Hawkins environmental

Noise Assessment: 82 Guilford Street, Bloomsbury

Sudaj Limited

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1. INTRODUCTION

1.1. Overview

Hawkins Environmental Limited has been instructed by Sudaj Limited to undertake a noise assessment for the redevelopment of 82 Guilford Street, Bloomsbury, situated within the London Borough of Camden. The site currently comprises a four storey plus basement terraced property containing a number of bedsitting rooms. The proposals will see the conversion of the existing building structure into four self-contained apartments. A site location plan can be seen in **Appendix 1**.

During the planning process, it has been identified that the site may require a noise assessment to determine whether the site is suitable for residential use, due to its location close to a number of busy roads. Consequently, a noise survey was conducted to characterise the noise climate of the site with the proposed layout. By measuring both the ambient and maximum noise levels it has been possible to determine whether mitigation is necessary to achieve reasonable internal and external noise levels.

All noise measurements were conducted in accordance with BS 7445-2: 1991 *'Description and measurement of environmental noise Part 2: Guide to the acquisition of data pertinent to land use'*, with the assessment methodology used to assess noise ingress into the proposed development conducted in accordance with BS 8233: 2014 *'Guidance on sound insulation and noise reduction for buildings',* and the National Planning Policy Framework.

2. NOISE CRITERIA

2.1. The Nature, Measurement and Effect of Noise

Noise is often defined as sound that is undesired by the recipient. Whilst it is impossible to measure nuisance caused by noise directly, it is possible to measure the loudness of that noise. 'Loudness' is related to both sound pressure and frequency, both of which can be measured. The human ear is sensitive to a wide range of sound levels. The sound pressure level of the threshold of pain is over a million times that of the quietest audible sound. In order to reduce the relative magnitudes of the numbers involved, a logarithmic scale of decibels (dB) is normally used, based on a reference level of the lowest audible sound.

The response of the human ear is not constant over all frequencies. It is therefore usual to weight the measured frequencies to approximate the human response. The resulting 'A' weighted decibel, dB(A), has been shown to correlate closely to the subjective human response.

When related to changes in noise, a change of ten decibels from say 60 dB(A) to 70 dB(A) would represent a doubling in 'loudness'. Similarly, a decrease in noise from 70 dB(A) to 60 dB(A) would represent a halving in 'loudness'. A change of 3 dB(A) is generally considered to be just perceptible[1]. **Table 2.1** details typical noise levels. A glossary of acoustic terms can be found in **Appendix 2**.

Table 2.1: Typical Noise Levels

Approximate Noise Level (dB(A))	Example
0	Limit of hearing
30	Rural area at night
40	Library
50	Quiet office
60	Normal conversation at 1 m
70	In car noise without radio
80	Household vacuum cleaner at 1 m
100	Pneumatic drill at 1 m
120	Threshold of pain

2.2. The National Planning Policy Framework

In March 2012, the National Planning Policy Framework (NPPF) was published to replace the thousands of pages of national planning policy guidance, including guidance on noise. The intention was to let councils decide their own priorities though their Local Plans and reduce the amount of "red tape" to enable growth and development. Amongst many other documents, the NPPF replaces the 1994 document *Planning Policy*

[1] Communities & Local Government (1994). Planning Policy Guidance 24: Planning & Noise.

Guidance Note 24 (PPG 24) 'Planning and Noise' published by the then Department of Environment, which is now officially withdrawn as official government guidance.

The NPPF includes 12 core planning principles which include:

- Always seek to secure high quality design and a good standard of amenity for all existing and future occupants of buildings;
- Take account of the different roles and character of different areas, promoting the vitality of the main urban areas, protecting the Green Belts around them, recognising the intrinsic beauty of the countryside;
- Contribute to conserving and enhancing the natural environmental and reducing pollution; and
- Take account of and support local strategies to improve health, social and cultural wellbeing for all.

It also states that the planning system "*should contribute to enhance the natural environment, by... preventing both new and existing development from contributing to or being put at risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution…To prevent unacceptable risks from pollution, planning policies and decisions should ensure that new development is appropriate for its location*".

Section 123 of the NPPF talks specifically about noise stating that *"Planning policies and decisions should aim to:*

- *Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*
- *Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and*
- *Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."*

The purpose of the NPPF is for Local Planning Authorities to determine for themselves whether a "*new development is appropriate for its location"* or how to determine what constitutes "*a good standard of amenity for all…future occupants of buildings"*.

2.3. Noise Policy Statement for England

The Noise Policy Statement for England(NPSE)[2] provides further guidance on the interpretation of Section 123 of the NPPF and states that:

"Within the context of sustainable development:

- *avoid significant adverse impacts on health and quality of life;*

[2] The Noise Policy Statement for England, March 2010, Defra.

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

NPSE introduces established concepts originally from the field of toxicology that are now being applied to noise impacts. They are:

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

NPSE goes on to state that *"it is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available."*

2.4. National Planning Practice Guidance on Noise

The NPPG provides more guidance on the assessment of noise for planning purposes and builds on the concepts of NOEL, LOAEL etc introduced in NPSE to establish whether noise is a factor that needs to be taken into account. It states:

"Local planning authorities' plan-making and decision taking should take account of the acoustic environment and in doing so consider:

- *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 the Explanatory Note of the Noise Policy Statement for England, this would include identifying whether the overall effect of the noise exposure (including the impact during the construction phase wherever applicable) is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation."

However it goes into more detail about the subjective nature of noise and how the results of any assessment must be treated flexible and pragmatically. The guidance states:

"The subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation. These factors include:

- *the source and absolute level of the noise together with the time of day it occurs. Some types and level of noise will cause a greater adverse effect at night than if they occurred during the day – this is because people tend to be more sensitive to noise at night as they are trying to sleep. The adverse effect can also be greater simply because there is less background noise at night;*
- *for non-continuous sources of noise, the number of noise events, and the frequency and pattern of occurrence of the noise;*
- *the spectral content of the noise (ie whether or not the noise contains particular high or low frequency content) and the general character of the noise (ie whether or not the noise contains particular tonal characteristics or other particular features). The local topology and topography should also be taken into account along with the existing and, where appropriate, the planned character of the area.*

More specific factors to consider when relevant:

- *where applicable, the cumulative impacts of more than one source should be taken into account along with the extent to which the source of noise is intermittent and of limited duration;*
- *consideration should also be given to whether adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time. In both cases a suitable alternative means of ventilation is likely to be necessary. Further information on ventilation can be found in the Building Regulations.*
- *In cases where existing noise sensitive locations already experience high noise levels, a development that is expected to cause even a small increase in the overall noise level may result in a significant adverse effect occurring even though little to no change in behaviour would be likely to occur.*
- *Where relevant, Noise Action Plans, and, in particular the Important Areas identified through the process associated with the Environmental Noise Directive and corresponding regulations should be taken into account. Defra's website has information on Noise Action Plans and Important Areas. Local authority environmental health departments will also be able to provide information about Important Areas.*
- *The effect of noise on wildlife. Noise can adversely affect wildlife and ecosystems. Further information may be found on Defra's website. Particular consideration should be given to noisy development affecting designated sites.*
- *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.*
- *The potential effect on an existing business of a new residential development being located close to it should be carefully considered as the existing noise levels from the business may be regarded as unacceptable by the new residents and subject to enforcement action. In the case of an established business, the policy set out in the third bullet of paragraph 123 of the Framework should be followed.*
- *Some commercial developments including fast food restaurants, night clubs and public houses can have particular impacts, not least because activities are often at their peak in the evening and late at*

night. Local planning authorities will wish to bear in mind not only the noise that is generated within the premises but also the noise that may be made by customers in the vicinity."

2.5. Planning Policy Guidance Note 24 'Planning and Noise'

In September 1994 the then Department of Environment published the *Planning Policy Guidance Note 24 'Planning and Noise'*. The document (PPG 24) was intended to be used by Local Planning Authorities as guidelines in determining the acceptability of proposed development sites that may be affected by noise.

The PPG 24 states:

"*Noise Exposure Categories for Dwellings*

When assessing a proposal for residential development near a source of noise, local planning authorities should determine into which of the four noise exposure categories (NEC's) the proposed site falls, taking account of both day and night-time noise levels. Local planning authorities should have regard to the advice in the appropriate NEC, as shown in ***Table 2.2*** *below:*

Table 2.2: PPG 24 Noise Exposure Categories

Noise Exposure Category	*Planning Response*
A	*Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as a desirable level.*
B	*Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise.*
C	*Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quieter sites, conditions should be imposed to ensure a commensurate level of protection against noise.*
D	*Planning permission should normally be refused.*

A recommended range of noise levels is given below for each of the NEC's for dwellings exposed to noise from road, rail, air and 'mixed sources'. Annex 2 (of the PPG) provides a detailed explanation of how the boundaries of each of the NEC's have been derived. Paragraph 9 of the main text explains that in some cases local planning authorities may be able to justify a range of NEC's of up to 3 dBA above or below those recommended."

The recommended noise guidelines are shown in **Table 2.3** below.

Table 2.3: Noise Levels Corresponding to the NECs for New Dwellings

Noise Levels Corresponding To The Noise Exposure Categories For New Dwellings $L_{Aeq\,T}$ dB				
Noise Source	**Noise Exposure Category**			
	A	B	C	D
Road Traffic				
0700-2300	<55	55-63	63-72	>72
2300-0700[1]	<45	45-57	57-66	>66
Rail Traffic				
0700-2300	<55	55-66	66-74	>74
2300-0700[1]	<45	45-59	59-66	>66
Air Traffic				
0700-2300	<57	57-66	66-72	>72
2300-0700[1]	<48	48-57	57-66	>66
Mixed Sources				
0700-2300	<55	55-63	63-72	>72
2300-0700[1]	<45	45-57	57-66	>66

Notes. 1. Night-time noise levels (2300-0700): sites where individual noise events regularly exceed 82 dB L_{Amax} (S time weighting) several times in any one hour should be treated as being in NEC C, regardless of the $L_{Aeq.8hr}$ (except where the $L_{Aeq.8hr}$ already puts the site in NEC D).

Local Authorities could adopt a flexible approach to the above criteria and could, depending on their areas and local requirements, adjust the criteria.

To "*ensure an adequate level of protection against noise"* it was common practice to ensure that a good standard of internal noise amenity can be obtained, using the guidance within BS 8233 and the WHO Guidelines.

PPG 24 was officially withdrawn in March 2012 with the publication of the NPPF. Prior to March 2012, Local Planning Authorities almost exclusively utilised PPG 24 to determine site suitability in terms of noise and used PPG 24 in conjunction with BS 8233 to determine whether the property will retain a good level of amenity based on the noise climate of the site. Whilst a Noise Exposure Category was determined for each development site under consideration prior to March 2012, in practice the Noise Exposure Category was largely irrelevant providing that the internal noise levels within the development could be mitigated in accordance with BS 8233.

Whilst the withdrawal of PPG 24 and the advent of the NPPF will enable Local Planning Authorities to determine their own methodologies and even determine whether noise is a priority, in the absence of any other local guidance or policy, any other nationally adopted guidance, or any informal guidance, it is anticipated that methodology contained within the withdrawn PPG 24 document will still be utilised as a method for determining site suitability, in conjunction with the target internal noise levels within BS 8233. Furthermore, the vast majority

of Local Planning Authorities still reference PPG 24 and BS 8233 as the guidance to use in relation to noise; therefore, whilst officially withdrawn, PPG 24 currently remains in common usage.

2.6. BS 8233: 2014 *'Guidance on sound insulation and noise reduction for buildings'*

Originally published in 1999, the 2014 edition of BS 8233 significantly updates the guidance in light of the policy changes as a result of the advent of the NPPF and the withdrawal of PPG 24. The 2014 edition of BS 8233 sees a change in the title of the Standard, moving from a *'Code of Practice'* to *'Guidance'*, as the text *'largely comprises guidance that does not support claims of compliance'*.

BS 8233:2014 indicates that to control external noise ingress into a proposed development, a number of planning stages should occur as follows:

"a) Assess the site, identify significant existing and potential noise sources, measure or estimate noise levels, and evaluate layout options.

b) Determine design noise levels for spaces in and around the building(s).

c) Determine sound insulation of the building envelope, including the ventilation strategy".

BS 8233:2014 suggests design noise levels for various types of building. The recommended noise levels for dwelling houses, flats and rooms in residential use (when unoccupied) can be seen in **Table 2.4** below. This is replicated from Table 4 of Section 7.7.2 of BS 8233:2014. The guidance suggests that *"In general, for steady external noise sources, it is desirable that the internal ambient noise level does not exceed the guideline values".* The noise levels in **Table 2.4** are marginally different to those published in BS 8233:1999 *'Sound insulation and noise reduction for buildings –Code of practice'*, but are based on the existing guidance from the current World Health Organisation (WHO) *"Guidelines on Community Noise".*

Table 2.4: Summary of Noise Criteria: BS8233:2014

Activity	Location	07:00 to 23:00	23:00 to 0700
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 $L_{Aeq.8hour}$

When considering the noise level criteria considered in **Table 2.4**, the following points should be noted:

1. BS 8233: 2014 suggests that the above criteria should be adopted flexibly and that *"where development is considered necessary or desirable... the internal target level may be relaxed by up to 5 dB and reasonable internal conditions still achieved".*
2. The noise levels quoted above are annual averages and *"do not need to be achieved in all circumstances"* e.g. New Years Eve or fireworks night.
3. The noise levels in **Table 2.4** are *"for steady external noise sources"* such as traffic noise or plant noise. This is a departure from the 1999 version of BS 8233, where the recommended internal noise

levels were irrespective of the external noise source and therefore included the suggestion that in order to achieve *"reasonable"* noise levels within bedrooms at night, L_{AFmax} noise levels should not exceed 45 dB. Whilst this has been omitted from the 2014 version of BS 8233, it does state that "*Regular individual noise events (for example, scheduled 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. Sporadic noise events could require separate values."* Therefore, at sites which may be affected by individual noise events, it is more appropriate to use the guidance contained within the WHO *"Guidelines on Community Noise"* which suggest that good sleep will not generally be affected if internal levels of L_{AFmax} 45 dB are not exceeded more than 10-15 times per night.

4. BS 8233:2014 notes that if the design of the building is *"relying on closed windows to meet the guide values, there needs to be appropriate alternative ventilation that does not compromise the facade insulation or resulting noise level".*

5. BS 8233 provides guidance for noise in gardens and outdoor amenity space. It suggests that *"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."* The guidance does go on to say that these guideline values are not achievable in all circumstances and in some 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."*

2.7. The London Plan

The London Plan July 2011 with 2013 Alterations[3], provides an overall strategic plan for London, and it sets out a fully integrated economic, environmental, transport and social framework for the development of the capital to 2031. The Plan brings together the Mayor's strategies, including policy on a range on environmental issues, such as climate change, air quality, noise and waste. London boroughs' local plans need to be in general conformity with the London Plan, and its policies guide decisions on planning applications by councils and the Mayor.

Policy 7.15 specifically relates to noise and states:

"Development proposals should seek to reduce noise by:

a) minimise the existing and potential; adverse impacts of noise on, from, within, or in the vicinity of, development proposals;

b) separating new noise sensitive development from major noise sources wherever practicable through the use of distance, screening, or internal layout in preference to sole reliance on sound insulation;

c) promoting new technologies and improving practices to reduce noise at source."

[3] The London Plan - Spatial Development Strategy for Greater London (July 2011), Mayor of London.

2.8. London Plan – Housing Supplementary Planning Guidance

The Housing SPG, published in November 2012 highlights the elements of the London Plan that are relevant to housing development, and where applicable, provides more detail. The SPG states:

"Noise - Baseline

Standard 5.3.1 (and Policy 7.15) – The layout of adjacent dwellings and the location of lifts and circulation spaces should seek to limit the transmission of noise to sound sensitive rooms within dwellings.

Policy 7.15 Reducing Noise and Enhancing Soundscapes requires development proposals to seek to reduce noise and manage the effects of noise. It is another important aspect of retreat and privacy in a dwelling. Noise from the street and adjoining properties can cause stress, sleep disturbance and friction between neighbours as recognised in the NPPF154.

2.3.35 All dwellings should be built with acoustic insulation and tested to current Building Regulations standards155. However, acoustic insulation should not be relied upon as the only means of limiting noise and the layout and placement of rooms within the building should be considered at an early stage in the design process to limit the impact of external noise on bedrooms and living rooms. The impact of noise should also be considered in the placement of private external spaces."

2.9. Local Policy

The London Borough of Camden's Development Policies 2010-2025[4] document states in Policy DP28 Noise and Vibration that *"The Council will seek to ensure that noise and vibration is controlled and managed and will not grant planning permission for: a) development likely to generate noise pollution; or b) development sensitive to noise in locations with noise pollution, unless appropriate attenuation measures are provided. Development that exceeds Camden's Noise and Vibration Thresholds will not be permitted."*

The policy document goes on to describe noise thresholds at which noise levels will be acceptable:

"Table A: Noise levels on residential sites adjoining railways and roads at which planning permission will not be granted:

Noise description and location of measurement	***Period***	***Time***	***Sites adjoining roads***
Noise at 1 metre external to a sensitive façade	*Day*	*0700-1900*	*72 dB $L_{Aeq.12hr}$*
Noise at 1 metre external to a sensitive façade	*Evening*	*1900-2300*	*72 dB $L_{Aeq.4hr}$*
Noise at 1 metre external to a sensitive façade	*Night*	*2300-0700*	*66 dB $L_{Aeq.8hr}$*

[4] Camden Local Development Framework - Camden Development Policies - Adoption version 2010

Table B: Noise levels on residential sites adjoining railways and roads at and above which attenuation measures will be required:

Noise description and location of measurement	***Period***	***Time***	***Sites adjoining roads***
Noise at 1 metre external to a sensitive façade	*Day*	*0700-1900*	*62 dB $L_{Aeq.12hr}$*
Noise at 1 metre external to a sensitive façade	*Evening*	*1900-2300*	*57 dB $L_{Aeq.4hr}$*
Noise at 1 metre external to a sensitive façade	*Night*	*2300-0700*	*52 dB $L_{Aeq.8hr}$*
Individual noise events several times on one hour	*Night*	*2300-0700*	*>82dB L_{Amax} (S time weighting)*

3. NOISE MEASUREMENT STUDY

In order to determine the extent to which the site is affected by noise, a detailed noise measurement study has been carried out on the proposed development site. Noise measurements have been carried out in order to determine the overall $L_{Aeq.16hrs}$ and $L_{Aeq.8hrs}$ for the day and night time periods. In addition, the L_{Amax} L_{A10}, L_{A50}, and L_{A90} noise levels have also been measured.

All noise monitoring was conducted using a Norsonic 140 sound level meter, which conforms to BS EN IEC 61672 as a Class 1 precision measurement system. A Norsonic 1251 field calibrator was used before and after the measurement periods in order to ensure that the equipment had remained within reasonable calibration limits (+/- 0.5 dB). All of the equipment used has current certificates of calibration. **Appendix 3** summarises the equipment used including serial numbers and calibration certificates.

All noise monitoring has been conducted in accordance with the guidance set out in BS 7445-2: 1991 *'Description and measurement of environmental noise Part 2: Guide to the acquisition of data pertinent to land use*'. This standard details information that should be recorded in addition to the actual measured levels such as meteorological data, and a description of the noise source itself.

The survey was conducted from around 2pm on the 27th September 2012 to around 2pm on 28th September 2012. The noise monitoring was conducted by Nick Hawkins of Hawkins Environmental Limited. Nick is a Member of the Institute of Acoustics and holds the Institute of Acoustic's Certificate of Competence in Environmental Noise Measurement.

Weather conditions were conducive to successful monitoring. **Table 3.1** summarises the weather conditions during the measurement period.

Table 3.1: Summary of Weather Conditions during the Noise Measurements

General Description	The measurement periods were mainly cloudy and overcast, with some sunshine on the 27th. Towards the end of the measurements period, there was some light rain.
Windspeed	During the day and night, average windspeeds of around 0.5 m/s were experienced, with gusts of up to 2 m/s.
Temperature	The temperature went down to around 8°C at night, with temperatures generally around 15-19 °C during the day.
Precipitation	The measurement period remained dry until around 1pm on the 28th, when some light drizzle began. The roads were only just becoming wet when the measurement equipment was decommissioned.

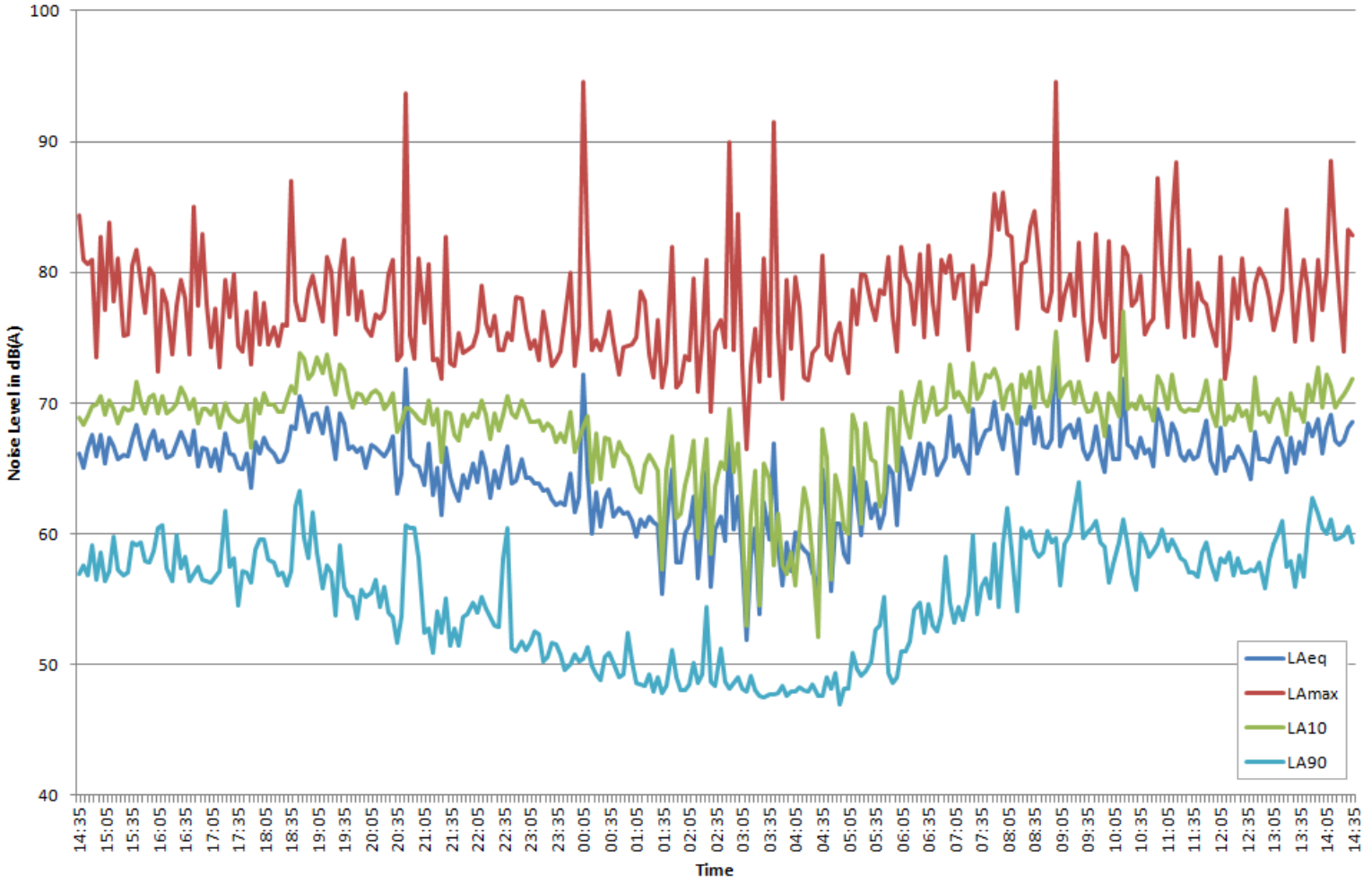
Noise measurements were carried out at the location identified in **Appendix 1** which is representative of the closest point of the proposed development to Guilford Road and is therefore considered to be a worst-case noise measurement location. The equipment was attached to a first floor window of No.77 Guilford Street in a facade location. The noise measurements are considered to be representative of the front facade of No. 82 Guilford Street.

The noise measurement data is detailed in **Appendix 4** and summarised in **Table 3.2** below, with graphs displaying the noise level displayed in **Figure 3.1**.

Table 3.2: Summary of Noise Level Measurements

Period (hours)	Measured Facade Noise Level L_{Aeq} dB
07:00-19:00	67.2
19:00-23:00	66.3
23:00-07:00	62.8

Figure 3.1: Noise Measurements



4. NOISE INGRESS INTO THE PROPOSED DEVELOPMENT

The assessment of the noise ingress into the proposed rooms for residential purposes and the determination of the facade noise insulation has been assessed using BS 8233: 2014 *'Guidance on sound insulation and noise reduction for buildings*'.

4.1. Site Assessment

The noise measurement study has identified that the primary noise source is road traffic on Guilford Street, although traffic noise from surrounding roads was also clearly audible at times, especially traffic noise associated with emergency vehicles. Aircraft movements were also clearly audible at times.

The noise measurement survey determined the noise levels to be used in the noise assessment. **Table 4.1** shows the calculated day and night time noise levels to be used in a noise assessment, corrected where appropriate for the effects of facade reflections.

Table 4.1: Summary of the Day and Night Time Noise Levels for Assessment

Period	Measured Facade Noise Level L_{Aeq} dB	Freefield Noise Level L_{Aeq} dB
07:00-19:00	67.2	64.2
19:00-23:00	66.3	63.3
23:00-07:00	62.8	59.8

Since the withdrawal of PPG24, the guidance from NPSE regarding NOEL, LOAEL and SOAEL has been used to assess the overall level of likely impact of noise on a proposed development site, albeit without specific noise levels. Unlike most other Local Authorities, the noise levels to be used for NOEL, LOAEL and SOAEL are specified in their policy in Camden's Table A and B (although they do not mention the terms NOEL, LOAEL and SOAEL), as demonstrated in **Table 4.2**. Note that the noise levels in Tables A and B and in **Table 4.2** are facade noise levels.

Table 4.2: Noise Impact Levels

	NOEL $L_{Aeq.T}$	LOAEL $L_{Aeq.T}$	SOAEL $L_{Aeq.T}$
07:00-19:00	<62	62 - 72	>72
19:00-23:00	<57	57 – 72	>72
23:00-07:00	<52	52 - 66	>66

It can be seen from comparing the facade noise levels in **Table 4.1** to those in **Table 4.2** that the measured external noise levels at the development site greater than NOEL, but less than SOAEL level for the day, evening and night time periods; therefore noise shouldn't be a constraint upon the development of the site, but suitable mitigation must be taken into account.

4.2. Determination of Design Noise Levels

The appropriate design noise levels at this site are those identified in **Table 2.4** and replicated in **Table 4.3** below.

Table 4.3: Summary of Noise Criteria: BS8233:2014

Activity	Location	07:00 to 23:00	23:00 to 0700
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 $L_{Aeq.8hour}$

4.3. Determination of Sound Insulation

The noise measurement survey indicates that attenuation is required and noise does need to be taken into account in the design of the building in order to meet the internal noise criteria contained within BS 8233 and comply with the guidance contained within the NPPF.

The Sound Reduction Index (R_w sometimes noted as SRI) is the level of sound attenuation afforded by a particular material. It is possible to calculate the R_w of a particular facade to determine the internal noise level based upon the noise survey results. It is widely known that a masonry wall will have a R_w of at least 50 dB. sometimes as high as 55 to 60 dB. The R_w of individual glazing solutions will vary considerably. However, typical double glazed window systems will have a R_w of 31 to 33 dB.

Section 6.7 of BS 8233 provides a rigorous calculation method for determining the internal noise levels within a proposed development. **Figure 4.1** shows the published calculation procedure.

Figure 4.1: BS 8233:2014 External to Internal Noise Level Calculation Method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3 \quad \text{(G.1)}$$

where:

$L_{eq,ff}$ is the equivalent continuous sound pressure level outside the room elements under consideration;

NOTE 3 It is the free-field sound level (i.e. in the absence of the facade), measured or estimated at the intended position of the element under consideration. It is related to the level $L_{eq,1}$ measured within a few millimetres of the actual facade by the relation $L_{eq,ff} \approx L_{eq,1} - 6$, and to the level $L_{eq,2m}$ measured 2 m away from the facade by the relation $L_{eq,ff} \approx L_{eq,2m} - 3$.

NOTE 4 The calculation method assumes the source is traffic noise and a facade shape correction factor is not required. BS EN 12354-3 provides a more detailed calculation method where these assumptions are not valid.

A_0 is a reference absorption area of 10 m² and is independent of frequency;

S_f is the total facade area in square metres (m²) of the room in question;

S_{wi} is the area in square metres (m²) of the windows of the room;

S_{ew} is the area in square metres (m²) of the external wall of the room;

S_{rr} is the area in square metres (m²) of the ceiling of the room;

S is the total area in square metres (m²) of elements through which sound enters the room, i.e. $S_f + S_{rr}$;

$D_{n,e}$ is the insulation of the trickle ventilator measured according to BS EN ISO 10140;

NOTE 5 Where more than one ventilation unit is required to achieve the background ventilation, the $D_{n,e}$ of the combined ventilators should be used in the calculation.

R_{wi} is the sound reduction index (octave band value) of the window (see Annex C);

R_{ew} is the sound reduction index (octave band value) of the external wall (see Annex C);

R_{rr} is the sound reduction index (octave band values) of the roof/ceiling (see Annex C);

A is the equivalent absorption area of the receiving room being considered (see Annex C);

3 is a correction factor.

Using the equation in **Figure 4.1**, it is possible to calculate the internal noise levels based on typical construction details and typical room dimensions and therefore calculate the minimum R_w for the windows. **Table 4.4** shows the results of this assessment.

Table 4.4: Summary of BS 8233 Calculations and Minimum Window R_w

Room Type	Day L_{Aeq}				Night L_{Aeq}				Suggested Window R_w	Ventilation Required?
	External (facade)	Internal			External (facade)	Internal				
		BS 8233 Max.	Windows Closed	Windows Open		BS 8233 Max.	Windows Closed	Windows Open		
Living room	64.0	35.0	33.6	49.0	-	-	-	-	35 dB	Yes
Dining room	64.0	40.0	33.6	49.0	-	-	-	-		Yes
Bedroom	64.0	35.0	33.6	49.0	59.8	30.0	28.5	44.8		Yes

Table 4.4 shows that in the worst affected rooms, closest to Guilford Street, the internal noise level within the bedrooms would be 33.6 dB(A) during the day and 28.5 dB(A) during the night time period, with a double glazed window unit with an overall R_w of 35, which is typical of a basic acoustic primary double glazed window system. This shows that under BS 8233, the daytime and night time noise levels are considered to be suitable for all room uses.

Typical room dimensions were taken from plans associated with this planning application, for the rooms closest to the main road and would therefore likely to be the worst affected rooms. A number of assumptions have been made regarding the acoustic properties of the construction materials. **Table 4.5** shows the acoustic properties of the construction materials used in the calculations.

Table 4.5: Summary of Acoustic Properties of Construction Material Used in the Calculations

Material	Frequency in Hertz					Notes
	125	250	500	1K	2K	
Vent $D_{n,e}$	48	46	49	54	65	*1*
Window R_{wi}	24	21	32	37	42	*2*
Wall R_{ew}	41	45	45	54	58	*3*

Notes:

1 – Data for a Greenwood Airvac MA3051 passive acoustic wall vent, with a typical R_w of 55; manufacturer supplied data;

2 - Data for a typical 10-20-4 high performance double glazed window unit with a R_w of 35; data supplied by Pilkington Glass;

3 – Data for a typical brick and blockwork external wall with a R_w of 50, from BS 8233:1999 'Sound insulation and noise reduction for buildings –Code of practice':

Table 4.4 shows that in the worst affected rooms, closest to Guilford Street, the internal noise level within the bedrooms with the windows partially open would cause noise levels to be in excess of the suitable noise levels contained within BS 8233. As a consequence, to ensure that windows do not need to be opened, which will then compromise the acoustic integrity of the facade, it will be necessary to install ventilation to all habitable rooms within the proposed development. An acoustically treated passive ventilation system should be suitable to provide ventilation, yet do not let noise into the premises as well as fresh air. It should be noted that it is not recommended that windows should be sealed, rather that future occupants have the option as to whether they want to be open the windows for ventilation.

The detailed calculations above are for the worst affected facades and facades further from the main sources of noise may not require the same robust protection from noise. Predictions based on the likely facade effects of the building show those windows on the rear facades of the building should experience suitable internal noise levels with a standard double glazed window unit, typically with a R_w of 31 to 33 dB.

It should be noted that the acoustic performance of the facade is dependent upon the relative performance of each element. For example, it may be possible to have a lower acoustic rated glazing system if the acoustic performance of the ventilation system is improved. Similarly, it may be necessary to have an improved glazing and ventilation package, if the walls of the proposed development are not typical brick and blockwork.

5. OVERALL CONCLUSIONS AND RECOMMENDATIONS

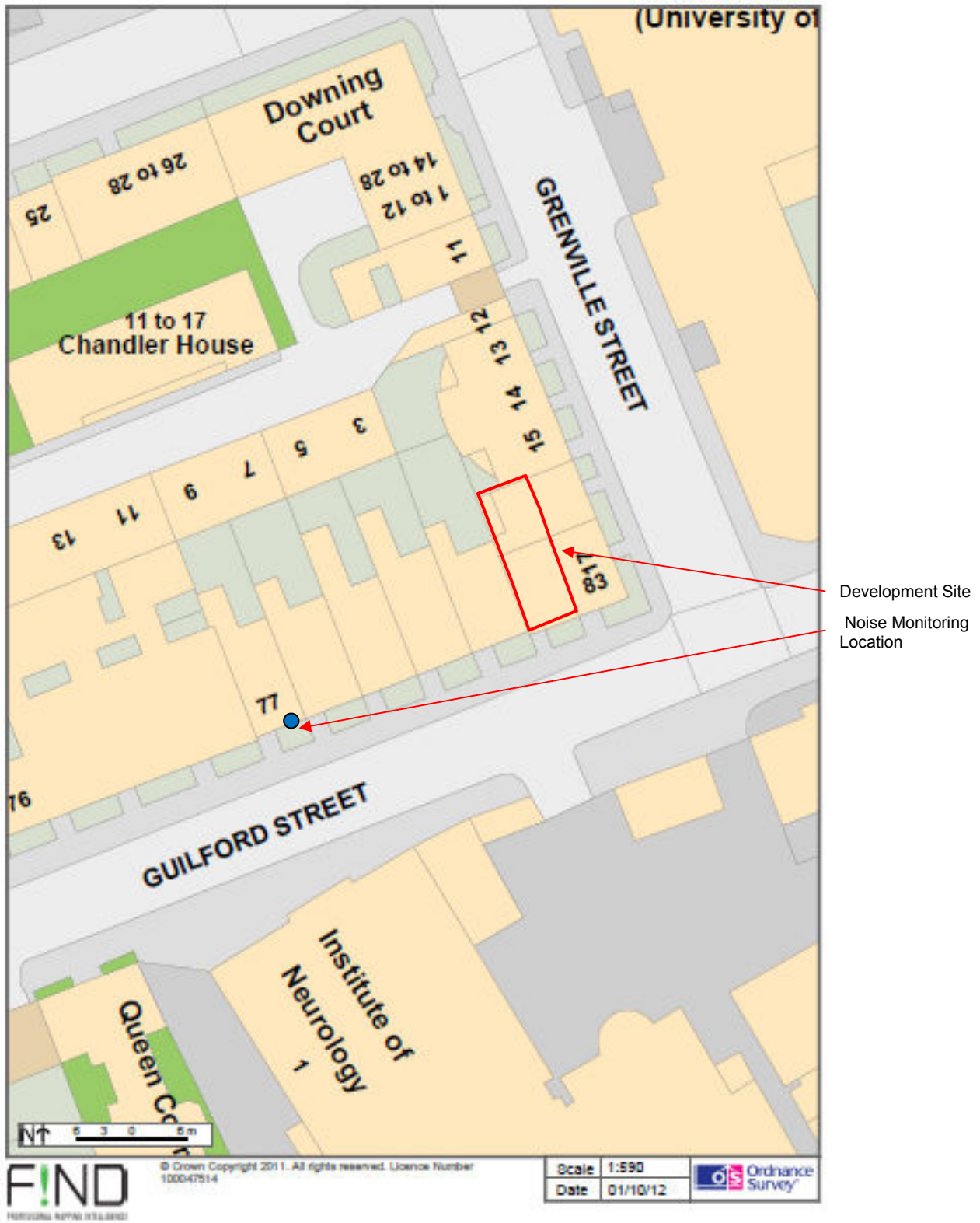
A detailed noise measurement study has been carried out at the site in order to determine whether as a result of noise, there are any significant constraints on developing the site for residential purposes.

The study has shown that based on noise from the adjacent road, if the site is to come forward for residential development, noise must be considered and attenuation must be provided.

Using the guidance and calculation methods contained within BS 8233: 2014 '*Guidance on sound insulation and noise reduction for buildings',* it has been shown that the recommended maximum internal noise levels for each room use under BS 8233 can be achieved through the provision of a good quality window unit with a R_w of at least 35 dB, and the provision of acoustically treated passive ventilation. Therefore, the noise environment of the site should not be a constraint on the proposed residential development.

Appendix 1
Site Location Plan

Appendix 1: Site Location Plan



Appendix 2
Glossary of Acoustic Terms

Appendix 2: Glossary of Acoustic Terms

Decibel (dB)	This is a tenth (deci) of a bel. Decibel can be a measure of the magnitude of sound, changes in sound level and a measure of sound insulation. Decibels are not an absolute unit of measurement but are an expression of ratio between two quantities expressed in logarithmic form.
dB(A)	A-weighted decibels, i.e. decibel level incorporating a frequency weighting (A weighting), which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness.
Freefield	A situation in which the radiation from a sound source is completely unaffected by the presence of any reflecting boundaries.
Hertz (Hz)	Unit of frequency, equal to one cycle per second. Frequency of sound waves refers to the number of pressure fluctuations per second. Frequency is related to the pitch of a sound.
$L_{Aeq,T}$	The equivalent steady sound level in dB(A) containing the same acoustic energy as the actual fluctuating sound level over the given period, T. For example, daytime noise is generally measured over a 16 hour period, so T is 16 hours. $L_{Aeq,T}$ can be measured directly with an integrating sound level meter.
L_{A10}	The 'A'-weighted sound pressure level of the residual noise in decibels exceeded for 10 per cent of a given time and is the $L_{A10,T}$. The L_{A10} is used to describe the levels of road traffic noise at a particular location.
L_{A50}	The 'A'-weighted sound pressure level of the residual noise in decibels exceeded for 50 per cent of a given time and is the $L_{A50,T}$.
L_{A90}	The 'A'-weighted sound pressure level of the residual noise in decibels exceeded for 90 per cent of a given time and is the $L_{A90,T}$. The L_{A90} is used to describe the background noise levels at a particular location.
L_{Amax}	The 'A'-weighted maximum sound pressure level measured over a measurement period.
R_w (or SRI)	The weighted sound reduction index as a single number laboratory measured rating used to describe the sound insulation of building elements.

Appendix 3
Schedule of Equipment

Appendix 3: Schedule of Equipment

Equipment Type	Manufacturer	Serial Number	Calibration Certification Number	Accreditation Body	Date of Last Calibration Check
Nor-140 Type 1 Sound Level Meter	Norsonic	1403056	11535	Campbell Associates	July 2012
Nor-1209 Pre-amplifier	Norsonic	12528	11535	Campbell Associates	July 2012
Nor-1225 Microphone	Norsonic	14360	11534	Campbell Associates	July 2012
Nor-1251 Sound Calibrator	Norsonic	32849	11533	Campbell Associates	July 2012
Nor-1284 Dehumidifier	Norsonic	222	Not Applicable		
Nor- 1212 Weather Protection Kit	Norsonic	Not Applicable			
Nor1408A/5 Extension Cable	Norsonic/Lemo	Not Applicable			

Calibration Report

Certificate No.:11535

Norsonic Type: 140 Serial no: 1403056

Customer: **Hawkins Environmental**
Address: **57 Verdi Close, Basingstoke, Hants. RG22 4JF.**
Contact Person: **Nick Hawkins.**

Instrument software version: V1.4.6238

Microphone :	Norsonic	Type: 1225	Serial no: 14360	Sens:-24.85dB
Preamplifier	Norsonic	Type: 1209	Serial no: 12528	
Calibrator:	Norsonic	Type: 1251	Serial no: 32849	Level:114.04dB
Wind screen	Norsonic	Type: Nor1451		

Measured with Preamplifier Mains adapter was included
Interface cable was included
This sound level meter has been calibrated as specified in BS 7580. PART 1: 1997.
Measurement Results:

Calibration of sound level meter - BS7580 Clause 5.4	Passed
Noise test - BS 7580 Clause 5.5.2	Passed
Level Linearity Test - BS 7580, Clause 5.5.3	Passed
Frequency weightings: A Network - BS 7580 Clause 5.5.4	Passed
Frequency weightings: C Network - BS 7580 Clause 5.5.4	Passed
Frequency weightings: Z Network - BS 7580 Clause 5.5.4	Passed
Time weightings F and S - BS7580 Clause 5.5.5	Passed
Peak response - BS7580 Clause 5.5.6	Passed
RMS accuracy - BS7580 Clause 5.5.7	Passed
Time weighting I - BS7580 Clause 5.5.8	Passed
Integrating Test : Time averaging - BS7580 Clause 5.5.9	Passed
Integrating Test : Pulse range - BS7580 Clause 5.5.10	Passed
Integrating Test : Sound exposure level - BS7580 Clause 5.5.11	Passed
Overload SPL Test - BS 7580 Clause 5.5.12	Passed
Overload Leq Test - BS 7580 Clause 5.5.12	Passed
Acoustic tests - BS 7580 Clause 5.4 and 5.6	Passed
Summation of acoustic tests - BS 7580 Clause 5.5.4	Passed

The sound level meter in the configuration tested conforms to the requirements of BS 7580 Part 1.

Comment:
Correct level with associated calibrator is 113.9dB(A). Results traceable to NPL London.

Measurement procedure: TP02

Environmental conditions:

Pressure:	Temperature:	Relative humidity:
100.934 kPa	22.4 °C	53.0 %RH

Date of calibration: 02/07/2012
Date of issue: 02/07/2012
Supervisor: Darren Batten Tech IOA
Engineer

Michael Tickner.

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Software version: 5.2e

Calibration Report

Certificate No.:11534

Manufacturer: Norsonic
Type: 1225
Serial no: 14360

Customer: Hawkins Environmental
Address: 57 Verdi Close, Basingstoke, Hants. RG22 4JF.
Contact Person: Nick Hawkins.

Measurement Results:

	Sensitivity: (dB re 1V/Pa)	Capacitance: (pF)
1:	-24.85	20.7
2:	-24.85	20.6
3:	-24.85	20.6
Result (Average):	**-24.85**	**20.7**
Expanded Uncertainty:	0.10	2.00
Degree of Freedom:	>100	>100
Coverage Factor:	2.00	2.00

The following correction factors have been applied during the measurement:
Pressure:-0.010 dB/kPa Temperature:-0.007 dB/°C Relative humidity:0.000 dB/%RH

Reference Calibrator: WSC1 - Nor1253-24269 Volume correction: 0.000 dB
Records:K:\C A\Calibration\Nor-1504\Nor-1017 MicCal\2012\NOR1225_14360_M1.nmf
Measurement procedure: TP05 V3.4

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with EA publication EA-4/02.

Comment: Results traceable to NPL London.

Environmental conditions:

Pressure:	Temperature:	Relative humidity:
100.932 ± 0.006 kPa	22.4 ± 1.2 °C	56.3 ± 2.5 %RH

Date of calibration: 02/07/2012
Date of issue: 02/07/2012

Supervisor : David Egan - Laboratory Manager
Engineer :

Campbell Associates
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Michael Tickner
Software version: 5.2g

Calibration Report

Certificate No.:11533

Manufacturer: Norsonic
Type: 1251
Serial no: 32849

Customer: Hawkins Environmental
Department:
Address: 57 Verdi Close, Basingstoke, Hants. RG22 4JF.
Order No:
Contact Person: Nick Hawkins.

Measurement Results:

	Level: (dB)	P. Stab : (dB)	Frequency: (Hz)	F. Stab : (%)	Distortion: (% TD)
1:	114.04	0.01	999.84	0.00	0.18
2:	114.04	0.01	999.83	0.00	0.18
3:	114.03	0.01	999.83	0.00	0.19
Result (Average):	**114.04**	**0.01**	**999.83**	**0.00**	**0.18**
Expanded Uncertainty:	0.10	0.02	1.00	0.01	0.10
Degree of Freedom:	>100	>100	>100	>100	>100
Coverage Factor:	2.00	2.00	2.00	2.00	2.00

The stated level is relative to 20µPa.

The following correction factors have been applied during the measurement:
Pressure:0.0005 dB/kPa Temperature:0.003 dB/°C Relative humidity: None
Reference microphone: WSM2 - GRAS40AG-28653. Volume correction: -0.015 dB
Records:K:\C A\Calibration\Nor-1504\Nor-1018 CalCal\2012\NOR1251_32849_M1.nmf
Measurement procedure: TP01 v7.9

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with EA publication EA-4/02.

Results traceable to NPL London.

Environmental conditions:

Pressure:	Temperature:	Relative humidity:
100.940 ± 0.003 kPa	22.3 ± 1.2 °C	57.9 ± 2.8 %RH

Date of calibration: 02/07/2012
Date of issue: 02/07/2012

Supervisor : Darren Batten TechIOA.
Engineer :

Michael Tickner
Software version: 5.2a

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Appendix 4
Summary of Noise Measurements

Appendix 4: Summary of Noise Measurements

Time	L_{Aeq}	L_{Amax}	L_{A10}	L_{A50}	L_{A90}
07:00	67.7	86.0	71.4	63.0	55.5
08:00	67.9	86.1	70.8	65.1	59.1
09:00	68.7	94.6	70.6	65.1	60.1
10:00	67.6	87.2	70.6	64.7	58.5
11:00	67.0	88.4	70.2	64.6	58.3
12:00	66.0	81.2	69.4	63.6	57.4
13:00	66.9	84.8	69.9	65.0	59.1
14:00	67.1	88.5	70.1	64.7	59.0
15:00	66.7	83.8	69.8	64.1	58.0
16:00	66.8	85.0	69.9	64.5	58.1
17:00	65.9	79.9	69.1	64.0	57.3
18:00	67.6	87.0	70.8	65.3	58.8
19:00	67.9	82.5	71.8	63.9	56.6
20:00	67.1	93.7	69.8	62.2	56.0
21:00	64.4	82.7	68.4	59.3	53.3
22:00	64.9	79.0	69.1	60.0	54.2
23:00	63.2	80.0	67.9	56.6	51.0
00:00	64.7	94.5	66.6	54.9	50.2
01:00	60.7	81.9	63.8	52.5	48.9
02:00	62.0	90.0	64.5	53.9	49.4
03:00	60.8	91.5	60.4	50.9	48.1
04:00	60.0	81.3	60.7	51.6	48.1
05:00	62.6	81.2	65.2	54.5	50.4
06:00	65.4	82.1	69.2	58.8	53.0
Day	**67.0**	**94.6**	**70.1**	**63.7**	**57.5**
Night	**62.8**	**94.5**	**64.8**	**54.2**	**49.9**