BIG SKY acoustics

Noise Assessment

Proposed air conditioning and extraction plant at
171 and 170a Drury Lane, London, WC2

14 September 2009

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On behalf of: Margin Finance Corporation Limited

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Contents

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1.0 Introduction

1.1 RadcliffesLeBrasseur, acting on behalf of Margin Finance Corporation Limited, have instructed Big Sky Acoustics to carry out a noise assessment of proposed plant at 171 and 170a Drury Lane, London WC2.

1.2 Big Sky Acoustics understands that the Local Planning Authority, in assessing the merits of the application, will wish to assess the potential noise from the proposed plant. Accordingly, this noise assessment has included:

- Noise monitoring at the nearest noise sensitive facade of residential property that may be affected by noise from the plant;
- Calculation of predicted noise from proposed plant at nearest existing residential property.

1.3 An explanation of acoustical terms used in this report is provided in Appendix A.

1.4 All sound pressure levels in this report are given in dB re: 20μPa.

2.0 Location

2.1 The location of the site is shown in Appendix B.

2.2 The site straddles two existing planning units, No 171 and 170a Drury Lane. Both of these are contained within a parade, which stretches from Parker Street to Macklin Street in which inclusive of the site there are six units at ground level.

2.3 The area is predominantly commercial in character, made up of a mixture of several offices, shops and entertainment venues. There are a few residencies in the area in upper floors.

2.4 The noise climate in the area during the assessment was considered typical for the location and is dominated predominantly by road traffic on Drury Lane. The noise climate at night also consists of road traffic and pedestrian noise. Relatively high average day-time and night-time noise levels are to be expected at this busy city centre location.

2.5 It is important when assessing the impact of individual plant that the concept of *new noise* associated with the new plant is taken into account. The incremental change to noise levels caused by the new plant, in an area where existing noise levels are already high, is likely to be very small.

2.6 The proposal is for a café at ground floor level and a restaurant at basement level. The café and restaurant will not operate past midnight. Also, it is envisaged that people will gradually exit during the course of the evening.

2.7 From the point of view of outdoor noise from customers, there will be no vertical drinking within this proposal. Customers will consume drinks at their tables, as part of a meal.

3.0 Assessment standards and guidance

Camden Council: UDP

3.1 Camden's Unitary Development Plan (UDP) specifically addresses the issue of noise from plant in Policy SD8A (Disturbance from plant and machinery).

3.2 SD8A states:

The Council will only grant planning permission for plant or machinery, including ventilation or air handling equipment, if it can be operated without causing a loss to local amenity and does not exceed the thresholds set out in Appendix 1 - Noise and Vibration (Table E).

Noise description and location of measurement	Period	Time	Noise level
Noise at 1 metre external to a sensitive façade	Day, evening and night	0000-2400	5dB(A) <LA90
Noise that has a distinguishable discrete continuous (whine, hiss, screech, hum) at 1 metre external to a sensitive façade	Day, evening and night	0000-2400	10dB(A) <LA90
Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1 metre to a sensitive façade	Day, evening and night	0000-2400	10dB(A) <LA90
Noise at 1 metre external to sensitive façade where LA90 >60dB	Day, evening and night	0000-2400	55dB LA_{eq}

Figure 1: Camden Council Unitary Development Plan: Appendix 1, Table E

3.3 The UDP continues in Paragraphs 1.51 and 1.52:

1.51 Plant and machinery, including ventilation and air handling equipment and any ancillary plant, ducting and equipment can have undesirable impacts on nearby properties. This can relate to their appearance and location as well as the odour and fumes and noise/vibration pollution that can be created.

1.52 The Council seeks to ensure that the level of noise/vibration from all plant and machinery does not increase existing ambient noise levels, therefore planning permission will only be granted for plant or machinery if it can be operated without causing a loss to local amenity and does not exceed the thresholds set out in Table E. In determining whether a proposal may be acceptable, the Council will require planning applications to include details of all proposed plant and machinery associated with a development, including an acoustic report. This may require close co-operation between an environmental or air handling engineer and the architect to agree an acceptable design solution for the particular premises and uses for which the system is designed. Supplementary guidance contains general guidance on minimising the impacts of plant and machinery.

PPG 24

3.4 Guidance on noise relating to planning and new development is given in Planning Policy Guidance "Planning and Noise" (PPG 24) [Reference 1]. PPG24 Annex 3, Paragraph 19 states *"The likelihood of complaints about noise from industrial sources can be assessed, where the standard is appropriate, using guidance in BS4142: 1990".*

BS 4142

3.5 British Standard 4142 [Reference 2] is the most relevant standard for assessing the likelihood of complaints in relation to noise from fixed industrial plant.

3.6 This standard compares the industrial noise level in terms of a L_{Aeq} for the noise source operation (the specific noise level) with the existing background noise levels in terms of an L_{A90} when the source is not operating. This can be corrected for the tonal or impulsive nature of the noise if appropriate, by adding 5dB, to give the 'rating level'. The arithmetical difference between the 'rating level' and the background is called the 'assessment level'.

3.7 With regard to the assessment level, BS4142 indicates that '...A difference of around 10dB or higher indicates that complaints are likely. A difference of around 5dB is of marginal significance. If the rating level is more than 10dB below the measured background noise level this is a positive indication that complaints are unlikely.'

BS 8233

3.8 British Standard 8233 [Reference 3] defines a range of ambient noise levels for a number of design criteria for good or reasonable conditions in certain habitable rooms. Figure 2 shows a summary of the levels recommended in BS 8233 for rooms used for resting and sleeping.

Criterion		Design range in dBA	
		Good	Reasonable
Reasonable resting/sleeping conditions	Living rooms	30	40
	Bedrooms	30	35

Figure 2: Indoor ambient noise levels as recommended in BS 8233:1999 (Table 5)

World Health Organisation

3.9 Guidance on maximum noise levels is given by the World Health Organisation (WHO) in a 1999 report entitled "Guidelines for Community Noise" [Reference 4]. This report states that to avoid negative effects on sleep, the equivalent continuous internal sound pressure level during the sleeping period should not exceed 30 dB L_{Aeq}. If the noise is not continuous, sleep disturbance has an improved correlation with maximum noise levels and effects have been observed at 45 dB L_{Amax} internally. It goes on to recommend that, at night, noise levels outside dwellings should not exceed 45 dB L_{Aeq} and maximum noise levels should not exceed 60 dB L_{Amax} so that people may sleep with bedroom windows partially open.

3.10 It is relevant to note that the WHO report has not been adopted into UK legislation or formal guidance, hence, it remains a source of information reflecting a high level of health care with respect to noise, rather than a standard to be rigidly applied. The guideline values in the WHO report give the lowest threshold noise levels below which the occurrence rates of particular effects can be assumed to be negligible. According to a report commissioned by the DETR, and undertaken jointly by the NPL and Southampton University [Reference 5], transgression of the WHO guideline values does not necessarily imply significant noise impact and indeed, it may be that significant impacts do not occur until much higher degrees of noise exposure are reached. The report states:

"While in an ideal world it may be desirable for none of these effects to occur, in practice a certain amount of noise is inevitable in any modern industrialised society. Perhaps the main weakness of both WHO-inspired documents is that they fail to consider the practicality of actually being able to achieve any of the stated guideline values"

"It is important to make clear ...that exceedances do not necessarily imply an over-riding need for noise control, merely that the relative advantages and disadvantages of noise control action should be weighed in the balance. It is all a question of balance and mere exceedance of the WHO guidelines just starts to tip the scales."

4.0 Proposed plant

4.1 The proposal is to replace the existing air-conditioning outdoor units with modern units at the same location in the basement car-park. Also, the extract louvres for an internal mechanical air extraction system, and compressor units for the kitchen freezer and chiller rooms, which will be located in the service area.

4.2 The proposed replacement air-conditioning plant consists of two Sanyo SPW-C906VH8 outdoor units. Manufacturer's noise data is given in Figure 3 below.

Specification	Cooling	Heating
Sound pressure level (single unit)	57 dBA	58 dBA

Figure 3: Manufacturers noise data, air-conditioning outdoor units (Sanyo SPW-C906VH8)

4.3 Total sound pressure levels are calculated by logarithmically summing the predicted maximum sound pressure from each unit to give a maximum (worst case, both units running in heating mode) value of 61 dBA.

4.4 Air conditioning inverters are normally over specified to ensure that plant does not run at maximum capacity and therefore have a reduced life.

4.5 The replacement of this old plant with newer plant can result in lower noise levels as modern plant is more efficient, and furthermore as mechanical plant ages it can become noisy due to degradation of bearings and resilient mountings.

4.6 Mechanical air extraction from the premises will be by means of a Vent-Axia TP630 axial fan. This is housed internally on anti-vibration mountings to attenuate any structure borne noise. The ventilation ducting, measuring 600x600mm, has attenuators fitted to it before and after the fan, along with charcoal filtration panels. The fan will be fitted with variable speed control and will typically run at low speeds. Maximum speed (and hence maximum noise level) is only required for occasional purge ventilation. Maximum sound power levels for the unit operating at full-speed are given in Figure 4 below.

Description	Octave bands centres (Hz)							
	63	125	250	500	1k	2k	4k	8k
Vent-Axia TP630-14 Axial Fan (inlet)	81	101	94	91	91	85	79	74
Vent-Axia TP630-14 Axial Fan (outlet)	97	102	95	94	94	88	82	77

Figure 4: Manufacturer's sound power level spectra in dB (re 10^{-12}Watts)

4.7 When the building is not in use it is normal that plant cycle times will reduce to relatively infrequent operation or be switched off altogether by means of a time switch.

4.8 In addition to the above plant, there will be two small remote compressors also located in the basement car park. These are low-noise compressors for the kitchen freezer and chiller rooms. This plant has been specified as 1 off Silensys 2480Z and 1 off Silensys 4524Z compressor units. Noise levels for this refrigeration plant are shown in Figure 5 below.

Specification	2480Z	4524Z
Sound pressure level (single unit)	66 dBA	56 dBA

Figure 5: Manufacturer noise data, refrigeration remote compressors (Tecumseh Silensys)

5.0 Nearest noise sensitive property

5.1 The nearest noise sensitive residential properties to the proposed plant have been identified as flats at the fourth floor level above the premises (see Figure 6).

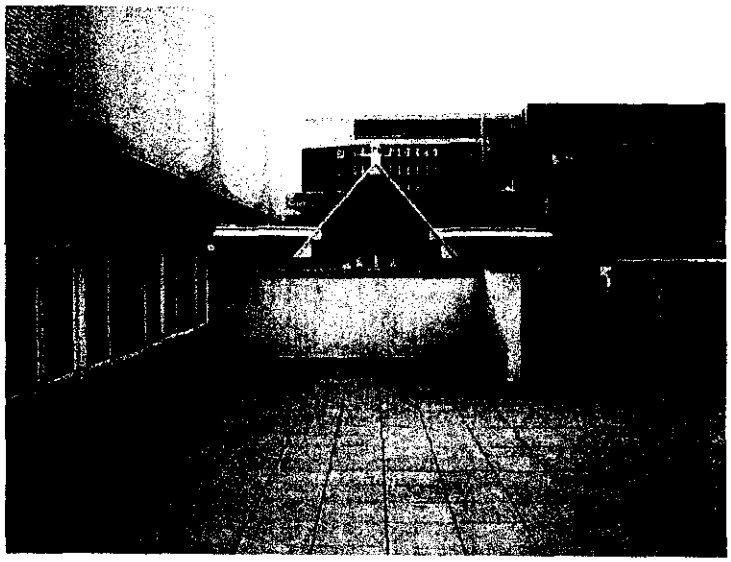

Figure 6: Flats at fourth floor level (left side of image)

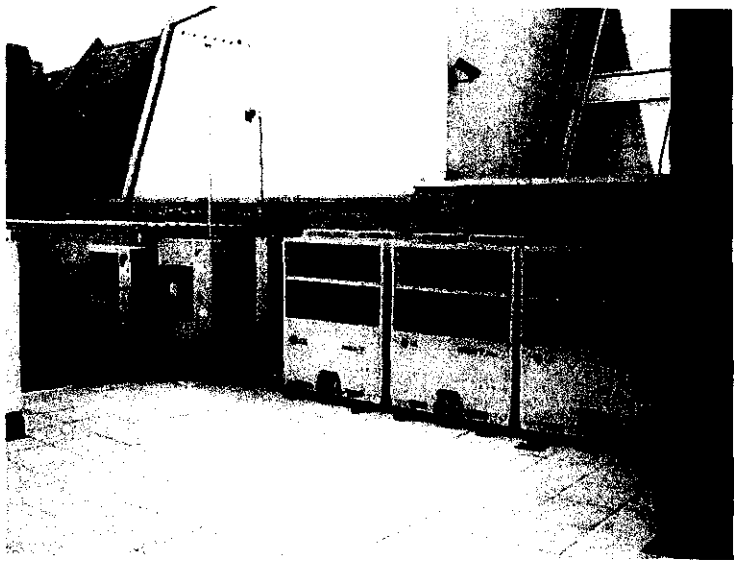

Figure 7: Plant opposite flats at fourth floor level (not associated with application)

5.2 Opposite the flats are a number of items of air-conditioning plant associated with the commercial usage of the floors immediately below the flats (see Figure 7). It should be noted that all plant detailed in this application will be located in the basement area. The plant at fourth floor level is in much closer proximity to the flats than the proposed plant. Although this existing plant should be operating within the constraints of local and national guidance for noise it will not be entirely silent and will therefore mask more distant items of plant.

5.3 The flats themselves at this fourth floor level are significantly distant and isolated from any activity in the basement service area. There are no direct paths from the basement to the flats, and the basement, by its very nature as a basement, is almost totally enclosed (apart from the vehicle access route). Therefore no *line of sight* exists between this plant and any noise sensitive property.

5.4 It is therefore a reasonable assumption that any sound from plant in the basement will be attenuated to a very high degree by both the distance from the plant to the flats, and the massive physical structure of the building in-between.

6.0 Survey procedure

6.1 A survey of the background noise level was carried out from the roof terrace area at fourth floor level. Additional measurements were taken 1m from the NW façade of the flats in front of the windows to habitable rooms.

6.2 Attended noise measurements were made in continuous samples of 1 second intervals using the fast time response and included the L_{Aeq} and L_{A90} indices. Simultaneous third-octave frequency spectra were also obtained during the survey. Throughout the course of the survey an outdoor microphone windshield was used.

6.3 The instrumentation used to carry out the noise measurements is detailed in Appendix C. The calibration of the measuring equipment was checked prior to and immediately following the tests and no signal variation occurred. Calibration of equipment is traceable to national standards.

6.4 The weather was dry and the wind speed was a light breeze (recorded at 4 ms^{-1}) during the survey period. Temperature was recorded at 17° Celsius.

6.5 Measurements were made generally in accordance with BS7445:1991 'Description and measurement of environmental noise, Part 2 – Guide to the acquisition of data pertinent to land use' [Reference 6].

7.0 Noise survey results

7.1 The recorded noise levels are summarised in Figure 8 below.

Date	Time	Location	L_{Aeq} dB	L_{A90} dB
14/09/09	18:05	Roof terrace area (average) r	57.7	52.0
14/09/09	18:39	1 metre from façade of flats	53.1	52.0

Figure 8: Recorded noise levels at fourth floor level

8.0 Plant noise prediction

8.1 The proposed plant consists of:

Name	Model	Description
Sanyo	SPW-C906VH8 (2)	Aircon outdoor units
Vent-Axia	TP630-14	High pressure axial fan
Silensys	2480Z	Freezer compressor
Silensys	4524Z	Chiller compressor

Figure 9: Schedule of equipment

8.2 In order to assess the worst case plant noise the individual maximum sound pressure levels for each item of plant have been calculated at 1 metre distance and logarithmically summed in Figure 10 below to give a total worst case maximum plant noise figure.

Description	Sound pressure level, dBA
Sanyo SPW- C906VH88	58
Sanyo SPW- C906VH88	58
Vent-Axia TP630-14[1]	65
Silensys 2480Z	66
Silensys 4524Z	56
Total	**69**

Figure 10: Single figure A-weighted sound pressure levels

[1] Manufacturers sound power level spectra for Vent-Axia TP630-14 converted to an A-weighted sound pressure level at 1m and adjustment made for single attenuator pod on output side of fan plus 10m of straight unlined rectangular ducting.

8.3 Note: This calculated figure does not include any attenuation due to localised screening of plant. The predicted level of 69dBA (from Figure 10) is based on a maximum operating level for each item of plant operating @ 1m, with all plant operating simultaneously. This condition is an unlikely worst-case maximum noise level situation and may only occur in exceptional circumstances.

8.4 For the purposes of a simplified calculation of noise attenuation due to the distance between the plant and the flats a nominal attenuation due to a linear distance of 20 metres has been applied. The assumption that there is one physical barrier in the form of a masonry wall between the plant and the flats has also been made. Clearly this is an over-simplification but does assist in assessing the likelihood of any disturbance from the plant at the flats.

8.5 A linear distance of 20 metres in a simplified sound propagation calculation equates to an attenuation of 26dB, and attenuation due to a single masonry wall obscuring line of sight can reasonably be approximated to be at least 8dB when using a simplified barrier calculation according to Maekawa [Reference 7]. Therefore total attenuation during sound propagation from the basement to the fourth floor is predicted to be at least 34dB.

8.6 It is therefore been calculated that with all plant operating at maximum level in the basement area the resultant noise level due to that plant at the fourth floor flats will be no greater than 35dBA.

9.0 Assessment

Noise Assessment – Camden Council UDP

9.1 The noise thresholds set out in Camden Council's UDP, Appendix I, Table E state that noise at 1 metre external to a sensitive façade must be lower that 5dBA below the background noise level (L_{A90}). This assessment demonstrated predicted plant noise of 35dBA which is considerably below the recorded background noise level of 52dB L_{A90}.

9.2 Therefore this assessment demonstrates that plant noise is within acceptable limits. The plant does not cause a loss to local amenity and does not exceed the thresholds set out in Appendix 1 - Noise and Vibration (Table E) of the Camden Council UDP.

Noise Assessment - BS 4142

9.3 Assessment is based on predicted plant noise of 69dBA @ 1 metre, scaled to 20m (the approximate distance of the nearest noise sensitive property) and attenuated by a single barrier. The predicted noise level is therefore taken as 35dB. The predicted plant noise has then been assessed against the lowest recorded background level.

Predicted noise level	L_{Aeq} =	35dB
Residual noise level	$L_{Aeq(15min)}$ =	53dB
Background level	$L_{A90(15min)}$ =	52dB
Correction (from BS4142:1997 Table 1)		NA
Specific noise level	L_{Aeq} =	35dB
Acoustic feature correction		0
Rating level		(35 + 0)dB = 35dB
Background level	L_{A90} =	52dB
Excess of rating over background level		(52-35) dB = **-17dB**
Complaints are unlikely		

Figure11: BS4142 assessment

9.4 Calculation indicates that predicted noise levels generated by the proposed plant, with all plant in operation, when compared against the background level on a quiet Monday evening, results in an assessment level that is some 7dB quieter than the BS4142 level that would consider *"complaints are unlikely"*.

Noise Assessment - BS 8233

9.5 PPG 24 states that the A-weighted attenuation of windows, open for ventilation purposes, is between 10 and 15 dB. Figure 12 below shows the typical noise level due to plant that will be generated inside the properties when windows are open:

Location	**Internal noise level due to plant**
Room with window to rear façade	20-25 dB

Figure 12: Estimated internal noise levels (windows open)

9.6 These values are lower that the guideline values advocated in BS 8233 for "good" resting and sleeping conditions and it is therefore considered that further mitigation measures will not be required.

Noise Assessment – WHO Guidelines

9.7 Plant noise does not exceed the night time criteria of the WHO at the nearest noise sensitive property.

10.0 Conclusions

10.1 RadcliffesLeBrasseur has commissioned Big Sky Acoustics to carry out a noise assessment for proposed air-conditioning plant at 170 Drury Lane WC2B 5QA London.

10.2 The plant type, size, and location is typical of mechanical plant used in similar commercial applications in towns and cities in the UK. The air-conditioning outdoor units replace old plant at the building which would have had similar capacity for ventilation and cooling.

10.3 The analysis has been based on our current understanding of the site layout and information about the plant available to us at the time of writing.

10.4 An assessment of prevailing noise levels from proposed plant has been carried out with reference to Camden Council UDP, BS4142, BS8233 and WHO guidelines.

10.5 Plant noise is at a level that is unlikely to cause complaints and predicted internal noise levels will not disturb resting and sleeping within the nearest noise sensitive dwellings. The predicted plant noise falls within the WHO guidelines for external noise.

10.6 It is therefore concluded that there will be no loss of amenity to existing residents due to noise from the operation of the proposed plant as specified within this assessment.

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11.0 References

1. Department of the Environment. Planning Policy Guidance (PPG) 24, Planning and Noise, September 1994.
2. British Standards Institution. British Standard 4142: Method for rating industrial noise affecting mixed residential and industrial areas, 1997.
3. British Standards Institution. British Standard 8233: Sound Insulation and Noise Reduction for Buildings, 1999.
4. World Health Organisation. Guidelines for Community Noise, 2000.
5. National Physical Laboratory. Health Effect Based Noise Assessment Methods: A review and Feasibility Study. NPL report CMAM 16, 1998.
6. British Standards Institution. BS 7445: 'Description and measurement of environmental noise Part 2 - Acquisition of data pertinent to land use', 1991.
7. Z Maekawa, Noise reduction by screens, Applied Acoustics, Vol 1, 1968, pp 157-173.

Appendix A - Acoustic terminology

Sound Pressure Level and the decibel (dB)
A sound wave is a small fluctuation of atmospheric pressure. The human ear responds to these variations in pressure, producing the sensation of hearing. The ear can detect a very wide range of pressure variations. In order to cope with this wide range of pressure variations, a logarithmic scale is used to convert the values into manageable numbers. Although it might seem unusual to use a logarithmic scale to measure a physical phenomenon, it has been found that human hearing also responds to sound in an approximately logarithmic fashion. The dB (decibel) is the logarithmic unit used to describe sound (or noise) levels. The usual range of sound pressure levels is from 0 dB (threshold of hearing) to 140 dB (threshold of pain).

Frequency and Hertz (Hz)
As well as the loudness of a sound, the frequency content of a sound is also very important. Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second, or hertz (Hz). Sometimes large frequency values are written as kilohertz (kHz), where 1 kHz = 1000 Hz. Young people with normal hearing can hear frequencies in the range 20 Hz to 20,000 Hz. However, the upper frequency limit gradually reduces as a person gets older.

A-weighting
The ear does not respond equally to sound at all frequencies. It is less sensitive to sound at low and very high frequencies, compared with the frequencies in between. Therefore, when measuring a sound made up of different frequencies, it is often useful to 'weight' each frequency appropriately, so that the measurement correlates better with what a person would actually hear. This is usually achieved by using an electronic filter called the 'A' weighting, which is built into sound level meters. Noise levels measured using the 'A' weighting are denoted dBA. A change of 3dBA is the minimum perceptible under normal everyday conditions, and a change of 10dBA corresponds roughly to doubling or halving the loudness of sound.

Noise Indices
When a noise level is constant and does not fluctuate over time, it can be described adequately by measuring the dBA level. However, when the noise level varies with time, the measured dBA level will vary as well. In this case it is therefore not possible to represent the noise climate with a simple dBA value. In order to describe noise where the level is continuously varying, a number of other indices, including statistical parameters, are used. The indices used in this report are described below.

L_{Aeq} is the A-weighted 'equivalent continuous sound pressure level ' which is an average of the total sound energy measured over a specified time period. In other words, the L_{Aeq} is the level of a continuous noise which has the same total energy as the real fluctuating noise, measured over the same time period. It is increasingly being used as the preferred parameter for all forms of environmental noise.

L_{Amax} is the maximum A-weighted sound pressure level during the monitoring period.

L_{A90} is the A-weighted sound pressure level exceeded for 90% of the time period. The L_{A90} is used as a measure of background noise.

L_{A10} is the A-weighted sound pressure level exceeded for 10% of the time period. It is used for assessment of road noise and indicates the noisiest 10 % of sound produced.

Example noise levels:

Source/Activity	Indicative noise level dBA
Threshold of pain	140
Jet aircraft at 250m	105
Rock concert	104
Lawnmower	90
Diesel train	85
Heavy traffic	82
Vacuum cleaner	75
Ordinary conversation	60
Car at 40 mph at 100m	55
Rural ambient	35
Quiet bedroom	30
Whisper	30
Watch ticking	20
Threshold of hearing	0

Appendix B - Aerial image of site

Appendix C - Instrumentation

All measurements were carried out using a CEL-593 integrating-averaging sound level meter with 1/3 octave real-time analyser conforming to the following standards: ANSI S1.4 Type 1 & 2, ANSI S1.43 Type 1 & 2, ANSI S1.11, IEC-651, IEC-804, IEC-225.

The calibration of the measuring equipment was checked prior to and immediately following the tests and no signal variation occurred. Calibration of equipment is traceable to national standards. The following instrumentation was used during the survey:

Description	
Casella sound level meter/real time analyser	type CEL-593
Casella type 1 measurement microphone	type CEL-250
Casella type 1 preamplifier	type CEL-526
Casella serial interface	type CEL-502
Casella type 1 sound calibrator	type CEL-284/2