HILSON MORAN

consulting engineers

Wellcome Trust

Bentley House, 200 Euston Road, London

Plant Noise Assessment Report

Issue	Date
1.0	01 October 2010

HILSON MORAN

ONE DISCOVERY PLACE

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engineering the future
for the built environment

Bentley House, 200 Euston Road, London
Plant Noise Assessment Report

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Contents

1 EXECUTIVE SUMMARY

A planning application for a new development, comprising a student Hall of Residence and associated amenity areas, is proposed at Bentley House, 200 Euston Road, London. The proposed development will include external building services plant.

Hilson Moran therefore undertook an environmental noise survey at the proposed development site, in order to determine prevailing noise levels affecting the site and its surroundings and inform the planning process.

The results of the survey and the requirements of Camden Council have been used to establish plant noise limits for the external plant units, not to be exceeded when measured at the nearest noise sensitive properties.

The plant manufacturer's noise emission data was used to predict noise levels from the proposed units at the nearest noise sensitive properties, which were then compared with the proposed plant noise limits.

Noise levels due to the proposed plant were predicted to fall significantly below the proposed noise limits; hence the proposed plant is predicted to comply with the acoustic requirements of Camden Council.

2 INTRODUCTION

A planning application for a new development, comprising a student Hall of Residence and associated amenity areas, is proposed at Bentley House, 200 Euston Road, London. The proposed development will include external building services plant.

The purpose of the assessment is to determine the prevailing background noise levels at a position representative of the nearest noise sensitive properties to the proposed plant, in order to determine external plant noise limits in accordance with Local Authority requirements.

Following this introductory section, a description of the site is given in Section 3. A description of the survey methodology is given in Section 4 with results presented in Section 5 and Appendix B. Plant noise limits are proposed in Section 6 and noise from the proposed plant assessed in Section 7.

Appendix A presents an explanation of the acoustic terminology used in this report.

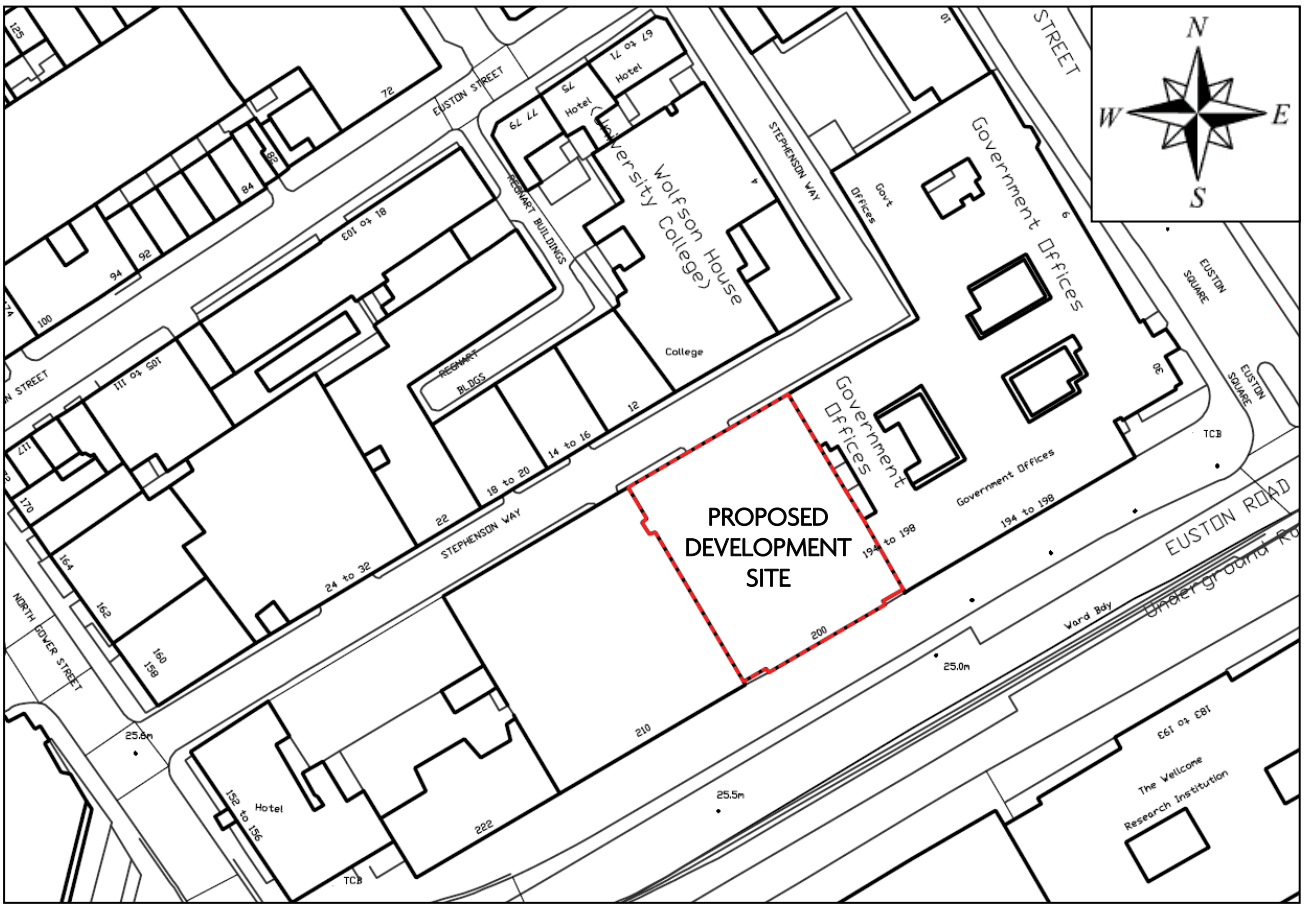
3 SITE DESCRIPTION

The proposed development site is located at 200 Euston Road in London. The site is currently occupied by Bentley House, a vacant 4-storey storage/archive building. Bentley House is bounded by Euston Road to the South, Stephenson Way to the North and office buildings to the East and West.

Whilst on site it was noted that the surrounding properties mainly consist of offices, as well as a hotel and café on the corner of Euston Road and North Gower Street. University College Hospital is located to the South-West of the site.

Figure 3.1 below shows the existing site and its surroundings.

Figure 3.1 Location of Proposed Development Site and Surrounding Land Use



4 SURVEY METHODOLOGY

An unmanned environmental noise survey was undertaken between approximately 14:00 hours on Friday 16 April 2010 and 14:00 hours on Tuesday 20 April 2010.

A-weighted (dBA) L_{max}, L_{eq} and L_{90} noise levels were measured throughout the environmental noise survey over contiguous 100 millisecond intervals. Octave band noise levels (from 63Hz to 8kHz) were also recorded so as to provide a more detailed description of the noise climate throughout the survey period.

The measurement positions are shown on Figure 4.1 and described in Table 4.1.

Figure 4.1 Site Plan Indicating Approximate Measurement Positions

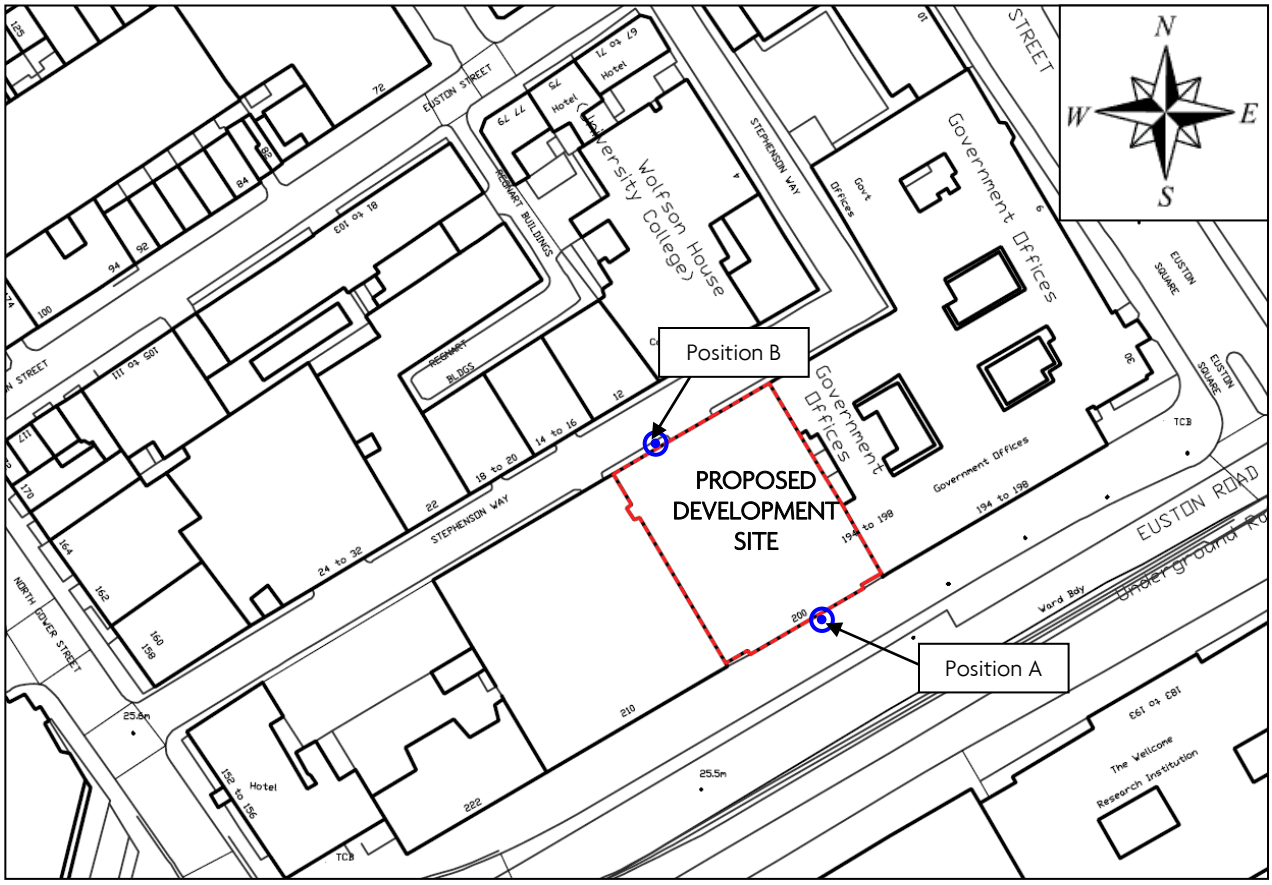


Table 4.1 Description of Noise Measurement Positions

Measurement Position	Description
A	At the Southern boundary of the proposed development site, protruding by approximately 0.5m from a first floor window of the existing building (200 Euston Road), at a height of approximately 5m above ground level, overlooking Euston Road
B	At the Northern boundary of the proposed development site, protruding by approximately 1m from a first floor window of the existing building (200 Euston Road) at a height of approximately 5m above ground level, overlooking Stephenson Way

Measurement position A was considered representative of typical noise levels at the noisiest façade of the site, in order to allow an assessment of the acoustic requirements of the proposed development façades to be undertaken.

Measurement position B was considered representative of typical noise levels at the quietest area of the site, to be used to determine suitable plant noise emission limits. Position B was also selected so that noise levels incident on the rear of proposed development site, due to road traffic along Stephenson Way, could be assessed.

The equipment used for the noise survey is summarised in Table 4.2.

Table 4.2 Description of Equipment used for Noise Survey

Measurement Position	Equipment	Description	Quantity	Serial Number
A	01 dB Solo	Type 1 automated logging sound level meter	1	60461
	01 dB PRE 21	Type 1 ½" microphone and pre-amplifier	1	13429
	01 dB BAP 21	Outdoor microphone casing	1	10936
B	01 dB Solo	Type 1 automated logging sound level meter	1	60447
	01 dB PRE 21	Type 1 ½" microphone and pre-amplifier	1	13259
	01 dB BAP 21	Outdoor microphone casing	1	10935
All	01 dB CAL 21	Calibrator	1	50441990

The weather conditions at the start and end of the survey periods were considered appropriate for undertaking environmental noise measurements i.e. there was little or no rainfall, the sky was fairly clear of cloud and there was only light wind. Hilson Moran understands these weather conditions were representative of the full survey period.

The noise monitoring equipment used was calibrated before and after the noise survey periods. No significant change was found.

5 SURVEY RESULTS & OBSERVATIONS

5.1 Results

Appendix B presents time history graphs showing the A-weighted (dBA) L_{max}, L_{eq} and L_{90} noise levels measured throughout the noise survey at each position (note that levels measured at position A have been corrected for nearby surface reflections in accordance with advice from BS8233: 1999[1]). We would consider the noise levels measured to be representative of the typical noise climate at the site, considering the location of the measurement positions and the dominant nearby noise sources.

The lowest measured 10-minute background L_{A90} noise levels during weekday/weekend daytime, evening and night-time periods at each position are summarised in Table 5.1 below.

Table 5.1 Lowest Measured Daytime, Evening and Night-time Background L_{90} Noise Levels

Measurement Position	Lowest Measured L_{90} Background Noise Level (dBA)					
	Daytime/Typical Office Hours (07:00 – 19:00 hours)		Evening (19:00 – 23:00 hours)		Night-time (23:00 – 07:00 hours)	
	Weekday	Weekend	Weekday	Weekend	Weekday	Weekend
A	66	63	64	63	56	57
B	55	52	52	52	51	51

From the measured noise levels, we have derived the logarithmically-averaged daytime, *evening* and night-time free-field ambient noise levels at each measurement position shown in Table 5.2.

Table 5.2 Overall Measured Daytime, Evening and Night-time Ambient Noise Levels

	Period, T	$L_{Aeq,T}$ (dB)	
		Position A	Position B
Daytime Logarithmic Average (12 hour)	07:00 – 19:00	72	61
Evening Logarithmic Average (4 hour)	19:00 – 23:00	73	58
Night-time logarithmic Average (8 hour)	23:00 – 07:00	72	56

5.2 Observations

Due to the nature of the survey (unmanned) we are unable to comment on the exact noise climate throughout the entire survey period. However, at the beginning and end of the survey the daytime noise climate at position A was noted to be dominated by noise from traffic movements along Euston Road. Night-time noise levels at position A were assumed to be affected by general ambient background noise (road traffic, etc.)

At position B, the daytime noise climate was noted to be dominated by noise from road traffic and occasional loading activities on Stephenson Way. Noise from traffic movements on Euston Road was clearly audible and noise from building services plant on surrounding buildings was also audible at this position. Night-time noise levels at position B were assumed to be affected by general ambient background noise (road traffic, etc.) as well as noise from building services plant.

6 EXTERNAL PLANT NOISE LIMITS

6.1 Local Authority Guidance

The proposed development site lies within the jurisdiction of London Borough of Camden (Camden Council). We understand Camden Council's typical standards relating to plant noise are as follows[2]

"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…"

Thresholds for noise levels from plant and machinery at which planning permission will not be granted by Camden Council are shown in Table 6.1 below

Table 6.1 Noise Levels from Plant and Machinery at Which Planning Permission will not be Granted

Noise Description and location of measurement	Period	Time	Noise Level
Noise at 1 metre external to a sensitive façade	Day, Evening and Night	00:00 – 24:00	5dB(A) less than L_{A90}
Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1 metre external to a sensitive façade	Day, Evening and Night	00:00 – 24:00	10dB(A) less than L_{A90}
Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1 metre external to a sensitive façade	Day, Evening and Night	00:00 – 24:00	10dB(A) less than L_{A90}
Noise at 1 metre external to a sensitive façade where L_{A90} > 60dB	Day, Evening and Night	00:00 – 24:00	55dB L_{Aeq}

Based on typical Camden Council standards and the lowest measured 10-minute background L_{A90} noise levels during daytime, evening and night-time periods at each position during the environmental noise survey, we would propose the plant noise limits shown in Table 6.2. The plant noise limits are to be achieved during the relevant plant operating period, when measured 1m external to the nearest noise sensitive façade to the site.

Table 6.2 Proposed External Plant Noise Limits – Noise Sensitive Properties

Measurement Position	External Plant Noise Limit during plant operating period (dBA)					
	Daytime/Typical Office Hours (07:00 – 19:00 hours)		Evening (19:00 – 23:00 hours)		Night-time (23:00 – 07:00 hours)	
	Weekday	Weekend	Weekday	Weekend	Weekday	Weekend
A	55*	55*	55*	55*	49	52
B	50	47	47	47	46	46

The above external plant noise limits are subject to approval by Camden Council. In accordance with the requirements of Camden Council, if noise from the proposed plant has a distinguishable discrete continuous note or distinct impulses then the above plant noise limits should be reduced by 5 dBA (except those marked *, where the lowest measured L_{A90} exceeds 60 dB so the plant noise limit remains at 55 dBA).

7 PLANT NOISE ASSESSMENT

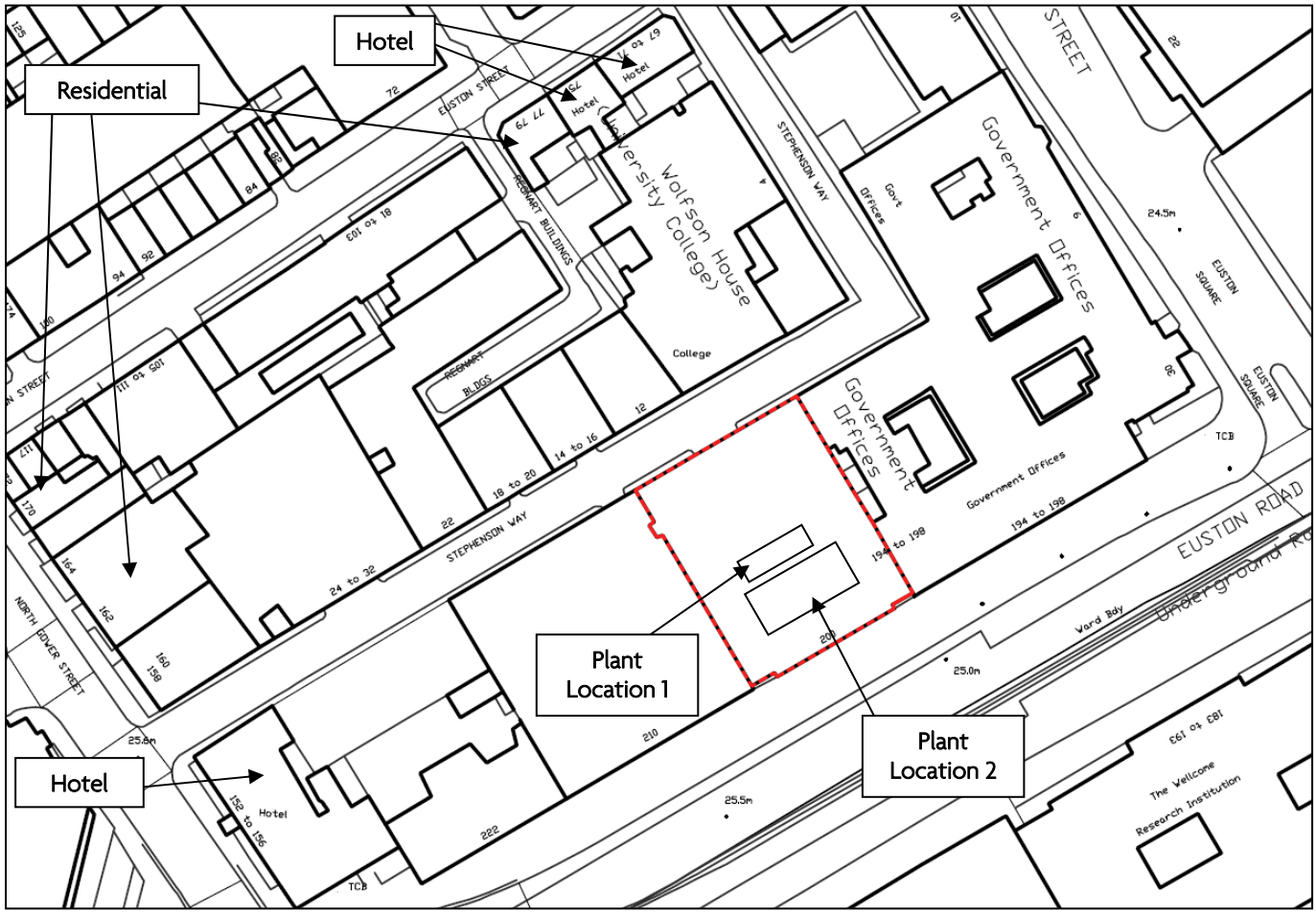
7.1 Proposed Plant Locations and Nearest Noise Sensitive Windows

We understand the proposed new items of plant are as follows:

- 1No CHP 120kWh (Plant Location 1)
- 1No. packaged boiler room (Plant Location 2), containing: 1No. supply and extract air handling unit, 2No condensing boilers, 4No pumps and 1No pressurisation set.

The sketch plan in Figure 7.1 indicates the approximate proposed locations of the new plant items on the roof of 200 Euston Road. The approximate locations of the nearest noise-sensitive (residential and hotel) properties are also shown.

Figure 7.1 Approximate Proposed Plant Locations and Nearest Noise Sensitive Properties



The nearest noise-sensitive properties to the proposed plant locations are noted to be the hotels and residential property on Euston Street, the hotel on the junction of Stephenson Way and North Gower Street, and the residential properties on North Gower Street.

7.2 Manufacturer's Plant Noise Data

Details of the proposed plant items are given in the following sections.

7.2.1 CHP Unit

Manufacturer: Ener-G

Model: Ener-G 100 CHP Unit

Approximate Dimensions: 3.7m (L) x 1.0m (W) x 2.5m (H)

Quantity: 1

Note: the CHP is to be housed inside an acoustic enclosure, supplied by Ener-G.

Noise emission data for the CHP Unit, taking account the acoustic enclosure, is given in Table 7.1.

Table 7.1 Sound Pressure Level at 1m from CHP Unit

Sound Pressure Level (dB) at 1m @ Octave Band Centre Frequency								dBA @ 1m
63	125	250	500	1k	2k	4k	8k	
87	83	73	63	55	55	53	49	70

7.2.2 Packaged Plant Room

The items of plant proposed within the packaged plant room are described in the following sections.

7.2.2.1 Supply and Extract AHU

Manufacturer: Daikin

Model: VAWL17000AAW1 Heat Recovery AHU

Approximate Dimensions: 2.9m (L) x 1.4m (W) x 2.1m (H)

Quantity: 1

Note: the AHU would be located within the packaged plant room, with ducted supply and extract outlet to fresh air. In-duct fan sound power levels for this AHU are given in Table 7.2.

Table 7.2 In-duct Fan Sound Power Levels for Supply and Extract AHU

Fan	In-duct Fan Sound Power Level (dB) @ Octave Band Centre Frequency							
	63	125	250	500	1k	2k	4k	8k
Supply	86	84	81	79	77	74	71	68
Extract	93	89	82	77	76	73	70	65

The air handling unit will include in-duct attenuators on both the supply intake and the extract exhaust ducts, providing the following minimum insertion losses presented in Table 7.3 below.

Table 7.3 In-duct Attenuator Insertion Losses for Supply and Extract AHU

Fan	Minimum Attenuator Insertion Loss (dB) @ Octave Band Centre Frequency							
	63	125	250	500	1k	2k	4k	8k
Supply	-4	-7	-13	-19	-23	-23	-16	-13
Extract	-4	-7	-13	-19	-23	-23	-16	-13

We understand the AHU casing panels will be constructed so as to achieve the casing losses shown in Table 7.4.

Table 7.4 Casing Losses for AHU

Casing Loss (dB) @ Octave Band Centre Frequency							
63	125	250	500	1k	2k	4k	8k
18	20	25	34	41	43	46	46

7.2.2.2 Condensing Boilers

Manufacturer: Viessman Ltd

Model: VitoCrossal 300 314kw Condensing Boilers

Approximate Dimensions 1.8m (L) x 1.0m (D) x 2.0m (H)

Quantity: 2

Noise emission data for each boiler unit is given in Table 7.5

Table 7.5 Sound Pressure Levels at 1m from 1No. Boiler Unit

Sound Pressure Level (dB) at 1m @ Octave Band Centre Frequency								dBA @ 1m
63	125	250	500	1k	2k	4k	8k	
58	58	55	52	49	46	43	40	55

7.2.2.3 Pumps

Manufacturer: Wilo

Model: Wilo IL65-210-2.2/4 2.2kW

Approximate Dimensions 0.8m (L) x 0.4m (D) x 0.4m (H)

Quantity: 2 (1No run 1No standby)

Noise emission data for each pump is given in Table 7.6.

Table 7.6 Sound Pressure Levels at 1m from Each Pump

Sound Pressure Level (dB) at 1m @ Octave Band Centre Frequency								dBA @ 1m
63	125	250	500	1k	2k	4k	8k	
48	51	55	55	51	48	45	40	57

7.2.2.4 Pumps

Manufacturer: Wilo

Model: Wilo DL125/320 18.5kW

Approximate Dimensions 0.8m (L) x 0.7m (D) 0.7m (H)

Quantity: 2 (1No run 1No standby)

Noise emission data for each pump is given in Table 7.7.

Table 7.7 Sound Pressure Levels at 1m from Each Pump

Sound Pressure Level (dB) at 1m @ Octave Band Centre Frequency								dBA @ 1m
63	125	250	500	1k	2k	4k	8k	
58	61	65	65	61	58	55	50	67

7.2.2.5 Pressurisation Set

Manufacturer: Wilo

Model: Wilo Comfort 225 18.5kW

Approximate Dimensions 0.8m (L) x 0.7m (D) 0.7m (H)

Quantity: 1No

Noise emission data for the pressurisation set is given in Table 7.8.

Table 7.8 Sound Pressure Levels at 1m from Pressurisation Set

Sound Pressure Level (dB) at 1m @ Octave Band Centre Frequency								dBA @ 1m
63	125	250	500	1k	2k	4k	8k	
58	61	65	65	61	58	55	50	67

7.3 Proposed Plant Operating Hours

Hilson Moran understands each item of plant may operate continuously.

7.4 Plant Noise Prediction Calculations

We have undertaken calculations to predict the total noise level due to the proposed plant, at a position 1 metre outside the nearest noise-sensitive windows to the plant, for comparison with the external plant noise limits proposed in Section 6.

Our calculations have considered reflections from the roof. As all of the nearest noise-sensitive windows are facing away from the plant locations and do not have line of sight to the plant locations our calculations have also considered acoustic screening due to intervening buildings. Appendix C presents full details of our calculations. Table 7.9 summarises the predicted noise levels due to each item of plant, as well as the total cumulative level due to all plant items.

Table 7.9 Summary of Plant Noise Prediction Calculations

Plant	Predicted Noise Level at 1m Outside Nearest Noise Sensitive Property (dBA)		
	1m From Hotels and Residential Property on Euston Street	1m From Hotel on junction of Stephenson Way and North Gower Street	1m From Nearest Residential Property on North Gower Street
CHP Unit	35	34	33
AHU Supply Louvre	11	10	9
AHU Extract Louvre	14	13	12
Packaged Plant Room Break-Out	17	16	15
Total Predicted Noise Level	**35**	**34**	**33**
External Plant Noise Limit	**46 ***		

** Plant may operate at any time, thus this worst case plant noise limit assumes operation during night-time periods on weekends*

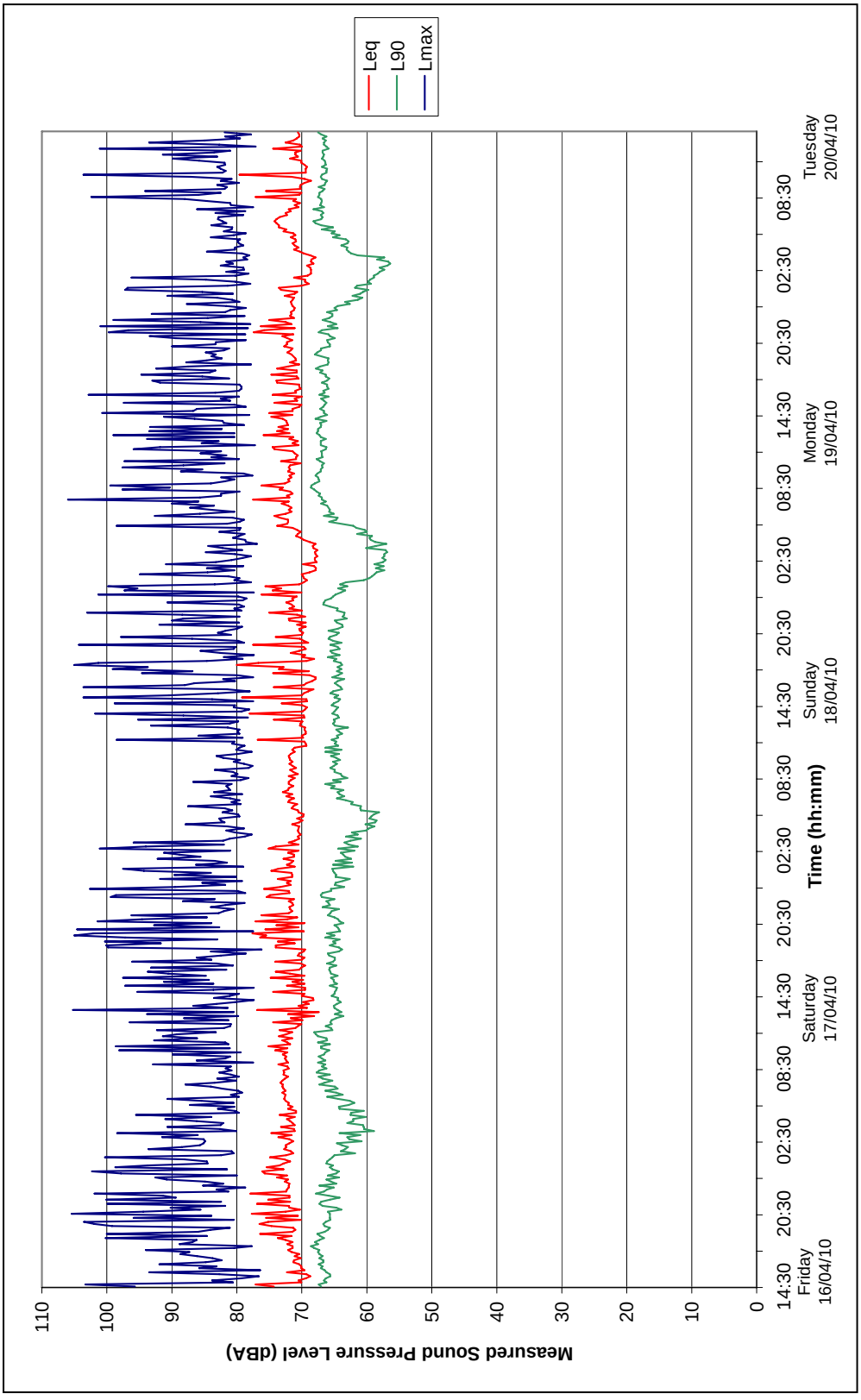
It can therefore be seen that the total predicted plant noise levels 1m outside the nearest noise-sensitive properties should fall significantly below the external plant noise limit, hence the proposed plant items should comply with Camden Council's acoustic requirements.

APPENDIX A: ACOUSTIC TERMINOLOGY

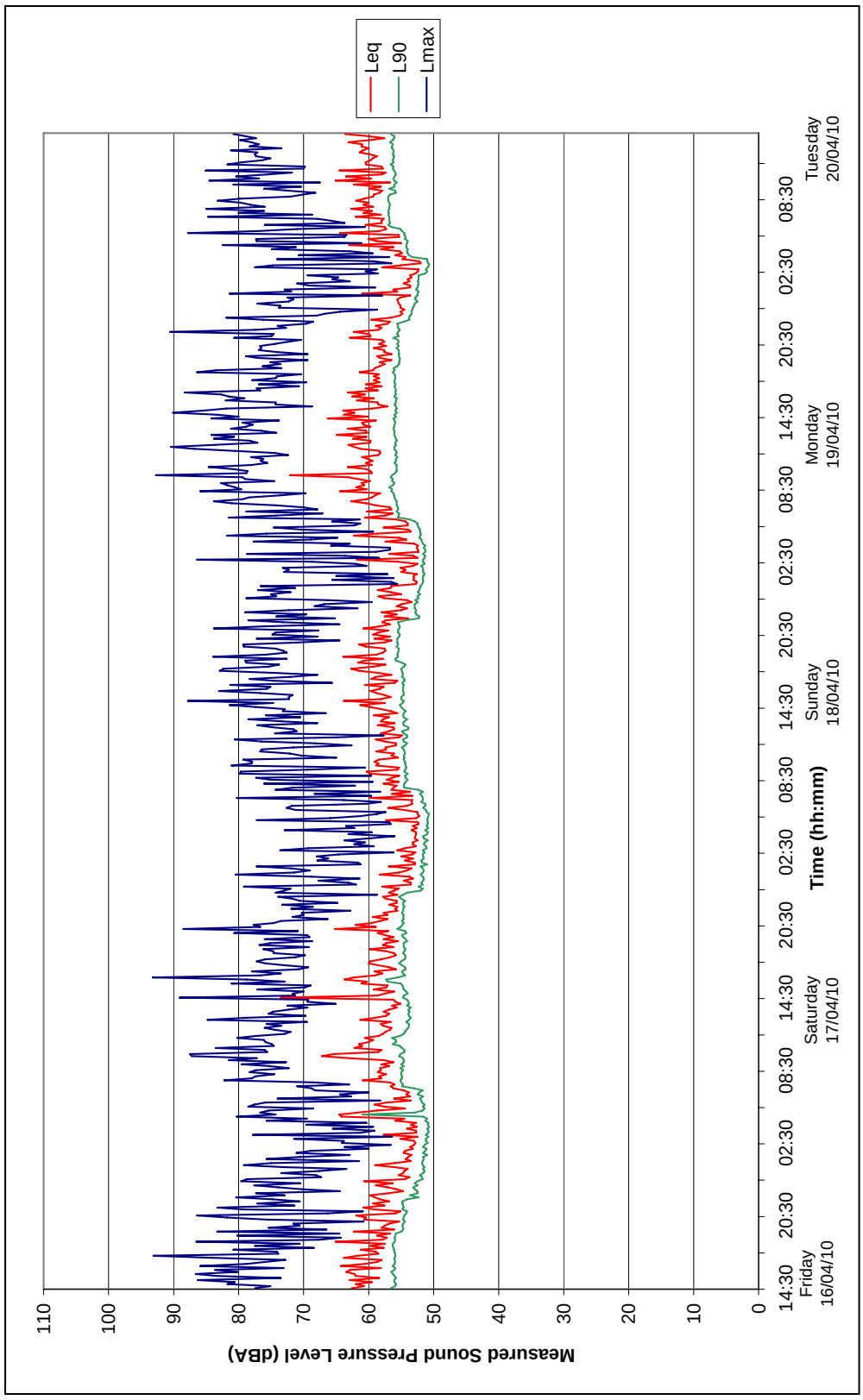
Parameter	Description
Decibel (dB)	A logarithmic scale representing the sound pressure or power level relative to the threshold of hearing ($20x10^{-6}$ Pascals).
Sound Pressure Level (SPL)	The sound pressure level is the sound pressure fluctuation caused by vibrating objects relative to the threshold of hearing.
Sound Power Level	The sound power of a noise source relative to the sound power at the threshold of hearing. Sound power is the total amount of sound inherent in a particular sound source, independent of its acoustic environment.
A-weighting, L_A (dBA)	The sound level in dB with a filter applied to increase certain frequencies and decrease others to correspond with the average human response to sound.
$L_{Aeq,T}$	The equivalent continuous noise level over the time period T. This is the sound level that is equivalent to the average energy of noise recorded over a given period.
$L_{n,T}$	The noise level exceeded for n% of the time over a given period T. e.g. L_{90}, the noise level exceeded for 90% of the time (background noise level).
L_{max}	The maximum noise level measured.

APPENDIX B: UNMANNED NOISE MONITORING RESULTS

B1. Time History Graph of Noise Levels at Measurement Position A (Facing Euston Road)



B2. Time History Graph of Noise Levels at Measurement Position B (Facing Stephenson Way)



APPENDIX C: FULL ATMOSPHERIC PLANT NOISE CALCULATIONS

C1. CHP Unit Atmospheric Noise Levels

Calculations of Predicted Noise Level at 1m Outside Nearest Window of Hotels and Residential Property on Euston Street:

CHP Unit	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dBA
Lp at 1m	87	83	73	63	55	55	53	49	70
Correction Lp to Lw[1]	+19	+19	+19	+19	+19	+19	+19	+19	
Distance attenuation (65m)[1]	-37	-37	-37	-37	-37	-37	-37	-37	
Hemi-spherical radiation	-8	-8	-8	-8	-8	-8	-8	-8	
Screening Loss [2]	-7.0	-8.0	-10.0	-12.0	-15.0	-18.0	-21.0	-23.0	
Resultant Lp at receiver	**54**	**49**	**37**	**25**	**14**	**11**	**6**	**0**	**35**

Calculations of Predicted Noise Level at 1m Outside Nearest Window of Hotel on Junction of Stephenson Way and North Gower Street:

CHP Unit	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dBA
Lp at 1m	87	83	73	63	55	55	53	49	70
Correction Lp to Lw[1]	+19	+19	+19	+19	+19	+19	+19	+19	
Distance attenuation (75m)[1]	-38	-38	-38	-38	-38	-38	-38	-38	
Hemi-spherical radiation	-8	-8	-8	-8	-8	-8	-8	-8	
Screening Loss[2]	-7.0	-8.0	-10.0	-12.0	-15.0	-18.0	-21.0	-23.0	
Resultant Lp at receiver	**53**	**48**	**36**	**24**	**13**	**10**	**5**	**0**	**34**

Calculations of Predicted Noise Level at 1m Outside Nearest Windows of Residential Properties on North Gower Street:

CHP Unit	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dBA
Lp at 1m	87	83	73	63	55	55	53	49	70
Correction Lp to Lw[1]	+19	+19	+19	+19	+19	+19	+19	+19	
Distance attenuation (85m)[1]	-39	-39	-39	-39	-39	-39	-39	-39	
Hemi-spherical radiation	-8	-8	-8	-8	-8	-8	-8	-8	
Screening Loss[2]	-7.0	-8.0	-10.0	-12.0	-15.0	-18.0	-21.0	-23.0	
Resultant Lp at receiver	**52**	**47**	**35**	**23**	**12**	**9**	**4**	**0**	**33**

C2. AHU Atmospheric Noise Levels

Calculations of Predicted Noise Level at 1m Outside Nearest Window of Student Accommodation on Stephenson Way:

AHU Supply Fan	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dBA
In-duct Lw	86	84	81	79	77	74	71	68	**82**
Attenuator Insertion Loss	-4	-7	-13	-19	-23	-23	-16	-13	
Grille End Reflection Loss[3]	-4	-1	0	0	0	0	0	0	
Distance attenuation (65m)[1]	-38	-38	-38	-38	-38	-38	-38	-38	
Hemi-spherical radiation	-8	-8	-8	-8	-8	-8	-8	-8	
Screening Loss[2]	-7.0	-8.0	-10.0	-12.0	-15.0	-18.0	-21.0	-23.0	
Resultant Lp at receiver	**25**	**22**	**12**	**2**	**0**	**0**	**0**	**0**	**11**

AHU Extract Fan	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dBA
In-duct Lw	93	89	82	77	76	73	70	65	**82**
Attenuator Insertion Loss	-4	-7	-13	-19	-23	-23	-16	-13	
Grille End Reflection Loss[3]	-4	-1	0	0	0	0	0	0	
Distance attenuation (65m)[1]	-38	-38	-38	-38	-38	-38	-38	-38	
Hemi-spherical radiation	-8	-8	-8	-8	-8	-8	-8	-8	
Screening Loss[2]	-7.0	-8.0	-10.0	-12.0	-15.0	-18.0	-21.0	-23.0	
Resultant Lp at receiver	**32**	**27**	**13**	**0**	**0**	**0**	**0**	**0**	**14**

Calculations of Predicted Noise Level at 1m Outside Nearest Window of Hotels on Euston Street:

AHU Supply Fan	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dBA
In-duct Lw	86	84	81	79	77	74	71	68	**82**
Attenuator Insertion Loss	-4	-7	-13	-19	-23	-23	-16	-13	
Grille End Reflection Loss[3]	-4	-1	0	0	0	0	0	0	
Distance attenuation (75m)[1]	-39	-39	-39	-39	-39	-39	-39	-39	
Hemi-spherical radiation	-8	-8	-8	-8	-8	-8	-8	-8	
Screening Loss[2]	-7.0	-8.0	-10.0	-12.0	-15.0	-18.0	-21.0	-23.0	
Resultant Lp at receiver	**24**	**21**	**11**	**1**	**0**	**0**	**0**	**0**	**10**

AHU Extract Fan	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dBA
In-duct Lw	93	89	82	77	76	73	70	65	**82**
Attenuator Insertion Loss	-4	-7	-13	-19	-23	-23	-16	-13	
Grille End Reflection Loss[3]	-4	-1	0	0	0	0	0	0	
Distance attenuation (75m)[1]	-39	-39	-39	-39	-39	-39	-39	-39	
Hemi-spherical radiation	-8	-8	-8	-8	-8	-8	-8	-8	
Screening Loss[2]	-7.0	-8.0	-10.0	-12.0	-15.0	-18.0	-21.0	-23.0	
Resultant Lp at receiver	**31**	**26**	**12**	**0**	**0**	**0**	**0**	**0**	**13**

Calculations of Predicted Noise Level at 1m Outside Nearest Window of Hotel on Junction of Stephenson Way and North Gower Street:

AHU Supply Fan	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dBA
In-duct Lw	86	84	81	79	77	74	71	68	**82**
Attenuator Insertion Loss	-4	-7	-13	-19	-23	-23	-16	-13	
Grille End Reflection Loss[3]	-4	-1	0	0	0	0	0	0	
Distance attenuation (85m)[1]	-40	-40	-40	-40	-40	-40	-40	-40	
Hemi-spherical radiation	-8	-8	-8	-8	-8	-8	-8	-8	
Screening Loss[2]	-7.0	-8.0	-10.0	-12.0	-15.0	-18.0	-21.0	-23.0	
Resultant Lp at receiver	**23**	**20**	**10**	**0**	**0**	**0**	**0**	**0**	**9**

AHU Extract Fan	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dBA
In-duct Lw	93	89	82	77	76	73	70	65	**82**
Attenuator Insertion Loss	-4	-7	-13	-19	-23	-23	-16	-13	
Grille End Reflection Loss[3]	-4	-1	0	0	0	0	0	0	
Distance attenuation (85m)[1]	-40	-40	-40	-40	-40	-40	-40	-40	
Hemi-spherical radiation	-8	-8	-8	-8	-8	-8	-8	-8	
Screening Loss[2]	-7.0	-8.0	-10.0	-12.0	-15.0	-18.0	-21.0	-23.0	
Resultant Lp at receiver	**30**	**25**	**11**	**0**	**0**	**0**	**0**	**0**	**12**

C3. AHU Packaged Plant Room Atmospheric Noise Levels

The packaged plant room is to be constructed from insulated steel panels, making up the walls, floor and roof. Acoustic louvres (approx 2.0m x 1.0m) shall be incorporated into the North West façade of the plant room construction. These louvres are likely to be the dominant source of noise break-out from the completed plant room. In determining the sound pressure level (Lp) radiated from the packaged plant room, first the total reverberant sound pressure level (Rev Lp) within the plant room must be calculated:

Rev Lp = Lw + 10*log(4/R_c) where R_c = Room Constant = (Sα)/(1-α)

Calculation of Room Constant of Packaged Plant room

Description	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Mean sound absorption co-efficient of plant room, α	0.08	0.12	0.08	0.07	0.05	0.05	0.05	0.05
Surface Area of Plantroom, m^2	144	144	144	144	144	144	144	144
Room constant, R_c	12.5	19.2	12.5	10.0	6.8	6.8	6.8	6.8

Determination of Total Plant Sound Power Level (Lw)

Description	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dBA
AHU Casing Radiated									
Combined Supply and Extract Fan Lw	94	90	85	81	80	77	74	70	85
AHU Casing Loss	-18	-20	-25	-34	-41	-43	-46	-46	
Radiated Lw	76	70	60	47	39	34	28	24	57
2No VitoCrossal 300 314kw Condensing Boilers									
Lp at 1m	58	58	55	52	49	46	43	40	55
Correction Lp to Lw[1]	17	17	17	17	17	17	17	17	
2No. Units	3	3	3	3	3	3	3	3	
Resultant Lw	78	78	75	72	69	66	63	60	75
1No Wilo IL65-210-2.2/4 2.2kW Pump (run/standby)									
Lp at 1m	48	51	55	55	51	48	45	40	56.6
Correction Lp to Lw[1]	11	11	11	11	11	11	11	11	
Resultant Lw	59	62	66	66	62	59	56	51	67.6
1No Wilo DL125/320 18.5kW Pump (run/standby)									
Lp at 1m	58	61	65	65	61	58	55	50	66.6
Correction Lp to Lw[1]	14	14	14	14	14	14	14	14	
Resultant Lw	72	75	79	79	75	72	69	64	80.6
1No Wilo Comfort 225 18.5kW Pressurisation Set									
Lp at 1m	58	61	65	65	61	58	55	50	66.6
Correction Lp to Lw[1]	14	14	14	14	14	14	14	14	

Resultant Lw	72	75	79	79	75	72	69	64	80.6
Total Resultant Plant Lw	81	81	83	83	79	76	73	68	84
Total Plantroom Rev Lp	**76**	**75**	**78**	**79**	**76**	**73**	**70**	**66**	**81**

Calculation of Radiated Lw from Packaged Plantroom Louvre

Description	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dBA
Total Plantroom Rev Lp	**76**	**75**	**78**	**79**	**76**	**73**	**70**	**66**	**81**
Area of Louvre, m^2	2	2	2	2	2	2	2	2	
Acoustic Louvre Insertion Losses (dB) (300mm deep)	-3	-5	-7	-11	-16	-20	-15	-14	
Radiated Lw of Louvre	76	73	74	71	63	56	58	55	**71**

Calculations of Predicted Noise Level at 1m outside nearest window of student accommodation on Stephenson Way:

	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dBA
Radiated Lw	76	73	74	71	63	56	58	55	**71**
Distance attenuation (65m)[1]	-35	-35	-35	-35	-35	-35	-35	-35	
Hemi-spherical radiation	-8	-8	-8	-8	-8	-8	-8	-8	
Screening Loss[2]	-7.0	-8.0	-10.0	-12.0	-15.0	-18.0	-21.0	-23.0	
Resultant Lp at receiver	26	22	21	16	5	0	0	0	17

Calculations of Predicted Noise Level at 1m outside nearest window of Hotels on Euston Street:

	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dBA
Radiated Lw	76	73	74	71	63	56	58	55	**71**
Distance attenuation (75m)[1]	-36	-36	-36	-36	-36	-36	-36	-36	
Hemi-spherical radiation	-8	-8	-8	-8	-8	-8	-8	-8	
Screening Loss[2]	-7.0	-8.0	-10.0	-12.0	-15.0	-18.0	-21.0	-23.0	
Resultant Lp at receiver	25	21	20	15	4	0	0	0	16

Calculations of Predicted Noise Level at 1m outside nearest of Hotel on junction of Stephenson Way and North Gower Street:

	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dBA
Radiated Lw	76	73	74	71	63	56	58	55	**71**
Distance attenuation (75m)[1]	-37	-37	-37	-37	-37	-37	-37	-37	
Hemi-spherical radiation	-8	-8	-8	-8	-8	-8	-8	-8	
Screening Loss[2]	-7.0	-8.0	-10.0	-12.0	-15.0	-18.0	-21.0	-23.0	
Resultant Lp at receiver	24	20	19	14	3	0	0	0	15

Calculation Notes and References:

1. Correction from Sound Pressure Level (Lp) to Sound Power Level (Lw) has been calculated based on BS 3746: 1996 *"Acoustics – Determination of sound power levels of noise sources using sound pressure - Survey Method using an enveloping measurement surface over a reflecting plane"*

2. Correction for screening calculated in accordance with Maekawa Method. Note each receptor screened by edge of 200 Euston Road and intervening buildings.

3. Grille end losses based on CIBSE Guide B5 *'Noise and Vibration Control for HVAC'*

DOCUMENT CONTROL & REFERENCES

Change History

Issue 0.1	29 September 2010	Document produced by Mark Brightwell and forwarded to Nicholas Jones for review.
Issue 0.2	29 September 2010	Document reviewed by Nicholas Jones and returned to Mark Brightwell for issue.
Issue 0.3	29 September 2010	Draft document issued to design team for review.
Issue 1.0	01 October 2010	Final document issued.

Changes Forecast

None

Document References

1. BS 8233 British Standard (BS) 8233: 1999 "Sound insulation and noise reduction for buildings – Code of practice"
2. London Borough of Camden Replacement Unitary Development Plan, Adopted June 2006