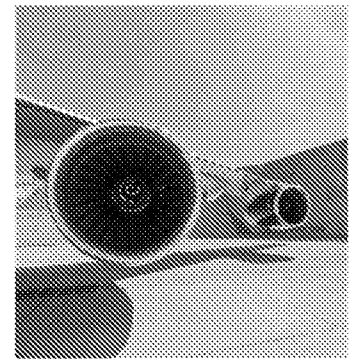
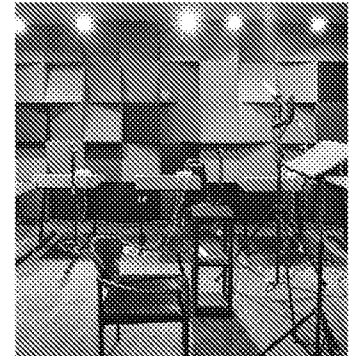
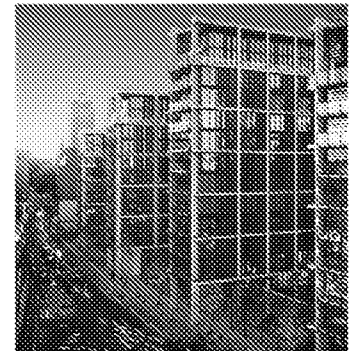




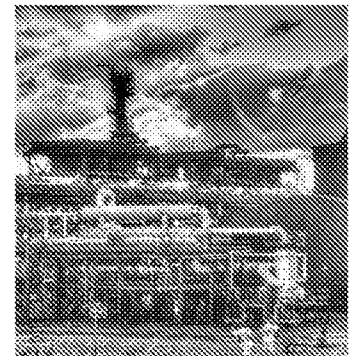
REPORT AS7839.190129.NIA2.0



WINDROOS NURSERY, LITTLEHAMPTON



NOISE IMPACT ASSESSMENT



Prepared: 04 February 2019

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AS7839/SP1	Indicative Site Plan
AS7839/MSP	Mitigation Strategy Plan
AS7839/TH1-TH6	Environmental Noise Time Histories
Appendix A	Acoustic Terminology

1.0 INTRODUCTION

Planning approval has been sought to develop land at Windroos Nursery, Littlehampton for residential use.

Clarke Saunders Associates has been commissioned by Dandara Limited to undertake an assessment of the current environmental noise impact on the site, with the aim of discharging Condition 18 of the Arun District Council Planning Decision Notice. Noise will be assessed in accordance with the guidance specified in the World Health Organisation Guidelines for Community Noise.

This assessment will propose outline mitigation measures for the proposed residential development, as required by the Planning Decision Notice.

This report is an update to the previously issued assessment AS7839.150513.NIA, to reflect the Approved Site Layout (Substitute Master Plan 13121 P10.003 – P2).

2.0 SITE DESCRIPTION AND PLANNING PERMISSION CONTEXT

The southern half of the site is currently occupied by an unoccupied commercial building, two residential properties and a large area of hard standing. The northern half of the site is largely unoccupied, containing only the remains of a glass-house previously belonging to the Windroos Nursery. The rest of the northern half of the site is empty waste ground.

Immediately to the north and west of the site lies existing residential development. A stretch of national rail runs from west-to-east beyond the residential development to the north, though the noise impact of this on the site is minimised by a combination of distance and screening provided by the intermediate residential development and the neighbouring Watersmead Business Park industrial buildings.

Immediately to the east of the site lies Norway Lane which serves the business park - containing light industrial warehouses, office buildings and car park space. The light industrial buildings receive a regular amount of heavy goods vehicle traffic via Norway Lane. A dual carriageway stretch of the A259 lies beyond the industrial buildings and is audible toward the northern end of the Windroos Nursery site. A single carriageway stretch of the A259 (Worthing Road) borders the south of site, with The Body Shop Roundabout approximately 80 metres to the south east.

Condition 18 of Arun District Council Planning Decision Notice LU/229/10/ states the following:

CONDITION 18 No development shall take place until the following information, relating to noise attenuation has been submitted to, and approved by, the Local Planning Authority, in consultation with the Council's Environmental Health Officers:-

- Details of façade attenuation measures proposed to habitable rooms fronting the A259 and the adjacent Watersmead Business Park (current plans do not indicate a boundary with the railway line;

- A specification of boundary attenuation measures indicated in the north-east corner of the site;

- A survey of the background noise adjacent to the north east boundary.

The development shall be carried out in accordance with the approved details.

Reason: To protect the amenities of occupiers of adjoining properties in accordance with Arun District Council Local Plan Policies GEN7 and GEN32.

2.1 WHO Guidelines for Community Noise (1999)

The guidance in this document details suitable noise levels for various activities within residential and commercial buildings.

The relevant sections of this document are shown in Table 2.1.

Criterion	Environment	Design range $L_{Aeq,T}$ dB
Maintain speech intelligibility and avoid moderate annoyance, daytime and evening	Living Rooms	35
Prevent sleep disturbance, night time	Bedrooms	30

Table 2.1 - Excerpt from WHO

[dB ref. 20µPa]

This guidance also states that individual noise events should not normally exceed 45 dB $L_{Amax,fast}$ within bedrooms at night.

For outdoor living areas, it is stated that:

'To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB L_{Aeq} on balconies, terraces and in outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50dB L_{Aeq} . Where it is practical and feasible, the lower outdoor sound level should be considered the maximum desirable sound level for new development.'

2.2 BS8233:2014 *Guidance on sound insulation and noise reduction for buildings*

The guidance in this document indicates acceptable noise levels for various activities within residential dwellings.

The relevant section of this standard is shown in the following table:

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

Table 2.2 - Excerpt from BS8233: 2014

[dB ref. 20µPa]

For external areas the standard states the following:

For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments.

However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.

3.0 SURVEY PROCEDURE & EQUIPMENT

A survey of the existing background noise levels was undertaken at the locations shown in site plan AS7839/SP1. Measurements of consecutive 5-minute L_{Aeq} , L_{Amax} , L_{A10} and L_{A90} sound pressure levels were taken between 12:30 hours on Friday 6th June and 11:15 hours on Monday 9th June 2014.

Additional synchronous 5-minute manual measurements were undertaken on Friday 6th June at various locations around the site, also shown in site plan AS7839/SP1.

The following equipment was used during the course of the survey:

- 3 no. Norsonic data logging sound level meter type 118;
- 1 no. Norsonic sound level calibrator type 1253.

The calibration of sound level meters was verified before and after use. No significant calibration drift was detected.

The weather during the survey was dry with light winds, which made the conditions suitable for the measurement of environmental noise.

Measurements were made generally in accordance with ISO 1996-2:2007 *Acoustics - Description, measurement and assessment of environmental noise – Part 2: Determination of environmental noise levels*.

Please refer to Appendix A for details of the acoustic terminology used throughout this report.

4.0 RESULTS

Figures AS7839/TH1-TH3 show the L_{Aeq} , L_{Amax} , L_{A10} and L_{A90} sound pressure levels as time histories at monitoring position 'A' (Norway Lane) and figures AS7839/TH4-TH6 show the same at monitoring position 'B' (Worthing Road).

The northern area of the site, in the vicinity of Measurement Position A is affected by building services plant noise from the light industrial unit opposite and road noise from the dual carriageway A259 further east, with maximum events attributed to passing heavy goods vehicles on Norway Lane. It is noted from the time histories that average noise levels decrease over the weekend at this measurement position. For this reason, the higher weekday average noise levels have been used to specify all following mitigation measures at receptors in the locality of this measurement position.

The southern area of the site, in the vicinity of Measurement Position B is primarily affected by road traffic noise from the single carriageway Worthing Road. Note that Monitoring Position B was located at a distance of 6m from the existing carriageway. The southern proposed dwelling facades are approximately 21m from the proposed re-aligned carriageway.

The average noise levels for the 'Daytime' and 'Night-time' periods at the monitoring locations are shown in Table 4.1.

Measurement Position	Daytime L_{Aeq} , 16 hour	Night-time, L_{Aeq} , 8 hour
A	55 dB	50 dB
A (weekday only)	59 dB	n/a
B	71 dB	65 dB

Table 4.1 - Daytime and night-time average noise level at survey measurement positions

[dB ref. 20µPa]

Typical maximum night time noise events at measurement position A were $L_{Amax,fast}$ 70dB.

Typical maximum night time noise events at measurement position B were $L_{Amax,fast}$ 81dB.

5.0 DESIGN REVIEW

The following design review is based on the July 2016 Boyle+Summers approved site layout masterplan (Substitute Master Plan 13121 P10.003 – P2) for the proposed development.

The review also assumes that all habitable rooms throughout the development are single aspect and that standard glazing areas of 1-2m² per room will be used. It has also been assumed that standard room dimensions will be featured. Minimum volumes of 25m³ and minimum width dimension of 3m are assumed.

5.1 Calculated Façade Levels

The measured sound pressure levels at the two monitoring positions have been corrected for distance losses in order to predict façade-incident levels at the nearest proposed building lines and garden areas to the Worthing Road and Norway Lane.

5.2 Architectural Arrangements

It has been assumed that all non-glazed elements, i.e. masonry walls/facings and the roof systems, will provide the following minimum sound insulation performances, when tested in accordance with ISO 10140-2:2010.

Frequency (Hz)	Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)					
	125	250	500	1k	2k	4k
Masonry	41	43	48	50	55	55

Table 5.1 - Assumed minimum sound reduction indices of solid constructions

6.0 REQUIRED GLAZING PERFORMANCE

The minimum sound insulation specifications for the glazed elements of the building façades closest to the Norway Lane and Worthing Road are given in the table below. These have been calculated using the monitoring data and appropriate corrections based on the distance of the proposed building facades from the relative noise sources.

Glazing Type	Single Figure Weighted Sound Reduction Figure (dB)	Ventilator Performance (dB)
Type A	R_w 30	$D_{n,e,w}$ 30
Type B	R_w 32	$D_{n,e,w}$ 34

Table 6.1 - Minimum required sound reduction indices for glazing and ventilators

The Type A glazing requirement is expected to be achieved by standard thermal double glazing units. In order that windows may remain closed to maintain the internal noise levels, it is expected that an alternative means of providing background ventilation will be required. If trickle vents or wall ventilators are used, the acoustic performance shown in Table 6.1 will be required.

The figures stated are for a single ventilator per room. If multiple vents are required, then the performance requirement shown in Table 6.1 will increase by a value equal to $+10\log(N)$, with N being the total number of vents serving the room. (*e.g., two vents in a room will require each vent to 3dB higher performance than indicated*).

The sound reduction specified for the windows must be met with any proposed trickle vents installed and open. However, there is no reason why windows cannot be opened for personal preference or purge ventilation, provided the required performance is reliably achieved when they are closed.

7.0 DISCUSSION

7.1 Glazing Specification

Table 7.1, below, identifies where the performance requirements shown in Table 6.1 apply. For clarity, see also attached mitigation strategy plan, AS7839/MSP1.

Elevation	Floor	Glazing type required
Green (north-eastern) aspects	All	Type A
Red (southern and south-eastern) aspects	All	Type B
Other	All	Standard Thermal Glazing / Standard Trickle Vents

Table 7.1 - Locations for glazing types

Standard thermal double glazing and standard (non-acoustic) trickle ventilators at all other plot façades within the development would be expected to result in satisfactory internal noise levels in line with Table 2.2.

Where specified, it is important that the quoted minimum sound reduction specifications are met by the entire glazing unit in each case, including frames, seals, etc. Glass performance alone is not an acceptable means of demonstrating compliance with the specification for window performance.

Windows to bathrooms, corridors or other non-habitable areas are not required to achieve the indicated specification.

7.2 Areas of External Amenity

Gardens located along the north-east extent of the development closest to Norway Lane are expected to be subject to levels in the region of L_{Aeq} 50-55dB during weekday daytime hours. These levels are within the range of WHO levels recommended for outdoor living areas. It is assumed that all plot gardens throughout the development will be surrounded by standard 1.8m high close boarded timber fencing (other than those specified as 2.0m high fencing: see below). This will provide additional screening losses and average daytime levels in the most exposed areas are therefore anticipated to be below the L_{Aeq} 50dB WHO guideline level.

Balconies are also proposed on block of flats located at the north east of the site. These are located on the north, south and western facades of the building and so do not overlook Norway Lane. Balconies on the north and south facades of the building feature an imperforate, clad construction facing towards Norway Lane and which also partially wraps around the north/south side of the balcony. The remainder of the balcony screen is formed from glazed panels. Due to this configuration and the orientation of incident road noise, as a minimum, seated receptors can expect to benefit from around 5dB of screening, commensurate with line of sight screening effects. Balconies on the west facade will be heavily screened by the intermediate building. As a result, levels on all balconies are expected to be below the L_{Aeq} 50dB WHO level recommended for outdoor living areas.

Many gardens belonging to the southern-most plots of the development are expected to experience average daytime levels in the region of L_{Aeq} 60-65dB, though some will benefit from variable road traffic noise screening due to intermediate houses.

Installation of 2.0m high close-boarded timber fencing along the garden boundaries, at the locations indicated in blue in the attached Mitigation Strategy Plan, AS7839/MSP1, is expected to control noise levels to below the higher L_{Aeq} 55dB WHO level recommended for outdoor living areas.

Fencing should be continuous and imperforate. Standard close boarding construction would provide adequate mass to achieve the required reductions, however, a good quality fence is recommended such that gaps do not form and the integrity is maintained over time.

8.0 CONCLUSIONS

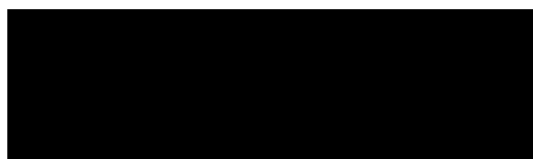
Measurements have been made of the prevailing noise climate at the proposed site for residential development at former Windroos Nursery, Littlehampton.

The measured levels have been assessed against currently available standards and guidance documents, including the World Health Organisation Guidelines for Community Noise (1999) and BS8233:2014, to address Condition 18 of Arun District Council Planning Decision Notice LU/229/10/.

For housing façades bordering the southern and eastern extents of the site, the survey has allowed the minimum sound reduction requirements of the external building fabric to be established as a performance specification.

Boundary attenuation measures for the southern extent of the site have also been specified.

Where suitable mitigation is adopted, internal noise levels within dwellings and external noise levels in external amenity areas are expected to be commensurate with -or less than- the recommended levels discussed in the aforementioned guidance documents.



Ben Alexander MIOA

CLARKE SAUNDERS ASSOCIATES

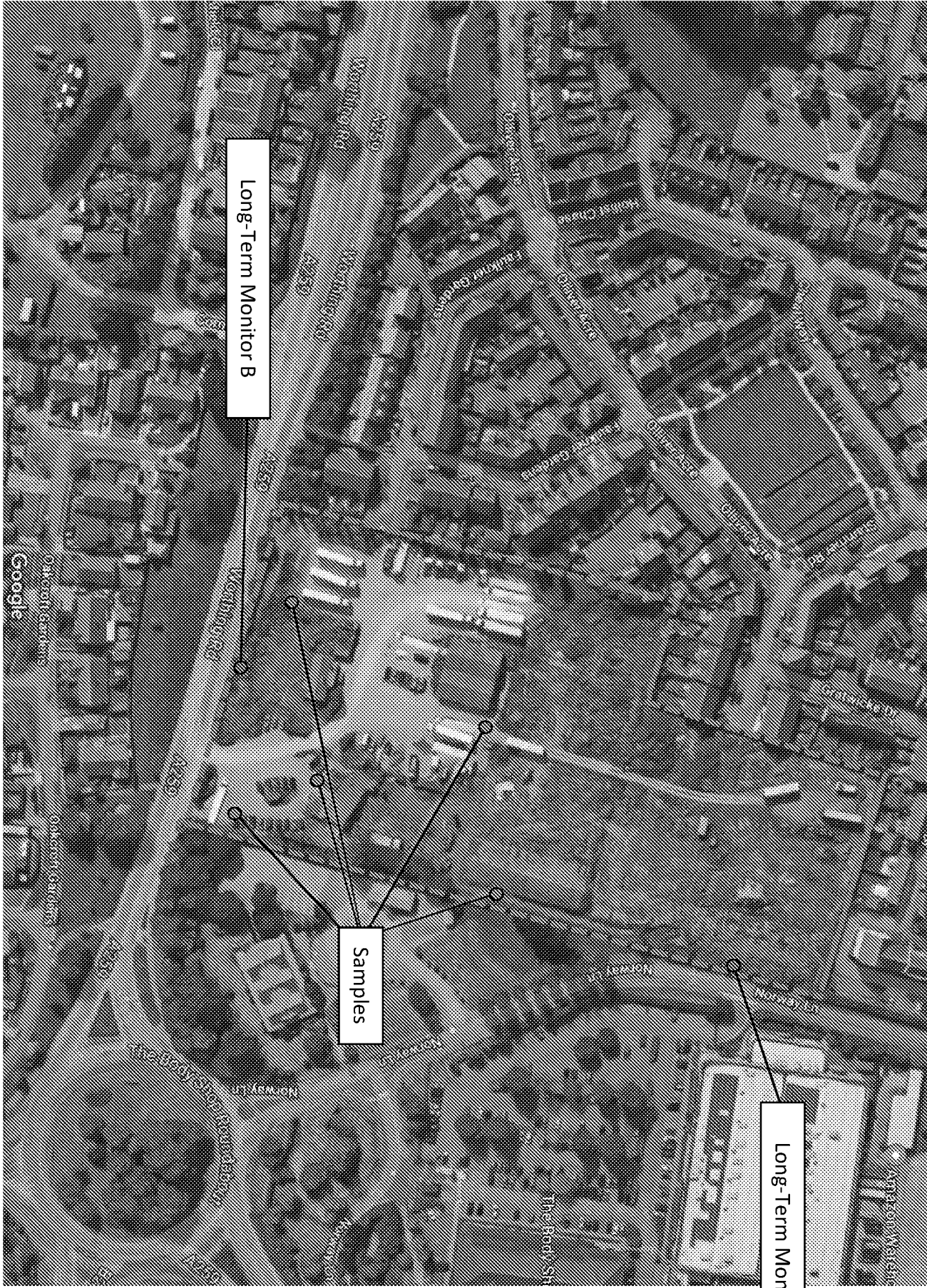
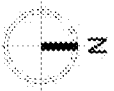


Figure AS7839/SP1



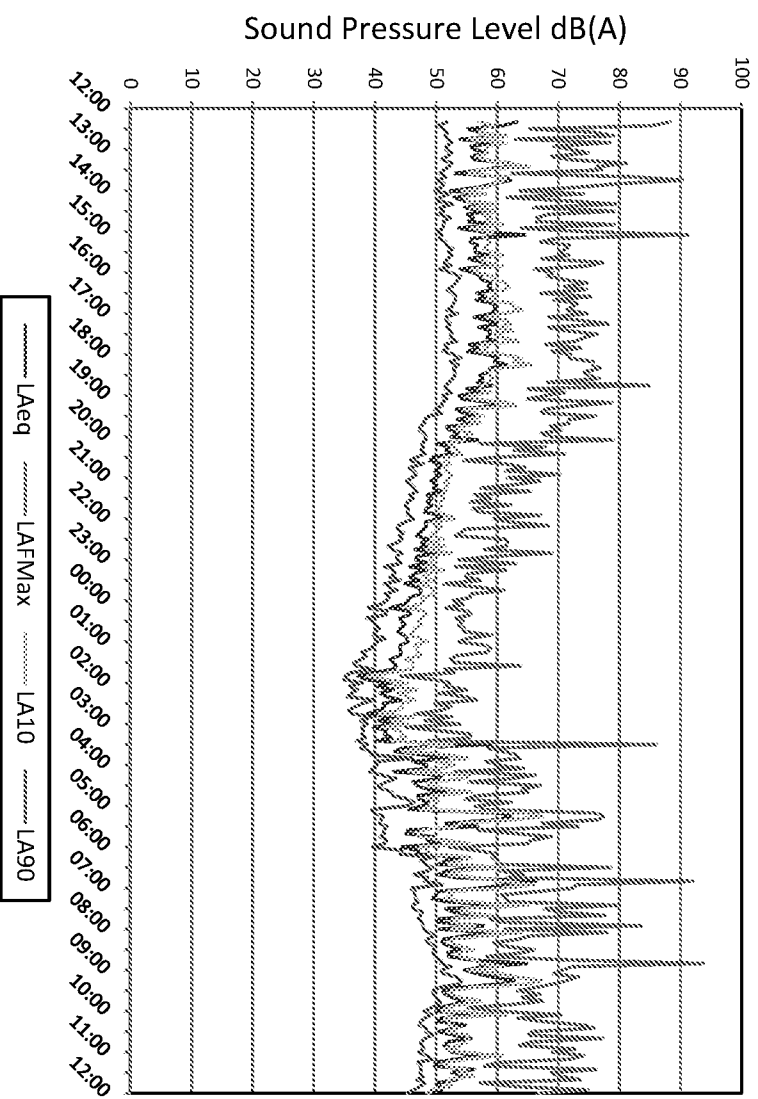
-  Type A Glazing
-  Type B Glazing
-  2.0m Fencing



Figure AS7839/MSP1

Windroos Nursery, Littlehampton

Environmental Noise Time History: Monitoring Location A

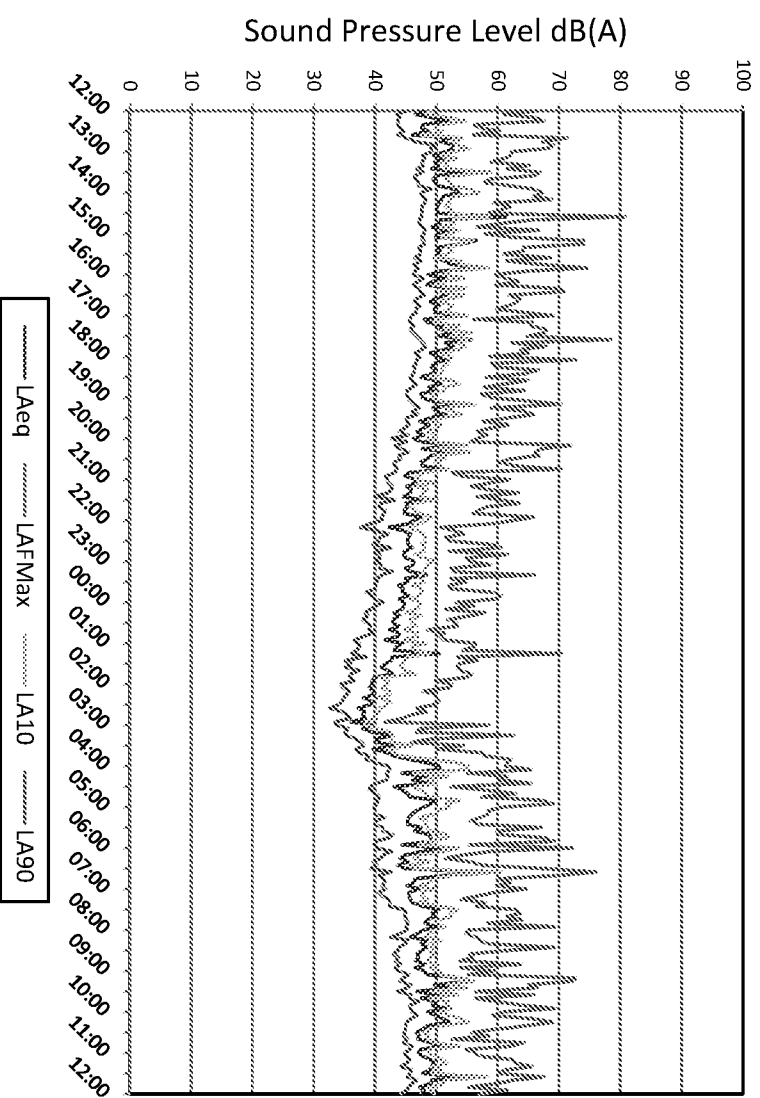


Friday 06 June to Saturday 07 June 2014

Figure AS7839/TH1

Windroos Nursery, Littlehampton

Environmental Noise Time History: Monitoring Location A

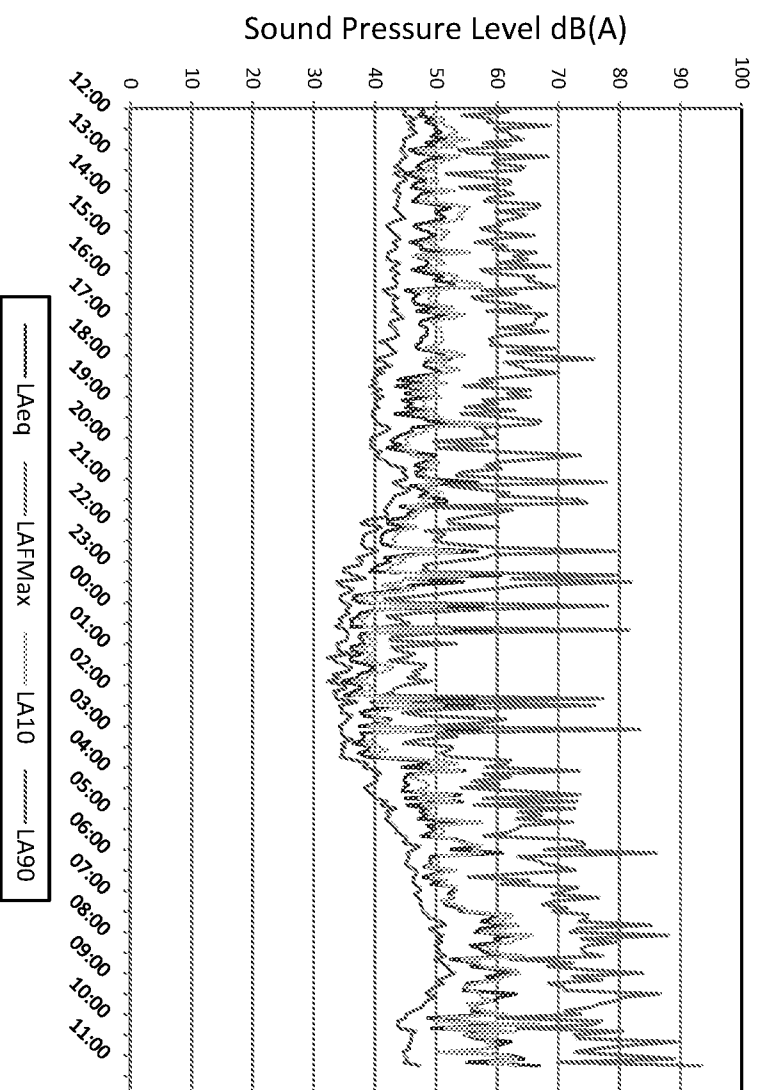


Saturday 07 June to Sunday 08 June 2014

Figure AS7839/TH2

Windroos Nursery, Littlehampton

Environmental Noise Time History: Monitoring Location A

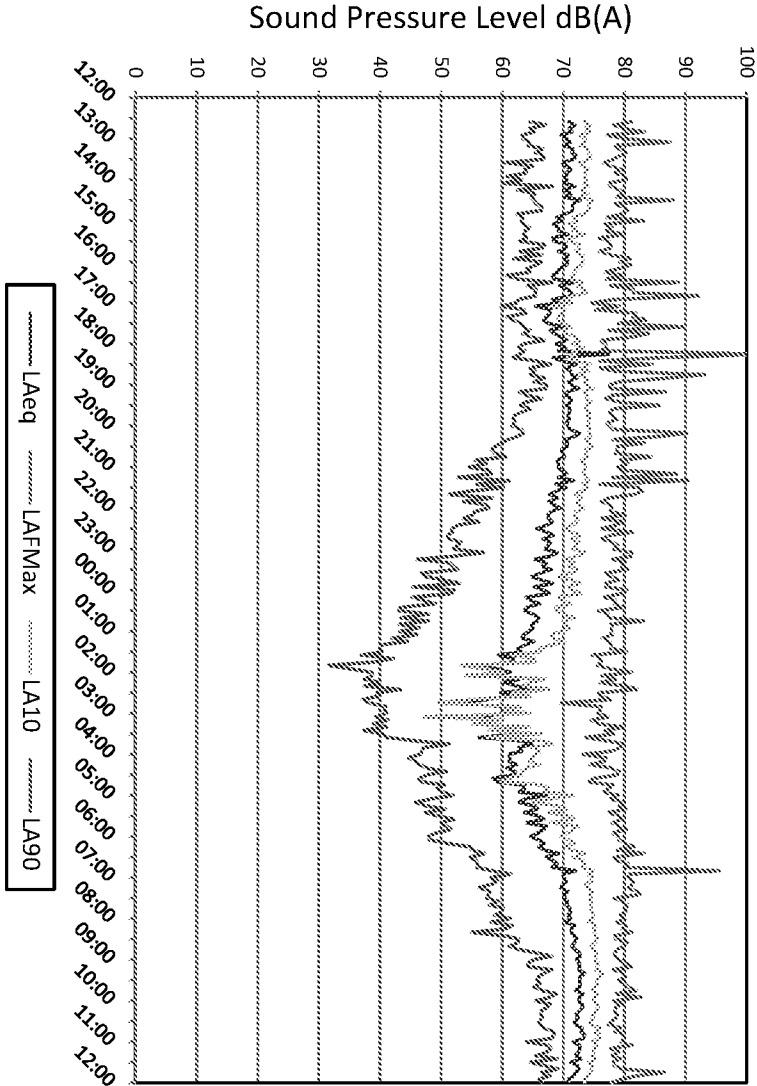


Sunday 08 June to Monday 09 June 2014

Figure AS7839/TH3

Windroos Nursery, Littlehampton

Environmental Noise Time History - Monitoring Location B

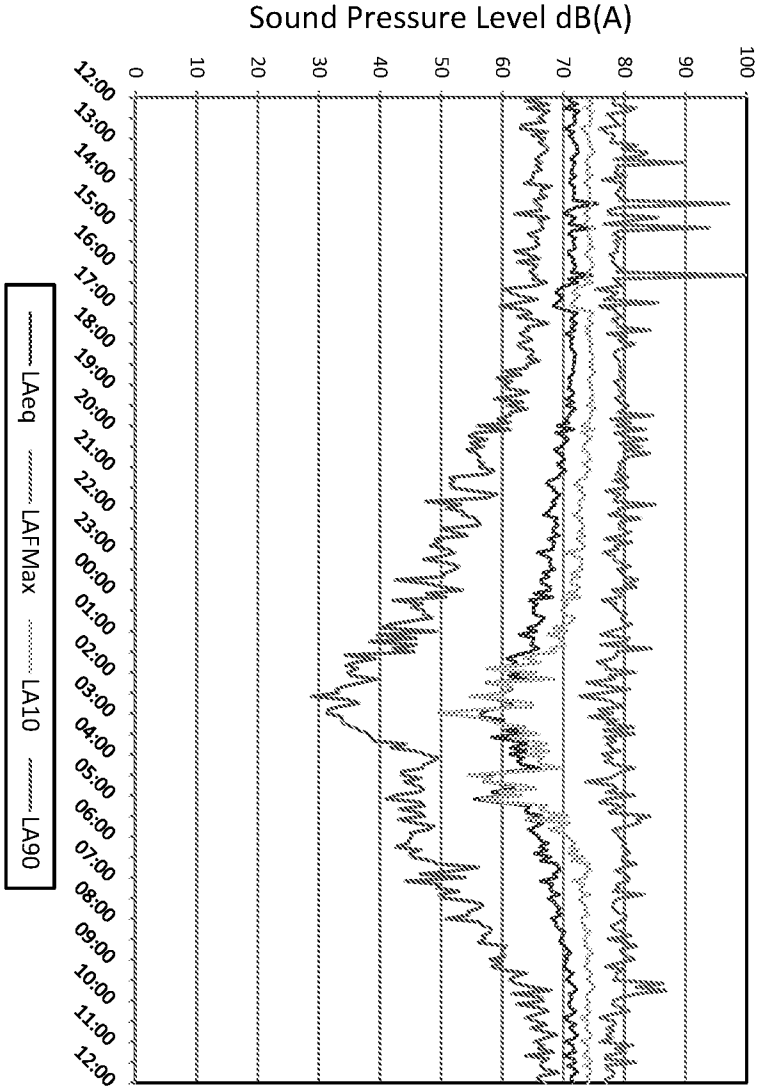


Friday 06 June to Saturday 07 June 2014

Figure AS7839/TH4

Windroos Nursery, Littlehampton

Environmental Noise Time History - Monitoring Location B

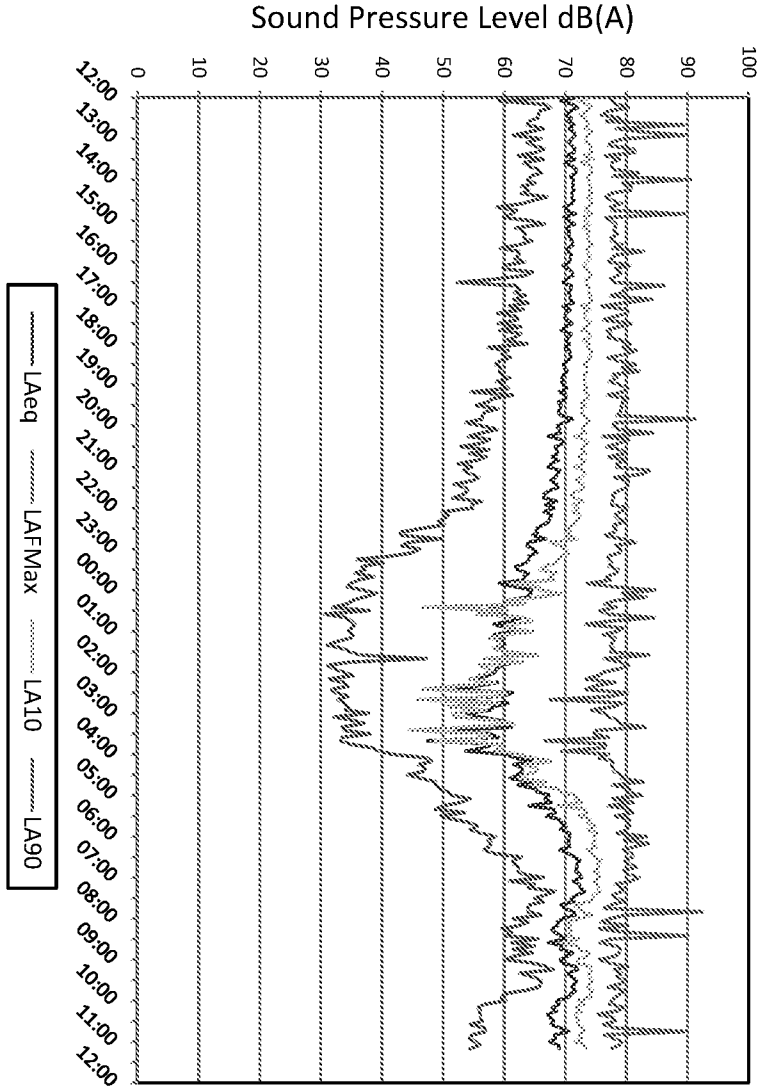


Saturday 07 June to Sunday 08 June 2014

Figure AS7839/TH5

Windroos Nursery, Littlehampton

Environmental Noise Time History - Monitoring Location B



Sunday 08 June to Monday 09 June 2014

Figure AS7839/TH6

Frequency	The rate per second of vibration constituting a wave, measured in Hertz (Hz), where 1Hz = 1 vibration cycle per second. The human hearing can generally detect sound having frequencies in the range 20Hz to 20kHz. Frequency corresponds to the perception of 'pitch', with low frequencies producing low 'notes' and higher frequencies producing high 'notes'.
dB(A):	Human hearing is more susceptible to mid-frequency sounds than those at high and low frequencies. To take account of this in measurements and predictions, the 'A' weighting scale is used so that the level of sound corresponds roughly to the level as it is typically discerned by humans. The measured or calculated 'A' weighted sound level is designated as dB(A) or L_A .
L_{eq}:	A notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (e.g. 8 hour, 1 hour, etc). The concept of L_{eq} (equivalent continuous sound level) has primarily been used in assessing noise from industry, although its use is becoming more widespread in defining many other types of sounds, such as from amplified music and environmental sources such as aircraft and construction. Because L_{eq} is effectively a summation of a number of events, it does not in itself limit the magnitude of any individual event, and this is frequently used in conjunction with an absolute sound limit.
L_{10} & L_{90}:	Statistical L_n indices are used to describe the level and the degree of fluctuation of non-steady sound. The term refers to the level exceeded for n% of the time. Hence, L_{10} is the level exceeded for 10% of the time and as such can be regarded as a typical maximum level. Similarly, L_{90} is the typical minimum level and is often used to describe background noise. It is common practice to use the L_{10} index to describe noise from traffic as, being a high average, it takes into account the increased annoyance that results from the non-steady nature of traffic flow.
L_{max}:	The maximum sound pressure level recorded over a given period. L_{max} is sometimes used in assessing environmental noise, where occasional loud events occur which might not be adequately represented by a time-averaged L_{eq} value.
R	<i>Sound Reduction Index</i> . Effectively the <i>Level Difference</i> of a building element when measured in an accredited laboratory test suite in accordance with the procedures laid down in BS EN ISO 10140-2:2010 and corrected for its size and the reverberant characteristics of the receive room.
R_w, D_w $D_{n1,w}$, $D_{n,e,w}$ $D_{n,f,w}$	Value of parameter, determined as above, but weighted in accordance with the procedures laid down in BS EN ISO 717-1 to provide a single-figure value.

1.1 Octave Band Frequencies

In order to determine the way in which the energy of sound is distributed across the frequency range, the International Standards Organisation has agreed on "preferred" bands of frequency for sound measurement and analysis. The widest and most commonly used band for frequency measurement and analysis is the Octave Band. In these bands, the upper frequency limit is twice the lower frequency limit, with the band being described by its "centre frequency" which is the average (geometric mean) of the upper and lower limits, e.g. 250 Hz octave band extends from 176 Hz to 353 Hz. The most commonly used octave bands are:

Octave Band Centre Frequency Hz	63	125	250	500	1000	2000	4000	8000
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APPENDIX A

ACOUSTIC TERMINOLOGY AND HUMAN RESPONSE TO BROADBAND SOUND

1.2 Human Perception of Broadband Noise

Because of the logarithmic nature of the decibel scale, it should be borne in mind that sound levels in dB(A) do not have a simple linear relationship. For example, 100dB(A) sound level is not twice as loud as 50dB(A). It has been found experimentally that changes in the average level of fluctuating sound, such as from traffic, need to be of the order of 3dB before becoming definitely perceptible to the human ear. Data from other experiments have indicated that a change in sound level of 10dB is perceived by the average listener as a doubling or halving of loudness. Using this information, a guide to the subjective interpretation of changes in environmental sound level can be given.

INTERPRETATION

Change in Sound Level dB	Subjective Impression	Human Response
0 to 2	Imperceptible change in loudness	Marginal
3 to 5	Perceptible change in loudness	Noticeable
6 to 10	Up to a doubling or halving of loudness	Significant
11 to 15	More than a doubling or halving of loudness	Substantial
16 to 20	Up to a quadrupling or quartering of loudness	Substantial
21 or more	More than a quadrupling or quartering of loudness	Very Substantial

1.3 Earth Bunds and Barriers - Effective Screen Height

When considering the reduction in sound level of a source provided by a barrier, it is necessary to establish the "effective screen height". For example if a tall barrier exists between a sound source and a listener, with the barrier close to the listener, the listener will perceive the sound as being louder if he climbs up a ladder (and is closer to the top of the barrier) than if he were standing at ground level. Equally if he sat on the ground the sound would seem quieter than if he were standing. This is explained by the fact that the "effective screen height" is changing with the three cases above. In general, the greater the effective screen height, the greater the perceived reduction in sound level.

Similarly, the attenuation provided by a barrier will be greater where it is aligned close to either the source or the listener than where the barrier is midway between the two.