NSL
Noise Solutions Ltd

32 Parkway
Camden Town
NW1 7AH

Plant Noise Impact Assessment Report

On behalf of

chapman ventilation

Project Reference: 88248| Revision: 02| Date: 17th January 2019
Revised: 22nd January 2019

T: 01252 519881
W: noisesolutions.co.uk
E: hello@noisesolutions.co.uk
Noise Solutions Ltd, Unit 5, Oriel Court, Omega Park, Alton, GU34 2YT Reg no. 3483481

Document Information

Project Name	:	**32 Parkway, Camden Town**
Project Reference	:	**88248**
Report Title	:	**Plant Noise Impact Assessment**
Doc Reference	:	**88248/NIA**
Date	:	**17th January 2019**

	Name	Qualifications	Initials	Date
Prepared by:	Nigel Chandler	BSc(Hons), MIOA	NAC	17th January 2019
Reviewed and approved by:	Dean Bowden	BSc(Hons), MIOA	DMB	17th January 2019
For and on behalf of Noise Solutions Ltd				

Revision	Date	Description	Prepared	Reviewed/ Approved
01	18 Jan 2019	Plant location amended; executive summary added	DB	NAC
02	22 Jan 2018	Details clarified	NAC	DMB

Reg no. 3483481 Trading office Unit 5, Oriel Court, Omega Park, Alton, Hampshire, GU34 2YT

Contents

Appendices

Executive Summary

Noise Solutions Limited has carried out a noise survey in Camden to inform a noise impact assessment of new plant serving a new restaurant at 32 Parkway.

To control noise from the new plant to meet London Borough of Camden's published standard requirements, attenuation will be required as outlined below and described within this report:

- Manufacturer-specified acoustic enclosures to supply and kitchen extract fans
- Atmospheric-side attenuators to all ventilation systems
- Acoustic lagging to any unattenuated external ductwork.

1.0 Introduction

1.1. Noise Solutions Ltd (NSL) has been commissioned by Chapman Ventilation Ltd to undertake a noise assessment for new plant serving a new restaurant to be located at existing premises on 32 Parkway, Camden Town. The site is currently occupied by a Côte restaurant.

1.2. An environmental sound survey has been undertaken to establish the prevailing background sound levels at a location representative of the sound levels outside the nearest noise sensitive receptors to the site.

1.3. Cumulative plant noise emissions for the proposed plant have been predicted at the nearest noise-sensitive receptors and assessed using the local authority's typical requirements and nationally-recognised guidance.

1.4. To assist with the understanding of this report a glossary of acoustic terms can be found in **Appendix A**. An in-depth glossary of acoustic terms can be viewed online at www.acoustic-glossary.co.uk.

2.0 Details of development proposals

2.1. The new restaurant is proposed to occupy existing premises at 32 Parkway, Camden Town.

2.2. To facilitate this, new plant will be installed on the roof of the ground floor restaurant (first-floor level) and will comprise an air handling unit (AHU1), with an intake in the rear elevation, a kitchen extract fan (EF1), discharging at high level above the roof, and general/toilet extracts (EF2/EF3). In addition, three air conditioning (AC) units (CU1 to CU3) and one catering condensing unit will be located on the rear wall of the unit.

2.3. The proposed AC units, kitchen and general extract and supply systems may operate between 06.00 and 00.00 hours daily and will be switched off outside those hours; only the catering condenser will operate continuously.

2.4. The new plant will replace similar items serving the existing Côte restaurant at the premises.

2.5. Noise data for the proposed plant is presented in **Appendix D**. The locations of the proposed plant are shown in **Appendix F**.

3.0 Nearest noise-sensitive receptors

3.1. The premises are part of a mixed commercial and residential area, with numerous restaurants and similar premises nearby.

3.2. Windows of residential flats at 30 Parkway (Receptor R1) and 34 Parkway (Receptor R2) overlook the plant area, as shown in the photograph in **Appendix B**.

4.0 Existing noise climate

4.1. An environmental noise survey was undertaken to establish the typical background sound levels at a location representative of the noise climate outside the façades of the nearest noise sensitive receptors to the proposed plant area during the quietest times at which the plant will operate. It should be noted that the existing Côte restaurant plant was operational at the time of the survey.

4.2. The results of the environmental sound survey are summarised in Table 1 below. The full set of measurement results and details of the survey methodology are presented in **Appendix C**.

Table 1 Summary of survey results

Measurement period	Range of recorded sound pressure levels (dB)			
	$L_{Aeq(5mins)}$	$L_{Amax(5mins)}$	$L_{A10(5mins)}$	$L_{A90(5mins)}$
All times	48-68	57-87	48-71	47-64

4.3. Noise at the survey location was dominated by existing plant serving the Côte restaurant while the plant was operational. The existing plant was controlled via a timeclock, such that it switched off between approximately 00.00 and 08.00 hours.

4.4. In order to provide a robust assessment, it is appropriate to consider the lowest measured background sound level during the course of the survey to be representative of the environment in the absence of the existing plant. The lowest recorded background noise level during the course of the survey was 47dB L_{A90}.

5.0 Plant noise emission criteria

London Borough of Camden

5.1. Section 6 of the Camden Planning Guidance Amenity, published March 2018, gives guidance on noise and vibration.

5.2. Clause 6.8 refers noise thresholds within Appendix 3 of the Local Plan and to refers to the principles of No observed effect level (NOEL), Lowest observable adverse effect level (LOAEL) and Significant observed adverse effect level (SOAEL) and defines their meanings. Specifically, in the context of this report, LOAEL is defined as:

> *The level above which changes in behaviour (e.g. closing windows for periods of the day) and adverse effects on health (e.g. sleep disturbance) and quality of life can be detected.*

5.3. SOEAL is defined as:

The level above which adverse effects on health and quality of life occur. This could include psychological stress, regular sleep deprivation and loss of appetite.

5.4. Clause 6.27 states that:

Developments proposing plant, ventilation, air extraction or conditioning equipment and flues will need to provide the system's technical specifications to the council accompanying any acoustic report. "BS4142 Method for rating Industrial and Commercial Sound' contains guidance and standards which should also be considered within the acoustic report.

5.5. Appendix 3 within the Camden Local Plan published 2017 states:

"A relevant standard or guidance document should be referenced when determining values for LOAEL and SOAEL for non-anonymous noise. Where appropriate and within the scope of the document it is expected that British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound' (BS 4142) will be used. For such cases a 'Rating Level' of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion)."

5.6. Table C of the appendix states the criteria at which development related noise levels will be acceptable:

Table C: Noise levels applicable to proposed industrial and commercial development (including plant and machinery)

Existing Noise sensitive receptor	Assessment Location	Design Period	LOAEL (green)	LOAEL to SOAEL (Amber)	SOAL (Red)
Dwellings**	Garden used for main amenity (free field) and Outside living or dining or bedroom window (façade)	Day	'Rating level' 10dB* below background	'Rating level' between 9dB below and 5dB above background	'Rating level' greater than 5dB above background
Dwellings**	Outside bedroom window (façade)	Night	'Rating level' 10dB* below background and no events exceeding 57dBL_{Amax}	'Rating level' between 9dB below and 5dB above background or noise events between 57dB and 88dBL_{Amax}	'Rating level' greater than 5dB above background and/or events exceeding 88dBL_{Amax}

**10dB should be increased to 15dB if the noise contains audible tonal elements. (day and night). However, if it can be demonstrated that there is no significant difference in the*

character of the residual background noise and the specific noise from the proposed development then this reduction may not be required. In addition, a frequency analysis (to include, the use of Noise Rating (NR) curves or other criteria curves) for the assessment of tonal or low frequency noise may be required.

***levels given are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises.*

5.7. The plant noise data available indicates that the noise from the units is not tonal. It is therefore considered appropriate to exclude the 5dB additional penalty described in the notes to Table C.

BS 4142:2014 Methods for rating and assessing industrial and commercial sound

5.8. BS 4142:2014 is intended to be used to assess the likely effects of sound on people residing in nearby dwellings. The scope of BS 4142:2014 includes *"sound from fixed plant installations which comprise mechanical and electrical plant and equipment"*.

5.9. The procedure contained in BS 4142:2014 is to quantify the *"specific sound level"*, which is the measured or predicted level of sound from the source in question over a one-hour period for the daytime and a 15-minute period for the night-time. Daytime is defined in the standard as 07:00 to 23:00 hours, and night-time as 23:00 to 07:00 hours.

5.10. The specific sound level is converted to a rating level by adding penalties on a sliding scale to account for either potentially tonal or impulsive elements. The standard sets out objective methods for determining the presence of tones or impulsive elements but notes that it is acceptable to subjectively determine these effects.

5.11. The penalty for tonal elements is between 0dB and 6dB, and the standard notes: *"Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible."*

5.12. The penalty for impulsive elements is between 0dB and 9dB, and the standard notes: *"Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible."*

5.13. The Standard also notes: *"Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied."*

5.14. The assessment outcome results from a comparison of the rating level with the background sound level. The standard states:

- *Typically, the greater this difference, the greater the magnitude of the impact.*
- *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;*
- *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context;*
- *The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.*

5.15. The standard does state that "*adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.*"

5.16. The standard goes on to note that: *"Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night."*

5.17. In addition to the margin by which the Rating Level of the specific sound source exceeds the Background Sound Level, the 2014 edition places emphasis upon an appreciation of the context, as follows:

"An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context."

5.18. BS 4142:2014 requires uncertainties in the assessment to be considered, and where the uncertainty is likely to affect the outcome of the assessment, steps should be taken to reduce the uncertainty.

Summary of proposed criteria

5.19. Table 2 below summarises the proposed plant noise level limits at the nearest premises.

Table 2 Proposed plant noise emissions level limits at nearest receptors

Period	Residential
	Plant rating noise level, dB
Operating hours (06.00 – 00.00 hours)	37
All other times (00.00 – 06.00 hours)	37

6.0 Plant noise impact assessment

6.1. Cumulative noise emissions from the new proposed plant have been predicted at the nearest residential property to the site based on the noise output information shown in **Appendix D**.

6.2. Noise levels for the proposed air supply and extract systems have been predicted taking into account ductwork system losses, aperture size, directivity of sound propagation, screening (where applicable) and distance attenuation. Predictions are inclusive of the following atmospheric-side attenuators fitted to the ventilation systems.

Table 3 Proposed atmospheric-side attenuators to ventilation systems

Attenuator	Insertion losses dB, at octave band centre frequencies (Hz)							
	63	125	250	500	1k	2k	4k	8k
AHU1 Supply Intake	7	15	30	45	45	45	45	37
EF1 Kitchen Extract	6	12	24	34	40	33	26	17
EF2 General Extract	2	4	6	16	26	19	17	13
EF3 Toilet Extract	2	4	6	19	29	23	21	14

6.3. For the air conditioning units (CU1 to CU3) and the catering condensing unit, the assessment has considered the distance attenuation and screening (where applicable) between these items and the nearest noise sensitive receptors.

6.4. The predictions during operating hours period have been based on the proposed plant operating simultaneously at full capacity. Night-time predictions have been based upon the catering condensing unit being the only operational item of plant.

6.5. It should be noted that the proposed plant is not anticipated to exhibit any tonal or impulsive characteristics providing it is well maintained. All proposed external plant will be inverter driven and, therefore, will gently ramp up and down depending on the demands on the various systems. In any case, a +3dB acoustic feature correction has been applied to the noise level predictions in order to be robust.

6.6. Table 4, below, summarises the assessment of predicted noise rating levels. The full set of calculations is presented in **Appendix E**.

Table 4 Assessment of predicted noise levels at the nearest noise sensitive receptors

Receptor	Period	Predicted noise level at receptor, L_{Aeq} (dB)	Design criterion (dB)	Difference (dB)
Receptor R1. Residential at 30 Parkway	Operating hours (06.00 – 00.00 hours)	36	37	-1
	All other times (00.00 – 06.00 hours)	29	37	-8
Receptor R2. Residential at 34 Parkway	Operating hours (06.00 – 00.00 hours)	37	37	0
	All other times (00.00 – 06.00 hours)	23	37	-14

6.7. External noise level predictions demonstrate that cumulative noise emissions from the proposed plant meet the proposed criteria given in Table 2 of this report, being at least 10dB below the existing lowest background sound level outside the nearest residential windows. In addition, noise from the new plant is predicted to be significantly lower than that resulting from the existing (i.e. based on the results of the environmental noise survey). Plant noise should therefore be acceptable to London Borough of Camden.

6.8. Plant noise predictions include the following mitigation measures:

- Atmospheric-side attenuators fitted to the AHU intake and kitchen, general and toilet extract fans.

6.9. In addition, all unattenuated ducts will be acoustically lagged, and the AHU and kitchen extract fans will be installed within the manufacturer's acoustic enclosures.

Context and assessment of uncertainties

6.10. As BS 4142:2014 advises, the estimated impact must be considered within the context of the site and the surrounding acoustic environment. The following must, therefore, also be taken into consideration when determining the potential impact that may be experienced:

- The assessments are undertaken at the nearest residential windows. The impact on all other residential premises will be lower due to distance losses.

6.11. Where possible uncertainty in this assessment has been minimised by taking the following steps:

- The measurement of the background sound levels was undertaken over a period including the quietest times of the day and night (i.e. when existing plant was switched off).
- The sound level meter and calibrator used have a traceable laboratory calibration and were field calibrated before and after the measurements.

- Uncertainty in the calculated impact has been reduced by the use of a well-established calculation method.

- Care was taken to ensure that the measurement position was representative of the noise climate outside the nearby residential dwellings and not at a position where higher noise levels are present.

7.0 Summary

7.1. Noise Solutions Ltd (NSL) has been commissioned by Chapman Ventilation Ltd to undertake a noise assessment for new plant at a proposed new restaurant located at 32 Parkway, Camden Town.

7.2. An environmental sound survey was undertaken at the site in order to establish the typical background sound levels at the nearest residential window.

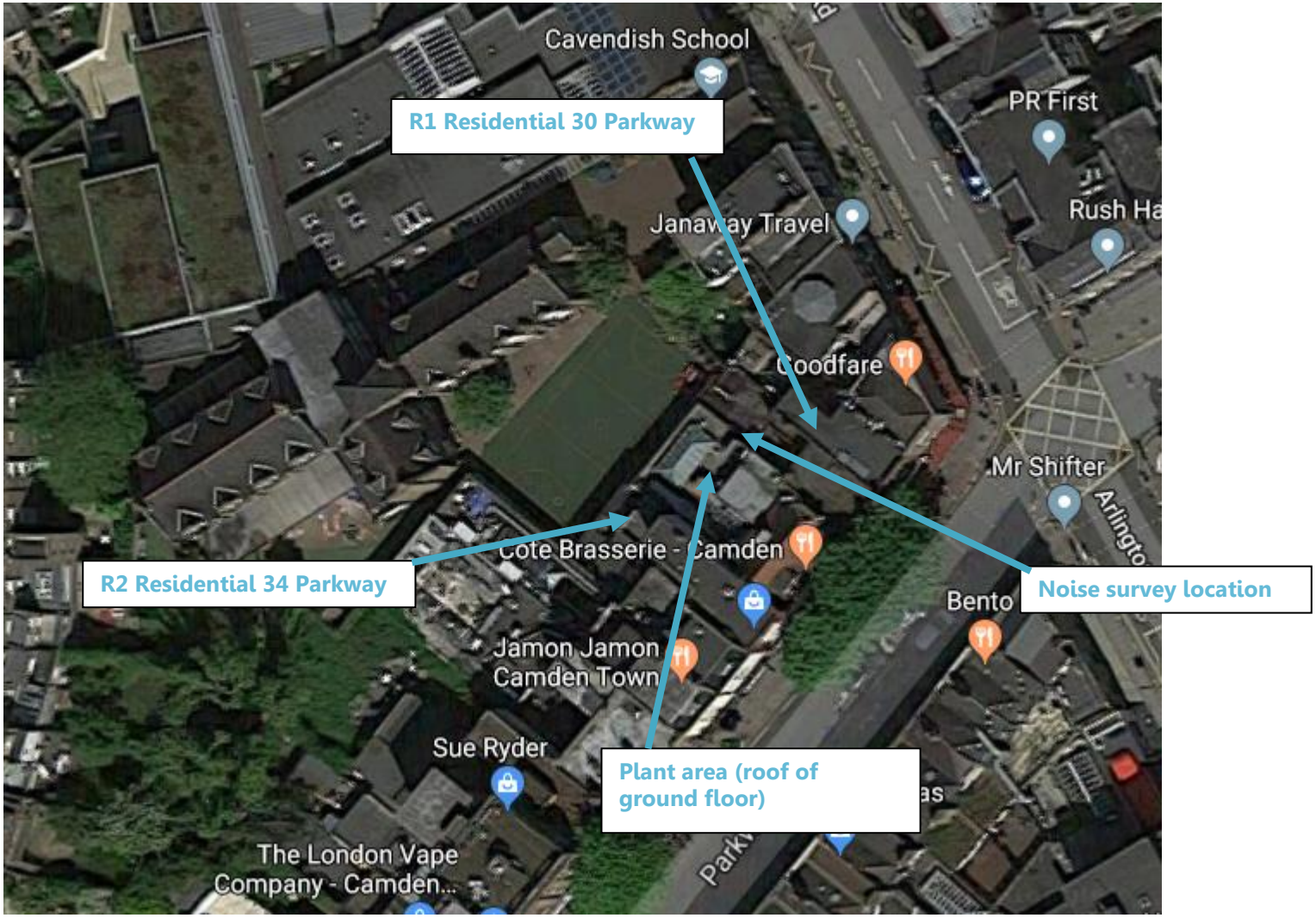
7.3. The cumulative plant noise emission levels for the proposed plant have been predicted at the most affected noise sensitive receptor and assessed against the typical requirements of London Borough of Camden and other guidance.

7.4. The results of the assessment demonstrate that cumulative noise levels at the most affected noise sensitive windows should be acceptable to the local planning authority during both the restaurant's potential operating hours and at all other times, inclusive of mitigation measures stated in section 6. These include the installation of suitable atmospheric-side silencers to the proposed supply and extract systems.

Appendix A Acoustic terminology

Parameter	Description
Ambient Noise Level	The totally encompassing sound in a given situation at a given time, usually composed of a sound from many sources both distant and near ($L_{Aeq,T}$).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1/s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa. The threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.
dB(A), L_{Ax}	Decibels measured on a sound level meter 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. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).
Fast Time Weighting	Setting on sound level meter, denoted by a subscript F, that determines the speed at which the instrument responds to changes in the amplitude of any measured signal. The fast time weighting can lead to higher values than the slow time weighting when rapidly changing signals are measured. The average time constant for the fast response setting is 0.125 (1/8) seconds.
Free-field	Sound pressure level measured outside, far away from reflecting surfaces (except the ground), usually taken to mean at least 3.5 metres
Façade	Sound pressure level measured at a distance of 1 metre in front of a large sound reflecting object such as a building façade.
$L_{Aeq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level recorded during a noise event with a period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise. $L_{A10,18h}$ is the A –weighted arithmetic average of the 18 hourly $L_{A10,1h}$ values from 06:00-24:00.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T. Generally used to describe background noise level.

Appendix B Aerial photograph of site showing areas of interest



Appendix C Environmental noise survey

Details of sound surveys

C.1 Measurements of the existing background sound levels were undertaken between 14.15 hours on Monday 7th January and 12.30 hours on Tuesday 8th January 2019.

C.2 The sound level meter was programmed to record the A-weighted L_{eq}, L_{90}, L_{10} and L_{max} noise indices for consecutive 5-minute sample periods for the duration of the noise survey.

Measurement position

C.3 The representative measurement position was located on the flat roof at the rear of the restaurant (location indicated on the site plan in **Appendix B**). 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'*, the measurements were undertaken under free-field conditions.

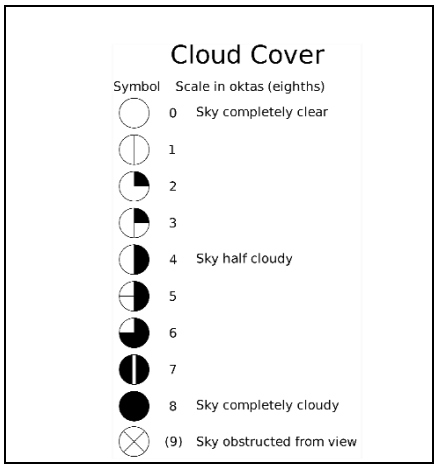
Equipment

C.4 Details of the equipment used during the survey are provided in the table below. The sound level meter was calibrated before and after the survey; no significant change (+/-0.2 dB) in the calibration level was noted.

Description	Model / serial no.	Calibration date	Calibration certificate no.
Class 1 Sound level meter	Rion NL-31 / 00593603	02/05/2018	TCRT18/1382
Condenser microphone	Rion UC-53A / 316133		
Preamplifier	Rion NH-21 / 30367		
Calibrator	Rion NC-74 / 35094453	09/03/2018	TCRT18/1141

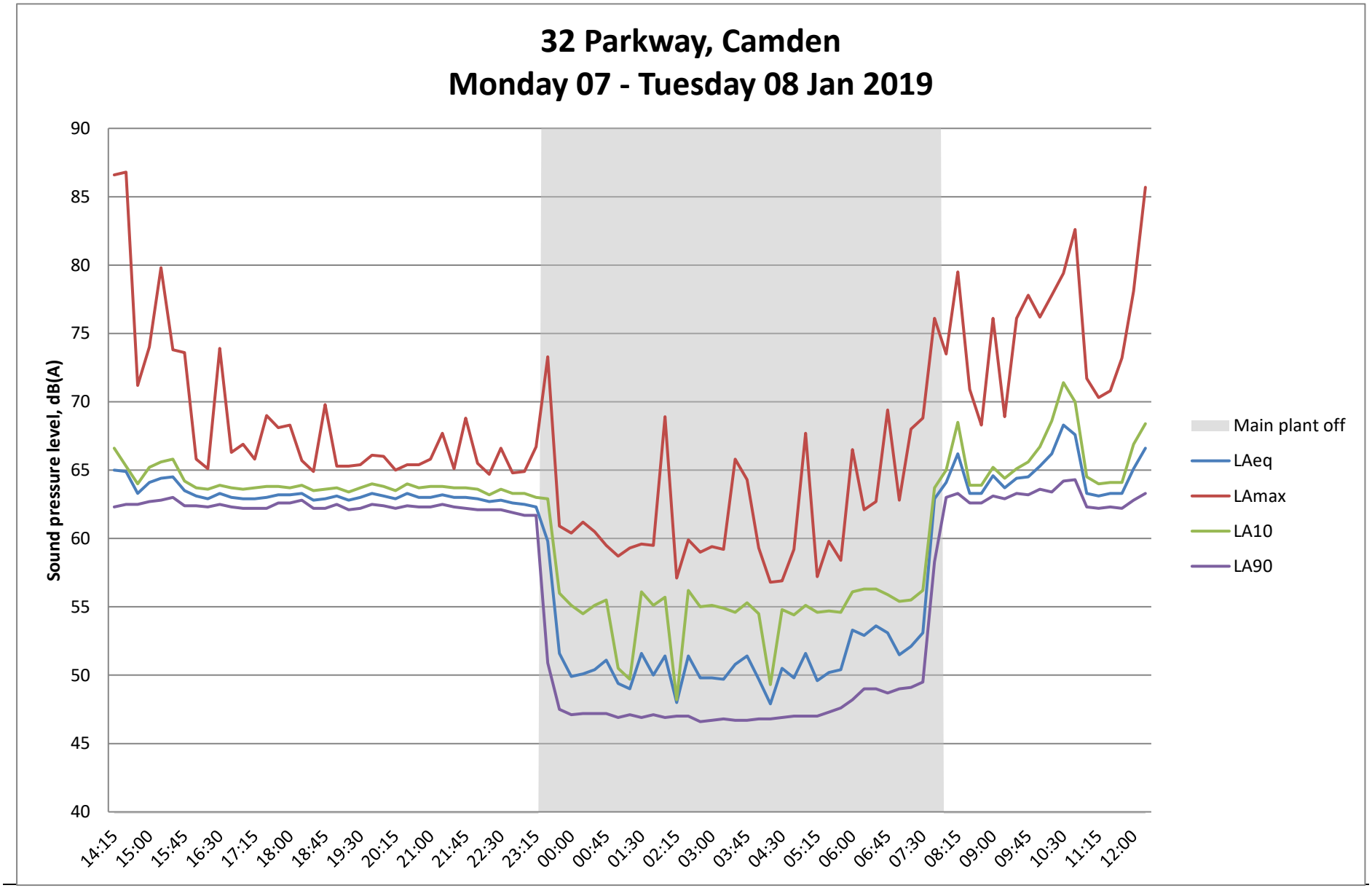
Weather conditions

C.5 Weather conditions were determined both at the start and on completion of the survey. It is considered that the meteorological conditions were appropriate for environmental noise measurements. The table below presents the weather conditions recorded on site at the beginning and end of the survey.

Weather Conditions				
Measurement Location	**Date/Time**	**Description**	**Beginning of Survey**	**End of Survey**
As indicated on Appendix B	14.15 7 Jan – 12.30 8 Jan 2019	Temperature	10	9
		Precipitation:	No	No
		Cloud cover (oktas - see guide)	8	1
		Presence of fog/snow/ice	No	No
		Presence of damp roads/wet ground	Damp patches on roof	Damp patches on roof
		Wind Speed (m/s)	<1	1
		Wind Direction	S	E
		Conditions that may cause temperature inversion (i.e. calm nights with no cloud)	No	No

Results

C.6 The results of the environmental survey are considered to be representative of the background sound pressure levels at the façades of the nearest noise sensitive receptors. The noise climate during the survey period was dominated by existing plant on the roof. The results of the survey are presented in a time history graph overleaf.


32 Parkway, Camden
Monday 07 - Tuesday 08 Jan 2019
Sound pressure level, dB(A)
90
85
80
75
70
65
60
55
50
45
40
14:15
15:00
15:45
16:30
17:15
18:00
18:45
19:30
20:15
21:00
21:45
22:30
23:15
00:00
00:45
01:30
02:15
03:00
03:45
04:30
05:15
06:00
06:45
07:30
08:15
09:00
09:45
10:30
11:15
12:00
Main plant off
LAeq
LAmax
LA10
LA90

Appendix D Plant information and manufacturer published sound pressure levels

Mark / Model	No. units	Notes	Sound levels, dB, at octave band frequencies (Hz)								
			63	125	250	500	1K	2K	4K	8K	L_{Aeq} (dB)
Air handling unit Aircraft Standard 1216	1	Inlet L_w	84	89	85	85	85	82	80	77	
		Casing breakout L_w	69	73	70	59	53	49	40	48	
EF1 Kitchen Extract Flakt Woods GMEB-1-04-063-5570	1	Outlet L_w	73	82	83	83	81	79	75	71	
		Casing breakout L_w	61	68	65	61	53	48	40	33	
EF2 General extract Systemair Circular Duct Fan K250L	1	Outlet, L_w,	76	78	66	65	62	60	53	50	
EF3 Toilet extract system Systemair Circular Duct Fan K200L	1	Outlet, L_w,	69	79	72	71	68	64	59	61	
CU1, CU2 Air conditioning unit. Toshiba RAV-GM1401AT8P-E	2	L_p at 1m									57
CU3 Air conditioning unit. Toshiba RAV-GM1101AT8P-E	1	L_p at 1m									57
Catering Condensing unit[1] (unknown model)	1	L_p at 10m									38

Note 1: The model of the catering condensing unit is unknown. The sound pressure level at 10m has been estimated based on typical catering condensing units selections.

Appendix E Plant noise calculations

Summary of predictions

Equipment	L_{Aeq} (dB)	
	Receptor R1	**Receptor R2**
EF1 - Kitchen Extract - discharge	17	18
EF2 - General Extract	20	23
EF3 - WC Extract	24	26
AHU1 - Supply AHU	27	31
CU1	24	18
CU2	24	18
CU3	24	18
Catering Condenser*	26	20
Cumulative Daytime Period	**33**	**34**
BS 4142:2014 feature correction	3	3
Rating level (daytime)	**36**	**37**
Cumulative Night-time Period	**26**	**20**
BS 4142:2014 feature correction	3	3
Rating level (night time)	**29**	**23**

**Operates overnight*

To Receptor R1

		Octave band centre frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	dB(A)
EF1 Kitchen Extract										
Source noise level (Termination)	In-duct L_w	73	82	83	83	81	79	75	71	**86**
System losses		-19	-15	-6	-6	-10	-14	-14	-14	
Directivity correction	Angle 90°	0	0	0	-2	-2	-4	-4	-4	
Atmospheric-side attenuator		-6	-12	-24	-34	-40	-33	-26	-17	
Distance correction	7m	-25	-25	-25	-25	-25	-25	-25	-25	
Screening correction		-5	-5	-5	-5	-5	-5	-5	-5	
Resultant L_p at receptor	L_p @ R1	18	25	23	10	-2	-3	0	5	**17**
EF2										
Source noise level	discharge L_w	76	78	66	65	62	60	53	50	68
System losses		-17	-12	-7	-3	-1	-2	-4	-4	
Atmospheric-side attenuator		-2	-4	-6	-16	-26	-19	-17	-13	
Distance correction	8m	-26	-26	-26	-26	-26	-26	-26	-26	
Directivity	Angle 60°	1	1	2	2	2	2	2	2	
Screening correction		-5	-5	-5	-5	-5	-5	-5	-5	
Resultant at receptor	L_p @ R1	27	32	24	17	5	9	2	3	**20**
EF3										
Source noise level	discharge L_w	69	79	72	71	68	64	59	61	73
System losses		-17	-12	-7	-3	-2	-3	-5	-5	
Atmospheric-side attenuator		-2	-4	-6	-19	-29	-23	-21	-14	
Distance correction	8m	-26	-26	-26	-26	-26	-26	-26	-26	
Directivity	Angle 60°	1	1	2	2	2	2	2	2	
Screening correction		-5	-5	-5	-5	-5	-5	-5	-5	
Resultant at receptor	L_p @ R1	20	33	29	19	8	9	4	13	**24**
AHU Supply fan										
Source noise level	In-duct L_w	84	89	85	85	85	82	80	77	90
System losses		-16	-12	-6	-3	-1	-1	-1	-1	
Atmospheric-side attenuator		-7	-15	-30	-45	-45	-45	-45	-37	
Distance correction	9m	-27	-27	-27	-27	-27	-27	-27	-27	
Directivity correction	Angle 0°	3	4	5	6	6	6	6	6	
Resultant at R1	L_p @ R1	37	39	27	16	18	15	13	18	**27**

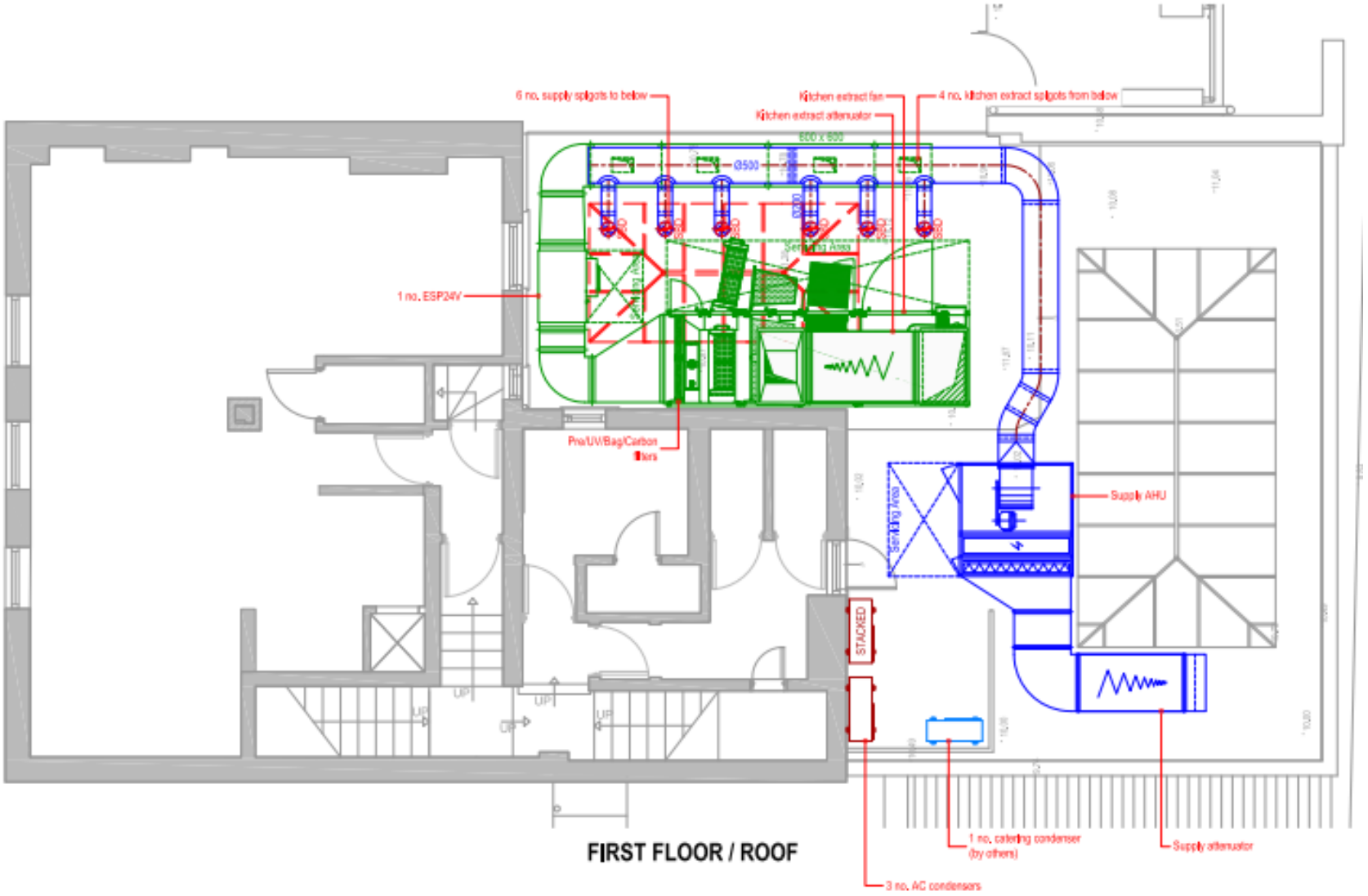
		Octave band centre frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	dB(A)
CU1, CU2, CU3										
Source noise level	L_p at 1m									57
Distance correction	5m									-14
Barrier/ Screening correction										-19
Resultant at R1	(each)									**24**
No. units	3									5
Total at R1										**29**
CC1										
Source noise level	Lp at 10m									38
No. units	1									0
Distance correction	5m									+6
Barrier/ Screening correction										-18
Resultant at R1										**26**

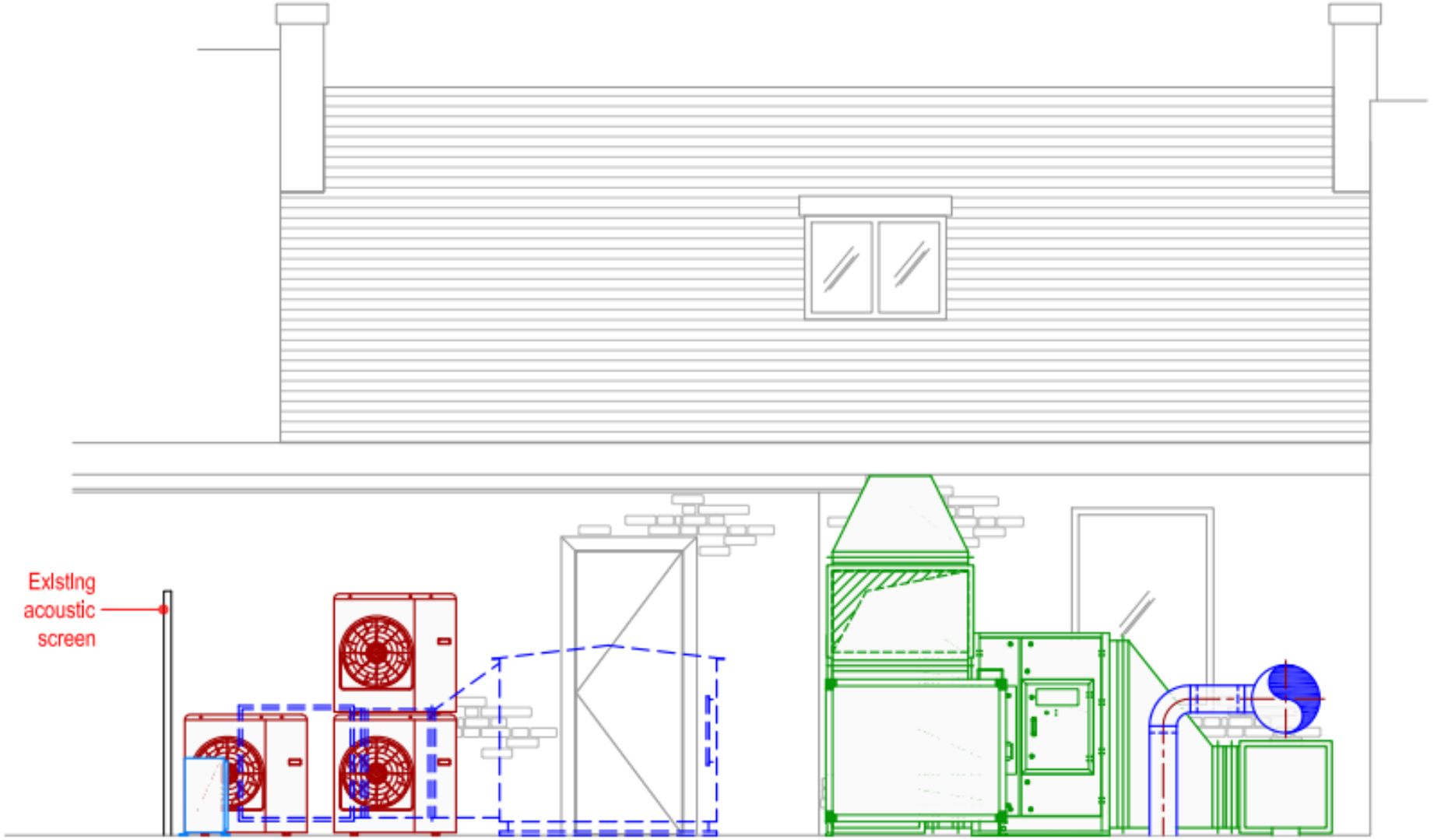
To Receptor R2

		Octave band centre frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	dB(A)
EF1 Kitchen Extract										
Source noise level (Termination)	In-duct L_w	73	82	83	83	81	79	75	71	**86**
System losses		-19	-15	-6	-6	-10	-14	-14	-14	
Directivity correction	Angle 90°	0	0	0	-2	-2	-4	-4	-4	
Atmospheric-side attenuator		-6	-12	-24	-34	-40	-33	-26	-17	
Distance correction	6m	-24	-24	-24	-24	-24	-24	-24	-24	
Screening correction		-5	-5	-5	-5	-5	-5	-5	-5	
Resultant L_p at receptor	L_p @ R2	19	26	24	12	0	-1	2	7	**18**
EF2										
Source noise level	discharge L_w	76	78	66	65	62	60	53	50	68
System losses		-17	-12	-7	-3	-1	-2	-4	-4	
Atmospheric-side attenuator		-2	-4	-6	-16	-26	-19	-17	-13	
Distance correction	6m	-24	-24	-24	-24	-24	-24	-24	-24	
Directivity correction	Angle 60°	1	1	2	2	2	2	2	2	
Screening correction		-5	-5	-5	-5	-5	-5	-5	-5	
Resultant L_p at receptor	L_p @ R2	29	34	26	19	8	12	5	6	**23**

		Octave band centre frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	dB(A)
EF3										
Source noise level	discharge L_w	69	79	72	71	68	64	59	61	73
System losses		-17	-13	-7	-3	-2	-3	-5	-5	
Atmospheric-side attenuator		-2	-4	-6	-19	-29	-23	-21	-14	
Distance correction	6m	-24	-24	-24	-24	-24	-24	-24	-24	
Directivity correction	Angle 60°	1	1	2	2	2	2	2	2	
Screening correction		-5	-5	-5	-5	-5	-5	-5	-5	
Resultant L_p at receptor	L_p @ R2	22	35	32	22	10	11	6	15	**26**
AHU Supply fan										
Source noise level	In-duct L_w	84	89	85	85	85	82	80	77	90
System losses		-10	-5	-1	0	0	0	0	0	
Atmospheric-side attenuator		-7	-15	-30	-45	-45	-45	-45	-37	
Distance correction	9m	-27	-27	-27	-27	-27	-27	-27	-27	
Directivity correction	Angle 0°	3	4	5	6	6	6	6	6	
Resultant L_p at receptor	L_p @ R2	43	45	31	19	19	16	14	19	**31**
CU1, CU2, CU3										
Source noise level	L_p at 1m									57
Distance correction	9.5m									-20
Barrier/ Screening correction										-19
Resultant L_p at receptor										18
No. units	3									5
Resultant L_p at receptor	L_p @ R2									**23**
CC1										
Source noise level	L_p at 10m									38
Distance correction	10m									0
Barrier/ Screening correction										-18
Resultant L_p at receptor	L_p @ R2									**20**

Appendix F Plant plan and elevation




Existing
acoustic
screen