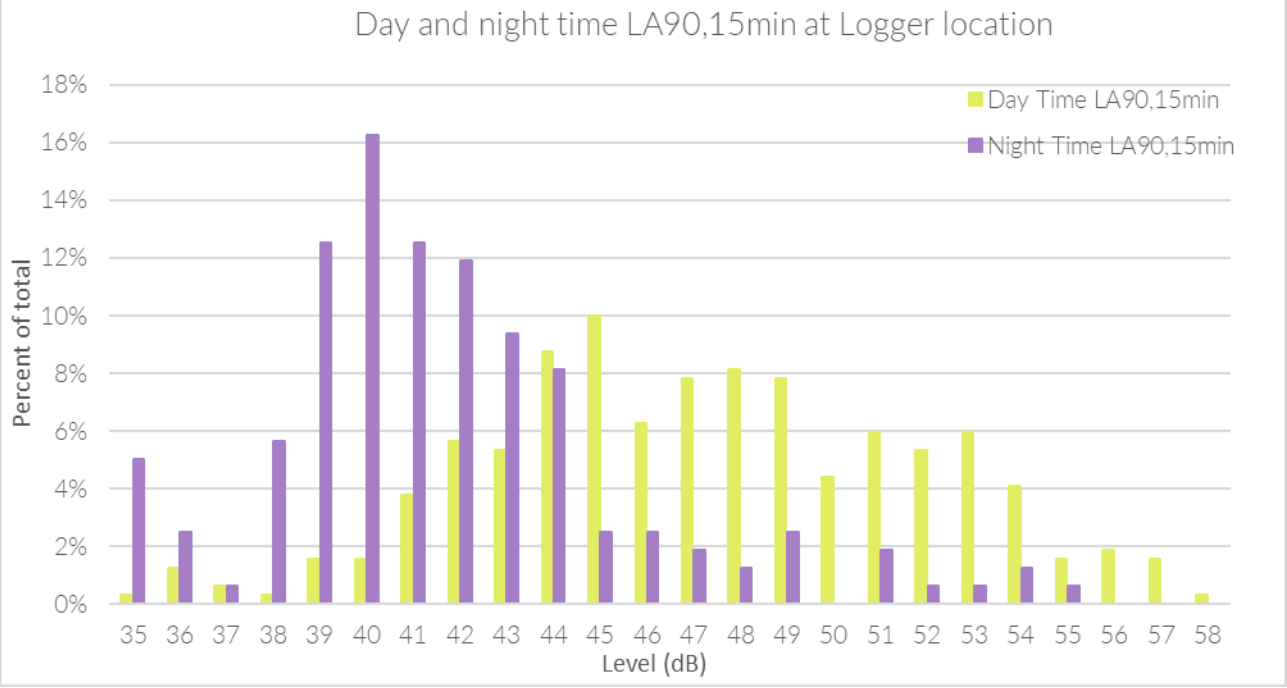


Figure 3: Statistical analysis of the background sound levels.

As stipulated in BS 4142, the typical background sound levels captured at the unattended survey for each representative period of interest are as below:

Representative receptors	Typical background sound level	
	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Receptors on Aghemund Close and Meadowland	44 dB $L_{A90,1\ hour}$	39 dB $L_{A90,15\ min}$

Table 7: Determined typical background sound levels representative of the nearest identified noise sensitive receptors.

The above typical background sound levels measured have been used to propose plant noise limits for the nearby residential receivers.

4.4 Attended measurement summary.

The results of the attended measurements from the onsite measurement locations are summarised in Table 8 below. Full details of the hand-held octave band measurements at these positions during the daytime are shown in the tables within Appendix C attached.

Measurement Position	Date and time	Measurement duration	$L_{Aeq,T}$ dB	$L_{A01,T}$ dB	$L_{A90,T}$ dB
Attended Location	28/11/2023 16:00	30 mins	59	71	46

Table 8: Measured noise levels at attended on site location.

On comparison of the measured noise levels with the survey conducted in March 2023, it is evident that noise levels at the attended location are comparable with those measured at the unattended logger. Therefore, the survey conducted in March 2023 is considered representative of the site.

5. Noise emissions of fixed plant.

Noise levels due to building services serving the proposed development are advised to meet the following noise level criteria shown below in Table 9 one metre from the nearest noise sensitive area as identified in Section 2.1. These are based on the typical background noise levels measured at the unattended logger which are deemed to be representative to those at the nearest noise sensitive receptors. This therefore presents a worst-case assumption.

Period	Lowest prevailing background noise level $L_{A90,T}$ dB	Noise emission limit calculation $L_{Ar,Tr}$ dB
Daytime (0700 to 2300)	44	39
Night-Time (2300 to 0700)	39	35

Table 9: Building services noise emission limits.

It should be noted that each of the limits stated above are the combined operational noise levels of plant at the nearest noise sensitive façade. As such, the combined operational noise levels of all plant are required to achieve the noise limits defined above.

For plant noise that is tonal, contains a specific character or is intermittent, the limits of Table 9 above need to include character correction in accordance with BS 4142: 2014.

The above noise limits would enable achievement of the requirements of BREEAM assessment category POL 05.

Noise levels outside commercial buildings should be acceptable at marginally higher levels than those proposed outside noise sensitive residential façades. Based on the level of noise that should be acceptable inside an office (35 to 40 dB in accordance with BS 8233: 2014) from external noise sources, the proposed plant could produce a noise level of 45-50 dB L_{Aeq} at one metre from commercial units with opening windows. This is determined on the basis that the internal noise level would not exceed 35 dB L_{Aeq} when a window is partially opened.

Similarly, for an office with a sealed façade, the proposed plant could produce a level of 60-65 dB L_{Aeq} at one metre, assuming that a sealed façade will provide a minimum noise reduction of 25 dB(A).

6. Building envelope and ventilation strategy.

The sound insulation properties of the building envelope depend upon the external noise levels present at the façade and the proposed design criteria for the internal noise levels of specific rooms, dependant on their use. Table 10 below assumes compliance with the internal noise levels stated in Table 5 and shows the level differences for varying spaces within the proposed development.

The examples shown represent the highest level differences required for each façade as identified in Figure 4 below, based on the measured noise data.

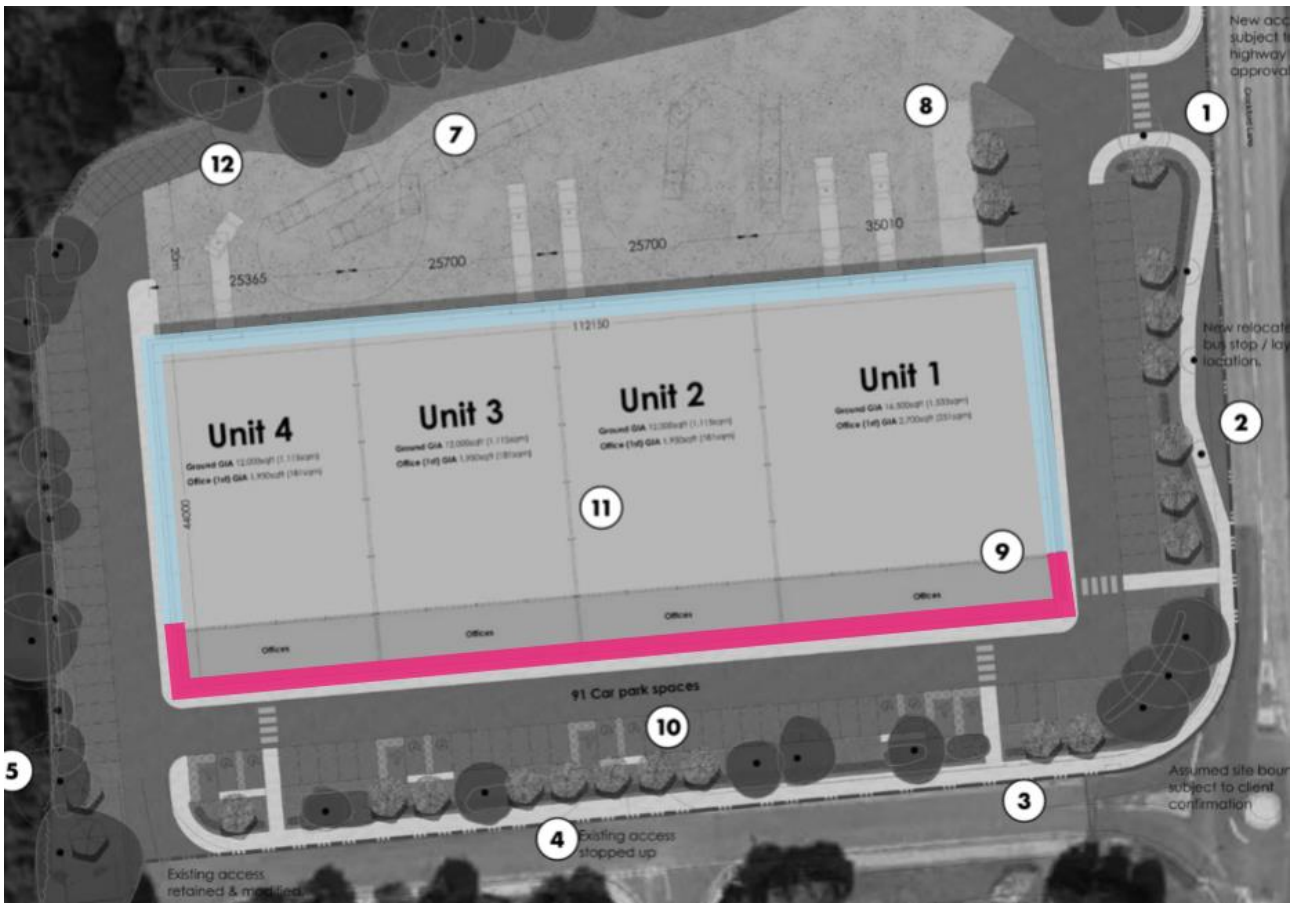


Figure 4: Facade locations

It should be noted that for offices, the highest level difference (D) shown for cellular office spaces within Table 10 takes precedence.

Façade	Room use	Noise levels (dB)		
		Measured external (maximum)	Proposed internal (maximum)	Minimum level difference D
Office facades	Cellular space	59	35	24
	Cellular space (L_{A01})	71	50	21
Warehouse facades	Warehouse	59	45	14

Table 10: Notional sound insulation values of proposed façade construction.

Simple natural ventilation through the use of opening windows will provide a level difference (D) in the order of 10 to 15 dB. It can be seen from Table 10 above that office spaces require greater levels of sound insulation based on the measured external noise levels.

As such, although windows may be openable for purge ventilation, provision for alternative forms of ventilation will need to be made such that windows are not required to be opened for ventilation purposes.

Table 11 below details the minimum required $R_w + C_{tr}$ of all window elements (glazing, seals, frames etc.) to each bedroom on each façade.

Façade	Minimum required $R_w + C_{tr}$ (dB)
Office façades	24*
Warehouse façades	14*

Table 11: Minimum required $R_w + C_{tr}$ of glazed elements.

*Note *: Achievable with a standard thermal double-glazed unit.*

It should be noted that at this stage it is assumed that the non-glazed element on all façades will be capable of achieving a sound reduction of 42 dB $R_w + C_{tr}$.

Examples of primary glazing configurations capable of achieving the minimum required $R_w + C_{tr}$ detailed within Table 11 are provided below:

– $R_w + C_{tr}$ 25 dB – 4mm glass, 16mm air gap, 4mm glass.

It should be noted that at this stage the required glazing sound insulation values have been based on a level difference comparison only. Detailed calculations will be required to be undertaken to determine refined glazing requirements once finalised plan and elevation drawings are available. As such, the sound insulation values stated within Table 11 are indicative and for guidance purposes only.

With the above façade sound reduction performances, achievement of the requirements of BREEAM assessment category HEA 05 would be possible.

7. Summary and conclusions.

Hoare Lea LLP has conducted an environmental noise survey for the proposed commercial development at Lindenwood Chineham Park. Unattended noise monitoring throughout a typical five-day period and sample octave band measurements were conducted.

Background noise levels typical of the daytime and night-time have been measured and used to define building services plant noise emission limits at the nearest noise sensitive receptors. The nearest receptors have been identified as existing residential dwellings along Aghemund Close and Meadowland to the northwest.

During the daytime the combined building services plant noise emission contribution limit advised is 39 dB(A) and during the night-time the combined building services plant noise emission contribution limit advised is 35 dB(A), one metre from the nearest residential façade.

Additionally, the total building services noise emissions shall not exceed 45 dB(A) at one metre from an office façade with opening windows and 60 dB(A) with a closed façade. This assumes a partially opened window provides a 10 dB(A) noise reduction and a closed façade will provide a minimum noise reduction of 25 dB(A).

With the proposed noise limits, the proposal would not have an adverse impact on surrounding neighbours

An assessment of the building envelope acoustic performance is provided with the minimum level difference (D) in accordance with the internal noise criterion of BS 8233: 2014 and the BCO Guide. The ventilation strategy should allow for full mechanical ventilation of all spaces as the level differences required are above those achievable by simple means of natural ventilation.

Glazing requirements for varying internal spaces and indicative primary glazing configurations have been provided.

The guidance provided within this report is sufficient to satisfy the requirements of Basingstoke and Deane Borough Council, in our opinion and confirms that the Site is considered suitable for development in terms of noise and the proposal would not have an adverse impact on surrounding neighbours. In addition, the guidance is sufficient to enable achievement of the credits available under BREEAM assessment categories HEA 05 and POL 05.

8. References.

1. Department for Environment, Food & Rural Affairs. *Noise policy statement for England.* 2010.

2. Ministry of Housing, Communities & Local Governement. *National Planning Policy Framework.* 2019.

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Appendix A – Acoustic terminology.

Sound
Sound is produced by mechanical vibration of a surface, which sets up rapid pressure fluctuations in the surrounding air.

The Sound Pressure
The Sound Pressure is the force (N) of sound on a surface area (m2) perpendicular to the direction of the sound. The SI-units for the Sound Pressure are Nm-2 or Pa (Pascal).

Sound is measured with microphones responding proportionally to the sound pressure – p. The power is proportional to the square of the sound pressure.

The Sound Pressure Level
The human ear has an approximately logarithmic response to sound pressure over a very large dynamic range. The lowest audible sound pressure approximately 2 x 10-5 Pa (2 ten billionths of an atmosphere) and the highest is approximately 100 Pa.

It is therefore convenient to express the sound pressure as a logarithmic decibel scale related to this lowest human audible sound, where:

$$L_p = 10\ \log\left(\frac{p^2}{p_{ref}{}^2}\right) = 10\ \log\left(\frac{p}{p_{ref}}\right)^2 = 20\ \log\left(\frac{p}{p_{ref}}\right)$$

Where: L_p *= sound pressure level (dB)*

p *= sound pressure (Pa)*

p_{ref} *= 2 x 10-5 – reference sound pressure (Pa)*

In accordance with the logarithmic scale, doubling the sound pressure level gives an increase of 6 dB.

Decibel (dB)
The decibel is the unit used to quantify sound pressure levels as well as sound intensity and power levels.

In accordance with the logarithmic scale, an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in the sound pressure level (measured in Pa). Subjectively, this increase would correspond to a doubling of the perceived loudness of the sound.

Sound Pressure Level of Some Common Sources
An indication of the range of sound levels commonly found in the environment is given in the following Table.

Source	Sound Pressure Level dB
Threshold of Hearing	0
Rustling Leaves	20
Quiet Whisper	30
Home	40
Quiet Street	50
Conversation	60
Inside a Car	70
Loud Singing	80
Motorcycle (10m)	90
Lawn Mower (1m)	100
Diesel Truck (1m)	110
Amplified Music (1m)	120
Jet Plane (1m)	130

Frequency
The rate at which the pressure fluctuations occur determines the pitch or frequency of the sound. The frequency is expressed in Hertz (Hz) or cycles per second.

Octave and Third Octave Bands
An octave is the interval between two points where the frequency at the second point is twice the frequency of the first.

There are many methods of describing the frequency content of a noise. The most common methods split the frequency range into defined bands, in which the mid-frequency is used as the band descriptor and in the case of octave bands is double that of the band lower. For example, two adjacent octave bands are 250 Hz and 500 Hz.

Third octave bands provided a fine resolution by dividing each octave band into three bands. For examples, third octave bands would be 160 Hz, 250 Hz and 315 Hz for the same 250 Hz octave band.

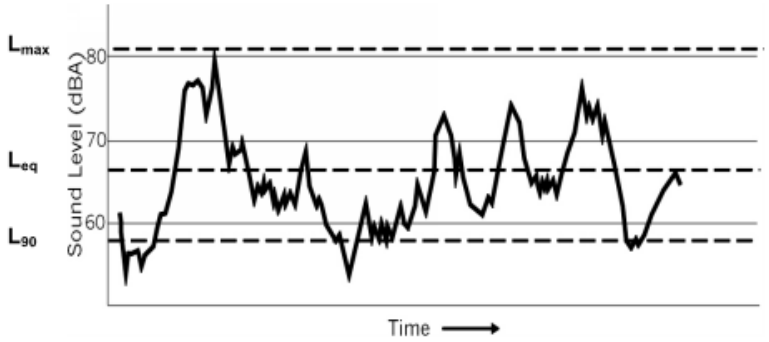
The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequency than to low frequencies within the range. This is the basis of the A-weighting.

A-Weighting
The A-weighting is a correction term applied to the frequency range in order to mimic the sensitivity of the human ear to noise. It is generally used to obtain an overall noise level from octave or third octave band frequencies.

An A weighted value would be written as dB(A), or including A within the parameter term.

Noise Units
In order to assess environmental noise, measurements are carried out by sampling over specific periods of time, such as five minutes, the statistically determined results being used to quantify various aspects of the noise.

The figure below shows an example of sound level varying with time. Because of this time variation the same period of noise can be described by several different levels. The most common of these are described below.



$L_{eq,T}$
The $L_{eq,T}$ is a parameter defined as the equivalent continuous sound pressure level over a defined time period 'T'. It is the sound pressure level equivalent to the acoustic energy of the fluctuating sound signal.

The $L_{eq,T}$ can be thought of as an 'average' sound pressure level over a given time period (although it is not an arithmetic average). Typically the $L_{eq,T}$ will be an A-weighted noise level in dB(A) and is commonly used to describe all types of environmental noise sources.

$L_{01,T}$
The $L_{01,T}$ is a parameter defined as the sound pressure level exceeded for 1% of the measurement period 'T'.

It is a statistical parameter and cannot be directly combined to other acoustic parameter.

$L_{10,T}$
The $L_{10,T}$ is a parameter defined as the sound pressure level exceeded for 10% of the measurement period 'T'.

It is a statistical parameter and cannot be directly combined to other acoustic parameter and is generally used to describe road traffic noise.

$L_{90,T}$
The $L_{90,T}$ is a parameter defined as the sound pressure level exceeded for 90% of the measurement period 'T'.

It is a statistical parameter and cannot be directly combined to other acoustic parameter and is generally used to describe the prevailing background noise level.

$L_{max,T}$
The $L_{max,T}$ is a parameter defined as the maximum noise level measured during the specified period 'T'.

Specific Noise Level, $L_{Aeq,Tr}$.
This is the equivalent continuous A-weighted sound pressure level at the assessment position due to a specific noise source operating over a given time interval.

Free Field
A measurement taken in the free field is at least 3.5m from reflecting vertical surfaces and 1.2m from the ground.

Façade
A measurement is influenced by the reflection of sound from the façade of a building within 3.5m. A façade measurement is made 1m in front of the vertical building surface.

R_w
A single-number quantity which characterizes the airborne sound insulation of a material or building element in the laboratory. See BS EN ISO 717-1: 1997.

Appendix B – List of measurement equipment.

Noise logger.

Rion - Microphone: UC-59 sn: 07371

Rion - Pre-amplifier: NH-25 sn: 43577

Rion - Sound Level Meter: NL-52 sn: 01143560

Brüel and Kjær - Sound Calibrator: 4231 sn: 3014189

Attended sound level meter.

Rion - Microphone: UC-59 sn: 10623

Rion - Pre-amplifier: NH-25 sn: 65307

Rion - Sound Level Meter: NL-52 sn: 01265405

Brüel and Kjær - Sound Calibrator: 4231 sn: 3014189

Sound level meters were field calibrated before and after noise surveys and no discernible variations occurred.

Appendix C – Octave band levels at measurement positions.

Measurement position	Time and date	Duration	single octave band figures						
			50	63	80	100	125	160	200
Attended location	28/11/2023 16:00	00:15:00	64	60	57	54	56	51	43
	28/11/2023 16:15	00:15:00	65	60	58	56	57	52	43

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