GILLIERON SCOTT
ACOUSTIC DESIGN

Report No:
2 Devonshire Mews South – Noise Impact Assessment 07112023

Date:
7th November 2023

For:
De Matos Ryan

2 Devonshire Mews South, W1G 6QW
PLANT NOISE IMPACT ASSESSMENT

By:
Gillieron Scott Acoustic Design
130 Brixton Hill
London SW2 1RS

t - 020 8671 2223
e - info@gsacoustics.org
w - www.gsacoustics.org

REVISION SCHEDULE

Document Revision	Date	Document Title	Details	Prepared by	Approved by
00	22/09/2023	3 Kensington Park Mews – Noise Impact Assessment 22092023	DRAFT FOR COMMENT	 Hugo Bell	 Lucie Zalberg
01	07/11/2023	3 Kensington Park Mews – Noise Impact Assessment 07112023	ISSUED	 Hugo Bell	 Lucie Zalberg

TABLE OF CONTENTS

Introduction 4
1.0 Brief 4
2.0 Context 4
3.0 Summary 5
4.0 Plant Noise Assessment Criteria 5
5.0 Survey Details and Results 7
6.0 Plant Noise Assessment 8
7.0 Uncertainty 10
8.0 Conclusion 10
9.0 Statement of Competence 11
APPENDICES 12
APPENDIX A: Site Overview 13
APPENDIX B: Survey Arrangement 14
APPENDIX C: Measurement Position 15
APPENDIX D: Time Series Graph 16
APPENDIX E Histogram Plot 17
APPENDIX F: Proposed Mechanical Layout 18
APPENDIX G: Survey Results 19
APPENDIX H: Equipment 26
APPENDIX I: Acoustic Feature Correction 27
APPENDIX J: Manufacturer's Data 28
APPENDIX K: Glossary of Acoustic Terms 30

Introduction

2 Devonshire Mews South, W1G 6QW is a residential property. It is proposed that a new Air Conditioning (AC) unit is to be installed on the property's external side wall to service the premises.

Gillieron Scott Acoustic Design (GSAD) have been commissioned to undertake a background noise survey at the site and a plant noise impact assessment in accordance with The London Borough of Westminster's noise policy, in order to ensure the necessary requirements are met for this installation.

GSAD have carried out a background noise survey at one fixed monitoring location between 11:15 on Friday 8th September and 15:00 on Monday 11th September 2023. The microphone location was chosen to be representative of the closest residential receptors.

It is understood that the plant will have the facility to operate at any time of day or night, therefore this assessment will be undertaken against the night-time period as a worst-case scenario.

The site location, plant area and nearest residential receptors are indicated in Appendices A, B and C.

1.0 Brief

- Undertake noise measurements at a fixed monitoring location over an extended period.
- Identify noise sensitive dwellings located close to the site and assess the topography of the intervening ground.
- Analyse the site-acquired data and determine the appropriate criteria to adopt from the London Borough of Westminster's noise policy.
- Using measured data from the survey and manufacturer's data for the proposed items of plant where possible, verify the impact of the development to satisfy the Local Authority's noise policy.
- Provide a technical report detailing findings of the noise survey.

2.0 Context

The site is a two-storey residential house currently undergoing renovation works located in Devonshire Mews South – a series of terraced properties in Marylebone. The site is proposing to install an Air Conditioning unit (AC) (Daikin VRV IV S-series Compact RXYSCQ6TV1) to the external side wall, to the property's south. The neighbouring premises are residential dwellings. The property is situated in proximity to Weymouth Street and Devonshire Street – which are made up of a mix of residential and commercial premises including medical practises, pubs and cafes. The property is positioned in central Marylebone and is therefore exposed to noise from busy roads including the A501 to the property's north and Great Portland Street to the property's east.

The nearest noise sensitive receptor has been identified as a set of windows on the third floor of the neighbouring premises, no 39 Weymouth Street, located approximately 11m from the proposed unit.

The dominant noise sources noted whilst on site included noise from traffic and pedestrians on both Weymouth Street and Devonshire Street, as well as noise from overhead aeroplanes.

At the time of the survey, the property was undergoing construction works, with the 2nd floor and roof-top levels covered in a tarpaulin. Construction works were undertaken between 08:00-17:00 Monday-Friday, and the data collected during these hours have been excluded from the noise impact assessment.

3.0 Summary

A background noise survey was undertaken between 11:15hrs on Friday 8th September and 15:00hrs on Monday 11th September 2023 at a single fixed monitoring location representative of the nearest noise sensitive residential windows.

It is understood that the plant will have facility to operate at any time, day or night, Monday to Sunday, therefore this assessment will be based on the night-time reference period. Manufacturer supplied noise data is provided in the Appendix.

Results from the survey show minimum background noise of 40dB $L_{A90,15min}$ during night-time.

Ambient noise levels during the day (07:00-23:00hrs) have been measured to be 47dB $L_{Aeq,16hrs}$, and 46dB $L_{Aeq,8hrs}$ during night-time (23:00-07:00hrs). In accordance with Westminster's noise policy, noise from mechanical ventilation with all plant operating shall be designed to 10dB below minimum background noise i.e. 30dB L_{Aeq} at 1m from the façade of any noise sensitive windows.

The site location, measurement position and measured results are presented in the following Sections and Appendices.

4.0 Plant Noise Assessment Criteria

4.1 BS4142:2014+A1:2019 "Methods for rating and assessing industrial and commercial sound"

BS4142:2014+A1:2019 provides methods for rating and assessing industrial and commercial sound. The standard is used to rate sound from fixed installations. The standard requires a "Specific Sound Level", in terms of L_{Aeq}, is determined either by measurement or calculation at a receptor location. This Specific Sound Level may then be corrected for the character of sound and is then termed the "Rating Level".

Once the Rating Level has been determined, the background sound level is subtracted from it and the greater the difference, the greater the likelihood of an '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. The standard advocates that each site and situation should take the context of the scenario into consideration and that "not all adverse impacts will lead to complaints and not every complaint is proof of an adverse 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.

The standard provides reference periods over which the assessment should take place which have been reproduced in the table below.

Table 1 – Reference Periods

Period	Hours
Typical Daytime	07:00 – 23:00
Typical Night-time	23:00 – 07:00

4.2 Local Authority Noise Policy

Westminster Council's policy, contained in the document 'Technical Guidance Note (September 2020)' for plant and machinery noise is referenced below:

Table 2 – Westminster council noise criteria for plant machinery and internal/external activities

Existing External Ambient Noise Level	Tonal or Intermittent Noise/Noise Source	Sound Emission Level that should not be exceeded at the nearest Noise Sensitive Receptor
Exceeds WHO Guideline levels: L_{Aeq} 55 dB over periods of daytime (07:00 – 23:00hrs) and L_{Aeq} 45 dB at night-time (23:00 – 07:00hrs).	Does not contain tones or intermittent noise sufficient to attract attention	10 dB below the minimum external background level
	Contains tones or be intermittent noise sufficient to attract attention	15 dB below the minimum external background level
	Noise emitted from emergency plant or generators	10 dB above the lowest background noise level within a 24-hour period.
Does not exceed WHO Guideline levels: L_{Aeq} 55 dB over periods of daytime (07:00 – 23:00hrs) and L_{Aeq} 45 dB at night-time (23:00 – 07:00hrs).	Does not contain tones or intermittent noise sufficient to attract attention	5 dB below the minimum external background level
	Contains tones or be intermittent noise sufficient to attract attention	10 dB below the minimum external background level
	Noise emitted from emergency plant or generators	10 dB above the lowest background noise level within a 24-hour period.
Below 30 dB $L_{A90,15min}$ at the nearest noise sensitive receptors Both daytime (07.00- 23.00hrs) and night-time (23:00 – 07:00hrs)	Noise contains and/or does not contain tones or intermittent noise	Site specific standards that avoid noise disturbance to nearest noise sensitive receptors may be considered.

Survey data shows that the site exceeds the daytime WHO Guideline level of 45 dB L_{Aeq} during night-time, therefore plant noise shall be assessed against the first set of criteria (10 dB below the minimum external background noise level).

5.0 Survey Details and Results

A background noise survey was undertaken between 11:15hrs on Friday 8th September and 15:00hrs on Monday 11th September 2023 at a single fixed monitoring location, in close proximity to the nearest noise sensitive windows. The microphone position is shown in Appendix C.

The levels were recorded in octave bands as L_{eq}, L_{max} and L_{90} with Fast time-weighting along with their respective A-weighted single-figure values. The clock on the sound level meter was synchronised to the correct time before deployment. The meter was then set to integrate sound levels over 15-minute periods in synchronisation mode. A list of the measurement equipment is reported in Appendix H.

The equipment was calibrated at the beginning and end of the survey period and a 0.1 dB drift in calibration was noted. Weather conditions were considered conducive to measurement.

Full survey results to one decimal place are presented in Appendix G. Graphical representations of the results are presented in Appendices D and E.

Table 3 – Summary of Minimum Background Noise Levels

Minimum Background Noise Level L_{A90}	
Daytime (07:00-23:00hrs)	**Night-time (23:00-07:00hrs)**
42 dB(A)	40 dB(A)

Therefore, this assessment of the newly proposed plant item in the following section will be based on the lowest night-time background noise level of 40 dB $L_{A90,15min}$.

6.0 Plant Noise Assessment

It is proposed that 1x Daikin VRV IV S-series Compact RXYSCQ6TV1 AC unit is installed on the side wall on the south side of the property. Manufacturer supplied noise data is provided in the Appendix. The proposed plant location and the unit's associated manufacturer supplied noise data is shown in the Appendix. The nearest residential building has been identified as no 39 Weymouth Street, neighbouring no 2 Devonshire Mews South.

The plant noise impact assessment for the most affected residential window has been carried out in the following tables. Table 4 shows the cumulative noise impact assessment for all newly proposed plant.

Table 4 –Noise Impact Assessment – Night-time (23:00hrs - 07:00hrs)

Element	Level		Comments
	AC Condenser		
Sound Power Level (SWL)	70	dB(A)	SWL, taken from manufacturer's datasheet, measured in a semi-anechoic room
Conversion to SPL	-11	dB	Conversion from SWL to SPL
Sound Pressure Level (SPL)	59	dB(A)	SPL at 1m, calculated from manufacturer datasheet, measured in an anechoic room (L_{Aeq})
Reflections	+6	dB	2 acoustically hard reflective surface in close proximity to the unit including the floor
Distance losses	-20	dB	Point source distance attenuation over 10m (1m from residential window)
Specific Sound Level	45	dB(A)	Specific sound level before acoustic feature corrections at 1m from the receptor
Acoustic Feature Correction	2	dB	2dB added for just perceptible tonality in accordance with BS4142 guidance
Rating Level	**47**	**dB(A)**	**At 1m from the closest receptor, L_{Aeq}**
Minimum background	40	dB(A)	Minimum measured $L_{A90,15min}$ during night-time reference period
Difference (Rating Level – Background)	+7	dB(A)	The rating level is 7 dB above minimum background noise level and therefore indicates an adverse impact in the context of this site in accordance with BS4142:2014+A1:2019.

As can be seen from Table 4 above, the assessment of noise breakout from the proposed plant unit without mitigation results in a rating level at the most affected receptor of 47 dB L_{Aeq}, which is 7 dB above the minimum background sound level of 40 dB $L_{A90,15mins}$ during the potential operating hours of the plant. This indicates an adverse impact in the context of this site in accordance with BS4142:2014+A1:2019 and is not in accordance with Westminster Council noise criteria, therefore requiring mitigation.

Recommended Mitigation Measures.

It is proposed that the unit is installed within an acoustic enclosure e.g. by ENVIRON (see Appendix J for example manufacturer's data) to achieve the minimum requirements as stated in Table 5. The assessment of noise impact following mitigation is set out below, including the minimum reductions required to be provided by the enclosure.

Table 5 –Noise Impact Assessment – Night-time (23:00hrs - 07:00hrs), Following Mitigation

Element	Level		Comments
	AC Condenser		
Sound Power Level (SWL)	70	dB(A)	SWL, taken from manufacturer's datasheet, measured in a semi-anechoic room
Conversion to SPL	-11	dB	Conversion from SWL to SPL
Sound Pressure Level (SPL)	59	dB(A)	SPL at 1m, calculated from manufacturer datasheet, measured in an anechoic room (L_{Aeq})
Reflections	+6	dB	2 acoustically hard reflective surface in close proximity to the unit including the floor
Distance losses	-20	dB	Point source distance attenuation over 10m (1m from residential window)
Mitigation	**-15**	**dB**	**Minimum required mitigation provided by acoustic enclosure**
Specific Sound Level	30	dB(A)	Specific sound level before acoustic feature corrections at 1m from the receptor
Acoustic Feature Correction	0	dB	Tonality is not predicted to be perceptible at 10 dB below minimum background and has therefore been omitted
Rating Level	**30**	**dB(A)**	**At 1m from the closest receptor, L_{Aeq}**
Minimum background	40	dB(A)	Minimum measured $L_{A90,15min}$ during night-time reference period
Difference (Rating Level – Background)	-10	dB(A)	The rating level is 10 dB below minimum background noise level and therefore indicates a low adverse impact in the context of this site in accordance with BS4142:2014+A1:2019 and demonstrates compliance with LA requirements.

Following a minimum of 15 dB(A) attenuation to the proposed unit, the rating level is shown to be 10 dB below the minimum measured background noise level ($L_{A90,15min}$) and therefore complies with Westminster Council's adopted noise policy.

The unit should be mounted on anti-vibration mounts selected to reduce structure borne noise transmission to the neighbouring dwellings.

If selected mechanical item of plant differ from the selection presented in this report, the noise assessment should be revised accordingly.

7.0 Uncertainty

The sound level meter was checked at the beginning and end of the survey and the field calibration a 0.1 dB drift. In the context of this environmental noise survey this level of drift it is considered insignificant.

Periods of construction noise were occurring in the locality of the survey between 08:00-17:00hrs Monday-Friday. These periods have been omitted from the results of the survey and therefore do not impact the assessment.

Due to site constrictions, it was not possible to install a weather station on site. Weather conditions have been monitored from historical weather data available online and were similarly noted at the time of installation and collection of the survey. At time of installation and collection, weather was sunny (with minimal cloud cover), dry and wind speeds were low. Historical weather data indicates that there was minimal rain, and only two periods in which wind speeds exceeded 5 m/s. These periods have been excluded from data used for our calculations.

Weather conditions throughout the monitoring period are considered conducive to environmental noise monitoring and deemed to not impact the results of the survey.

8.0 Conclusion

GSAD has undertaken a background noise survey at the site and the survey results are presented within this report, together with BS4142:2014+A1:2019 and Westminster Council's noise policy plant noise assessment for the proposed unit.

A minimum background sound level of 40 dB $L_{A90,15min}$ has been determined over the proposed operational hours of the plant items (any time of day or night).

The plant noise impact assessment has determined that the rating level from the newly proposed plant is predicted to be 47 dB L_{Aeq} and therefore requires mitigation.

Following a minimum of 15 dB(A) mitigation e.g. by acoustic enclosure to the unit, the rating noise level is predicted to be 10 dB below the minimum measured background noise level ($L_{A90,15min}$) during the proposed operational hours of the plant, which is a positive indication of a low impact on nearby residential dwellings in the context of this site in accordance with BS4142:2014+A1:2019 and demonstrates compliance with Westminster Council's adopted noise policy.

9.0 Statement of Competence

The assessment has been undertaken by the author of this report: Hugo Bell, BEng (Electronic Engineering w/ Music Technology Systems) MSc (Cognitive Science) AMIOA. Hugo is a Graduate Acoustic Consultant at Gillieron Scott Acoustic Design with experience across a diverse range of acoustic, psychoacoustic and audio technology projects gained during a Bachelors' degree at the University of York and a Masters' degree from the University of Edinburgh. The author has undertaken prior noise assessments according to the most recent 2014 revision of the British standard.

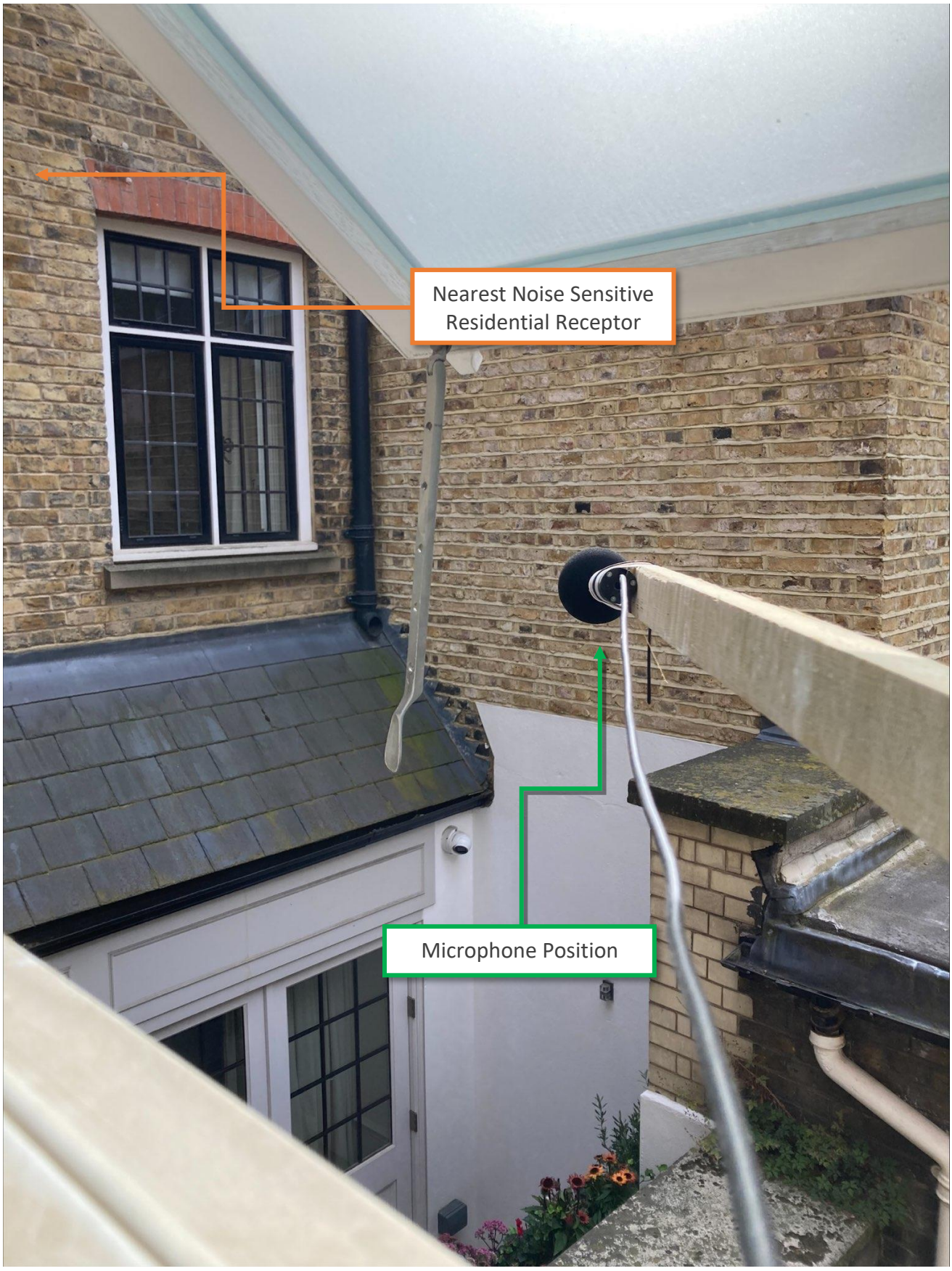
The assessment has been checked by: Lucie Zalberg, BSc (Physics) MSc (Architectural Acoustics) MIOA. Lucie is Director of Gillieron Scott Acoustic Design with 15+ years' experience since completing a degree at Pierre et Marie University in Paris and Bath University. The author has undertaken numerous noise assessments according to the 1997 revision of the British Standard and the most recent 2014 revision of the standard.

APPENDICES

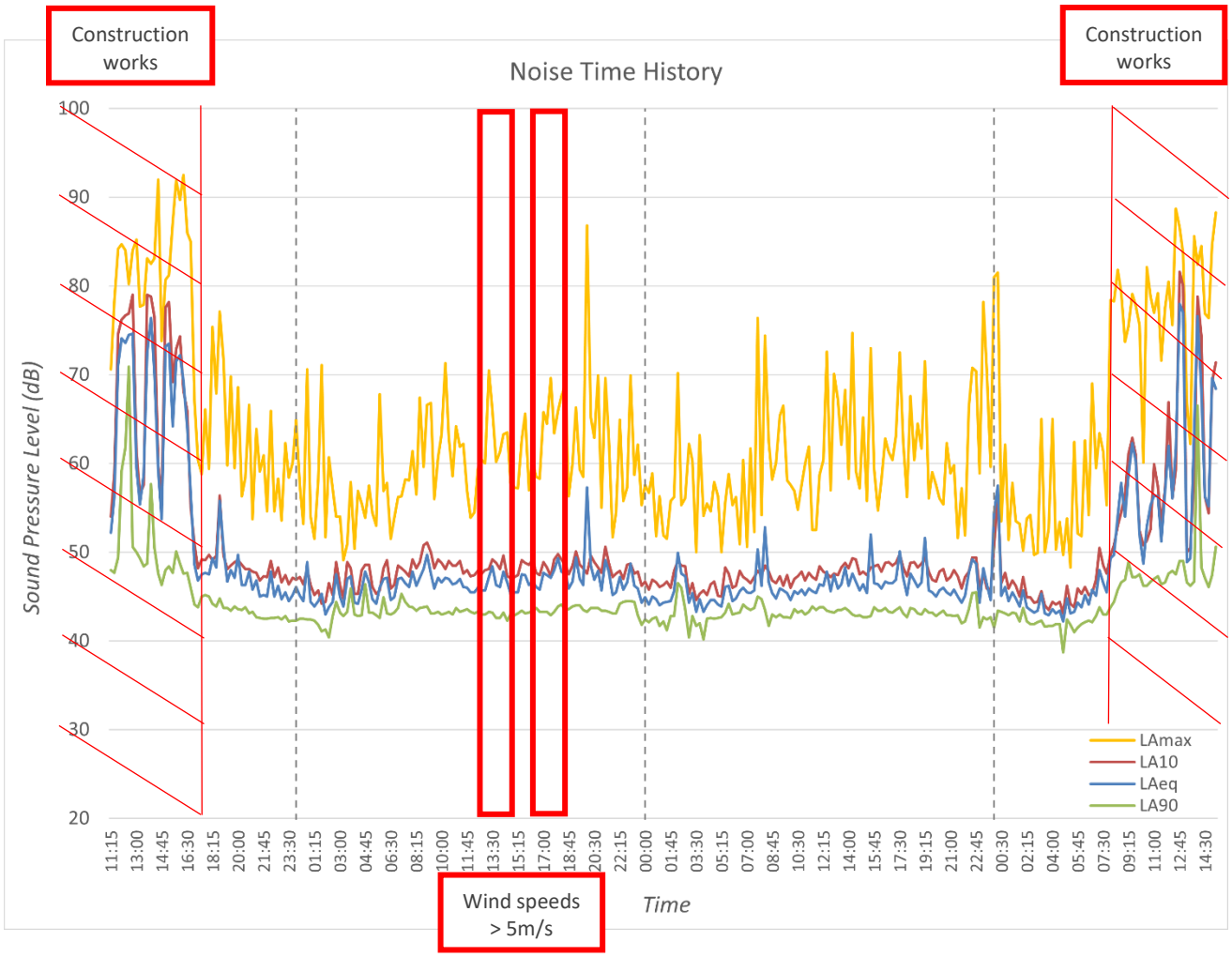
APPENDIX A: Site Overview

APPENDIX B: Survey Arrangement

APPENDIX C: Measurement Position



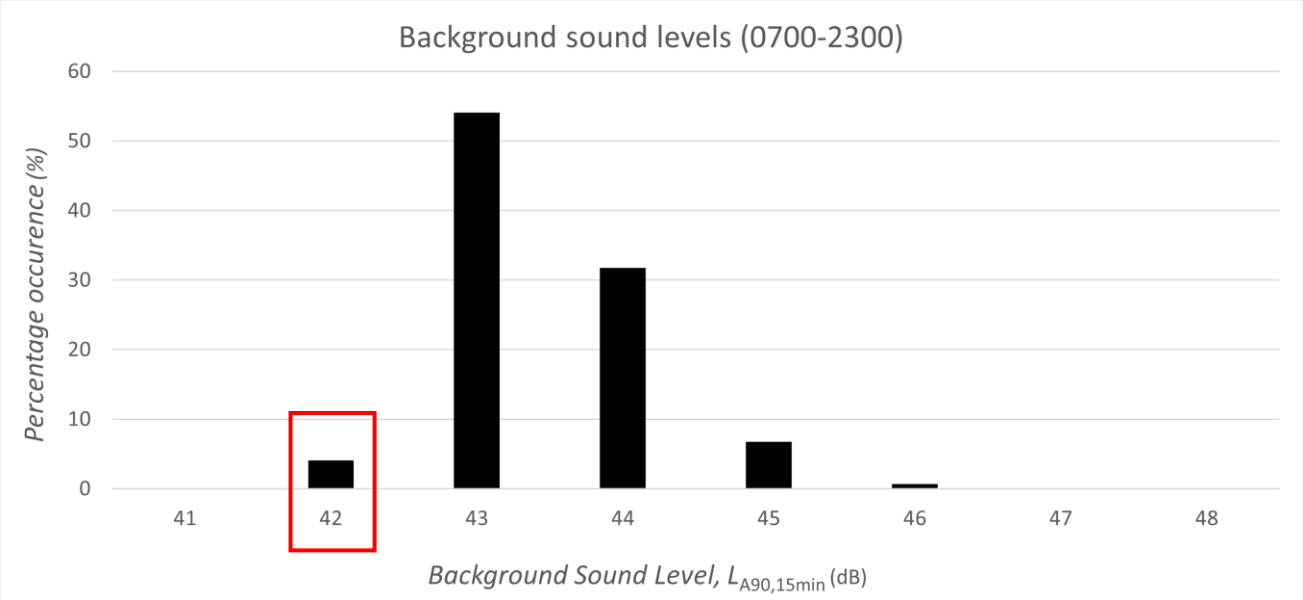
APPENDIX D: Time Series Graph

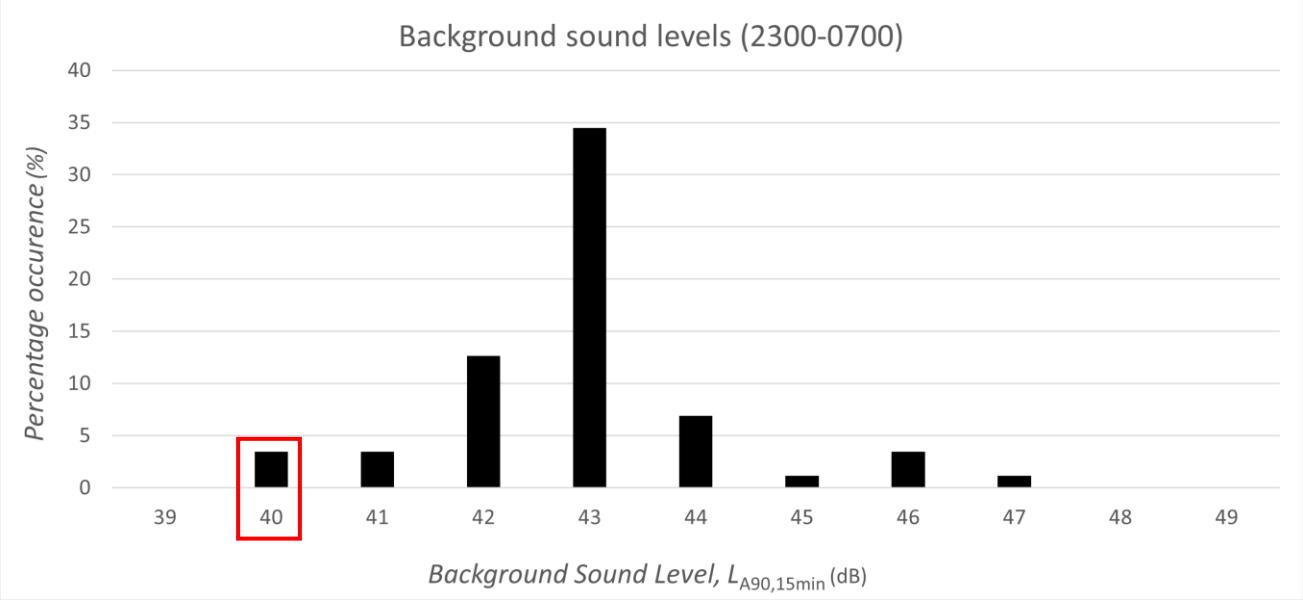


The periods marked above in red have been omitted from the results of the survey due to construction works occurring on site.

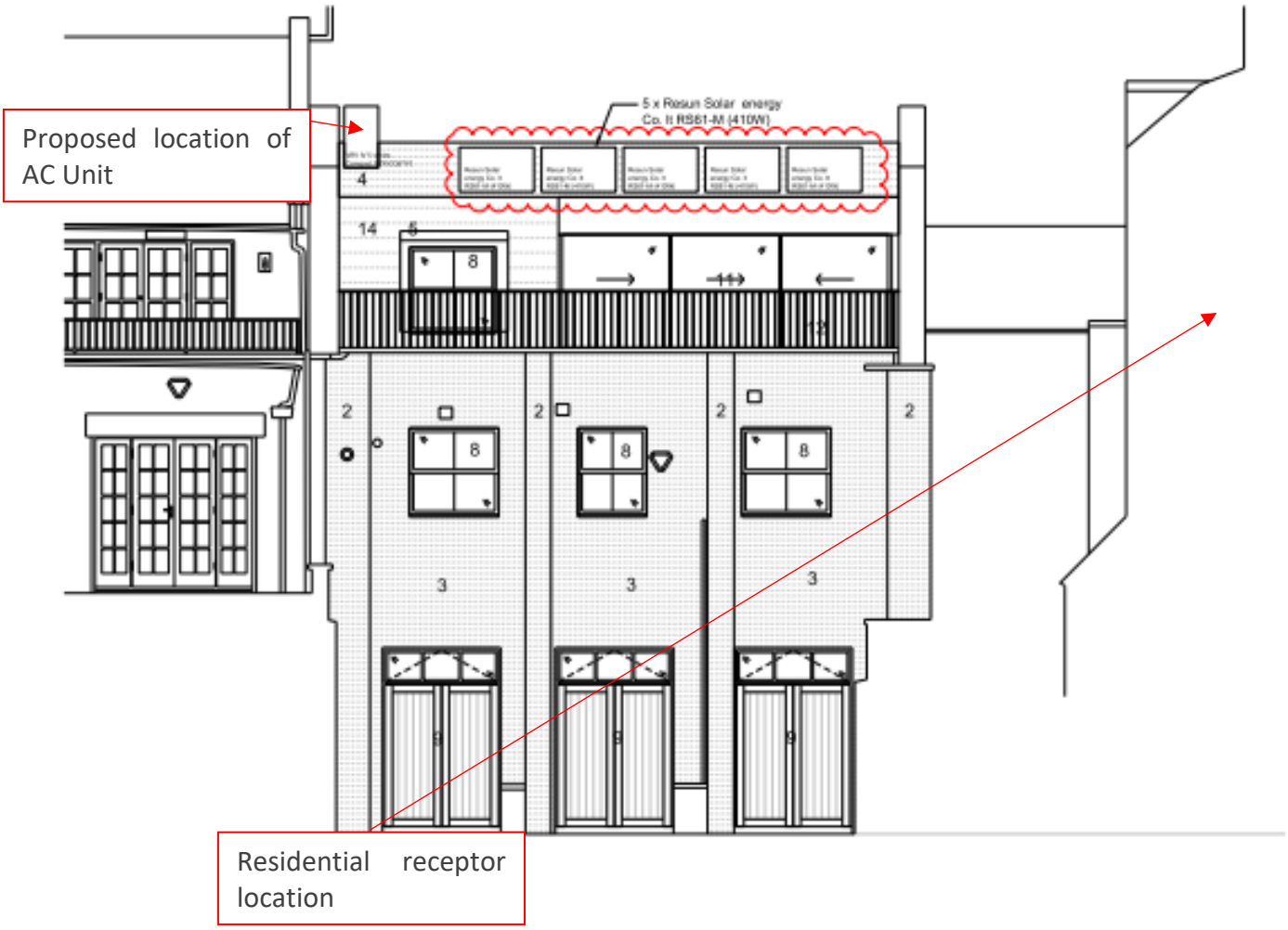
APPENDIX E Histogram Plot

Minimum Measured Background Noise Level during proposed operating hours of the plant





APPENDIX F: Proposed Mechanical Layout



APPENDIX G: Survey Results

Date	Time	LAeq	LAmax	LA10	LA90
08/09/2023	11:15	52.2	70.6	54	48
08/09/2023	11:30	56.2	78.3	58.8	47.7
08/09/2023	11:45	71.1	84.2	74.6	49.4
08/09/2023	12:00	74.1	84.7	76.2	59.2
08/09/2023	12:15	73.6	84	76.7	61.8
08/09/2023	12:30	74.5	80.2	76.9	70.9
08/09/2023	12:45	74.6	84	79	50.6
08/09/2023	13:00	59.5	85.2	61.3	50
08/09/2023	13:15	55.4	77.7	56.5	49.3
08/09/2023	13:30	58.8	77.9	57.6	48.4
08/09/2023	13:45	72.4	83.1	79	48.7
08/09/2023	14:00	76.4	82.5	78.8	57.7
08/09/2023	14:15	70.2	83.1	76.5	50.5
08/09/2023	14:30	59.1	92	59.7	47.6
08/09/2023	14:45	53.7	73.8	56	46.3
08/09/2023	15:00	73.2	80.7	77.6	48
08/09/2023	15:15	73.5	81.2	78.2	48.4
08/09/2023	15:30	64.2	87.2	69.2	47.7
08/09/2023	15:45	71.5	91.9	72.9	50.1
08/09/2023	16:00	72.2	89.7	74.3	48.7
08/09/2023	16:15	69.3	92.5	68.2	47.6
08/09/2023	16:30	64	86	65.9	47.7
08/09/2023	16:45	56.7	85	55.1	46
08/09/2023	17:00	48.6	67	50.9	44.1
08/09/2023	17:15	46.8	60.4	48.2	43.8
08/09/2023	17:30	47.5	58.8	49.2	45
08/09/2023	17:45	47.7	66.1	49.1	45.2
08/09/2023	18:00	47.5	59.4	49.7	45
08/09/2023	18:15	49.3	75.4	49.1	44.2
08/09/2023	18:30	48.3	67.9	49.6	43.9
08/09/2023	18:45	55.8	77.1	56.4	44.8
08/09/2023	19:00	50.5	71.7	49.6	43.7
08/09/2023	19:15	46.7	59.8	48.1	43.7
08/09/2023	19:30	48	69.8	48.5	43.4
08/09/2023	19:45	47.1	59.5	48.9	43.9
08/09/2023	20:00	49.7	68.6	49.1	43.6
08/09/2023	20:15	46.3	56.3	48.6	43.5
08/09/2023	20:30	46.3	58.4	48.1	43.8
08/09/2023	20:45	47.8	66.6	48.1	43.1
08/09/2023	21:00	45.8	53.7	47.8	43.3
08/09/2023	21:15	46.8	63.9	47.7	42.7
08/09/2023	21:30	45	59.1	46.8	42.6
08/09/2023	21:45	45.2	60.9	47.3	42.5
08/09/2023	22:00	45	54.6	47.2	42.5

08/09/2023	22:15	47.8	65.9	49	42.6
08/09/2023	22:30	45	54.6	47.2	42.6
08/09/2023	22:45	46.2	58.3	48.3	42.7
08/09/2023	23:00	44.7	53.6	46.6	42.4
08/09/2023	23:15	45.5	62.3	47.4	42.8
08/09/2023	23:30	44.5	58.4	46.4	42.2
08/09/2023	23:45	45.2	60.1	47.1	42.3
09/09/2023	00:00	46.1	64.9	46.9	42.3
09/09/2023	00:15	45.1	57.5	47.2	42.5
09/09/2023	00:30	44.5	53.2	46.4	42.5
09/09/2023	00:45	48.9	70.6	48.1	42.4
09/09/2023	01:00	44.4	54	46.3	42.4
09/09/2023	01:15	43.9	51.5	45.2	42.3
09/09/2023	01:30	44.5	58.1	45.7	41.8
09/09/2023	01:45	45.3	71.1	44.2	41.1
09/09/2023	02:00	43	51.7	44.4	41.3
09/09/2023	02:15	43.8	60.7	46.5	40.4
09/09/2023	02:30	44.4	57.1	45.2	42.8
09/09/2023	02:45	47.5	54	48.9	44.4
09/09/2023	03:00	45	54	46.3	43.2
09/09/2023	03:15	43.9	49.1	44.8	42.8
09/09/2023	03:30	47	50.9	48.9	43.3
09/09/2023	03:45	47.3	57.9	48.2	45.9
09/09/2023	04:00	44.3	50.4	45.3	43
09/09/2023	04:15	44.2	56.9	45.3	42.8
09/09/2023	04:30	45.8	55.5	48	42.9
09/09/2023	04:45	47.8	53.9	48.6	46.4
09/09/2023	05:00	46.6	57.5	48.6	43.2
09/09/2023	05:15	44.7	54.4	46.1	43.2
09/09/2023	05:30	44.2	53	45.3	42.9
09/09/2023	05:45	46	67.8	45.7	42.6
09/09/2023	06:00	47	56.9	48.2	44.9
09/09/2023	06:15	47.1	57.8	49.1	43.1
09/09/2023	06:30	44.6	51.5	45.9	43
09/09/2023	06:45	44.9	53.8	46.3	43.2
09/09/2023	07:00	47	56.2	48.5	43.7
09/09/2023	07:15	47.1	56.3	48.2	45.3
09/09/2023	07:30	46.5	58.2	47.8	44.4
09/09/2023	07:45	46.1	58.1	47.3	43.9
09/09/2023	08:00	47.8	61.4	49.2	43.8
09/09/2023	08:15	46.2	56.5	48.2	43.4
09/09/2023	08:30	47.1	67.4	48.9	43.7
09/09/2023	08:45	48.1	59.6	50.8	43.8
09/09/2023	09:00	49.7	66.6	51.1	43.9
09/09/2023	09:15	47.6	66.8	50	43.1
09/09/2023	09:30	45.9	56	48.2	43.1
09/09/2023	09:45	47.1	60.7	49.2	43.3
09/09/2023	10:00	46.6	63.3	48.8	43
09/09/2023	10:15	47.1	71.3	48.1	43.1

09/09/2023	10:30	47	62.9	49	43.3
09/09/2023	10:45	46.4	58.6	48.5	43
09/09/2023	11:00	46.5	64.2	48.5	43.7
09/09/2023	11:15	47	61.9	49	43.3
09/09/2023	11:30	46.1	62.2	47.6	43.4
09/09/2023	11:45	46	56.9	48	43.6
09/09/2023	12:00	45.5	53.9	47.3	43.3
09/09/2023	12:15	45.5	54.5	47.4	43.1
09/09/2023	12:30	46	59.3	47.9	43.3
09/09/2023	12:45	45.7	60.4	47.6	43
09/09/2023	13:00	45.7	60	48	43
09/09/2023	13:15	47.2	70.5	48.1	43.3
09/09/2023	13:30	48.4	66.1	49.2	43.2
09/09/2023	13:45	46.3	60.2	48.8	42.6
09/09/2023	14:00	46.1	61.3	48.1	42.6
09/09/2023	14:15	47.8	63.3	49.6	43.2
09/09/2023	14:30	46.6	63.5	47.3	42.3
09/09/2023	14:45	45.3	57.8	47.1	43
09/09/2023	15:00	45.5	57.3	47.2	42.9
09/09/2023	15:15	45.5	57.2	47.4	43.1
09/09/2023	15:30	47.5	62.7	49.1	43.4
09/09/2023	15:45	47.4	65.6	48.8	43.1
09/09/2023	16:00	46.3	57	48.6	43.2
09/09/2023	16:15	46.7	60.2	49.1	43.4
09/09/2023	16:30	46.1	58.5	47.7	43.7
09/09/2023	16:45	45.8	58.3	47.4	43.3
09/09/2023	17:00	47.7	65.8	48.9	43.3
09/09/2023	17:15	47.4	64.5	48.3	43.3
09/09/2023	17:30	47.1	69.6	47.3	42.9
09/09/2023	17:45	48	63.4	49.2	43.3
09/09/2023	18:00	49.3	65.9	49.8	43.9
09/09/2023	18:15	47.8	67.6	49.2	44.1
09/09/2023	18:30	47.6	68.8	48.6	43.6
09/09/2023	18:45	45.9	56.3	47.5	43.6
09/09/2023	19:00	46.7	60	48.5	43.9
09/09/2023	19:15	49.4	66.3	50.1	44
09/09/2023	19:30	47	59.3	48.6	44
09/09/2023	19:45	46.3	58.5	48.2	43.5
09/09/2023	20:00	57.3	86.8	47.6	43.3
09/09/2023	20:15	48.5	65.2	49.6	43.7
09/09/2023	20:30	46.9	62.9	48.9	43.7
09/09/2023	20:45	47.9	69.9	48.3	43.7
09/09/2023	21:00	45.7	55	47.7	43.4
09/09/2023	21:15	49.1	69.6	50.6	43.4
09/09/2023	21:30	47.8	62.9	48.8	43.3
09/09/2023	21:45	45.2	51.7	47.2	43.1
09/09/2023	22:00	45.5	54.5	47.6	43.1
09/09/2023	22:15	47.2	64.9	47.9	44.2
09/09/2023	22:30	45.8	55.8	47	44.4

09/09/2023	22:45	46.6	57.3	48.6	44.5
09/09/2023	23:00	48.7	69.9	48.7	44.5
09/09/2023	23:15	46.2	58.7	47.6	44.4
09/09/2023	23:30	45.9	62.1	47.8	42.9
09/09/2023	23:45	44.3	55.3	46.2	41.8
10/09/2023	00:00	44.9	57.6	46.7	42.4
10/09/2023	00:15	44.1	56.7	45.8	42.1
10/09/2023	00:30	45	58.9	46.9	42.5
10/09/2023	00:45	44.7	51.8	46.6	42.7
10/09/2023	01:00	44	56.3	46.1	41.7
10/09/2023	01:15	44.3	51.9	46.3	42.2
10/09/2023	01:30	44.4	51.5	46.7	41.2
10/09/2023	01:45	44.5	55.8	46	42.8
10/09/2023	02:00	45.6	56.2	47.9	42.8
10/09/2023	02:15	49.9	70.2	49	46.5
10/09/2023	02:30	47.6	55.3	48.5	46
10/09/2023	02:45	47.3	56.1	48.4	43.6
10/09/2023	03:00	44.3	62.2	45.3	40.4
10/09/2023	03:15	45.4	60.3	46.5	42.8
10/09/2023	03:30	43.3	50	44.6	41.7
10/09/2023	03:45	44.7	63.2	45.3	42
10/09/2023	04:00	43.3	54.1	45.7	40.2
10/09/2023	04:15	44	55.5	45.2	42.5
10/09/2023	04:30	44.6	54.6	46.4	42.6
10/09/2023	04:45	44.6	57.9	46.7	42.5
10/09/2023	05:00	44.1	56.3	45.1	42.6
10/09/2023	05:15	43.9	50	45	42.7
10/09/2023	05:30	46.1	55.6	48.3	43.2
10/09/2023	05:45	46.2	58.8	47.6	44.2
10/09/2023	06:00	44.5	55.3	46	43
10/09/2023	06:15	44.8	56.2	46.2	43.1
10/09/2023	06:30	45.6	50.9	47.9	43.2
10/09/2023	06:45	46	60.4	47.2	44.1
10/09/2023	07:00	45.5	50.6	46.9	43.7
10/09/2023	07:15	45.4	61.7	46.5	43.5
10/09/2023	07:30	45.7	52.3	47.2	43.7
10/09/2023	07:45	50.3	76.4	47.9	45
10/09/2023	08:00	46.2	54.2	47.4	44.7
10/09/2023	08:15	52.8	74.4	48.5	43.5
10/09/2023	08:30	46.6	62.4	47.8	41.7
10/09/2023	08:45	45.4	58.2	46.8	43
10/09/2023	09:00	44.8	60.1	46.5	42.7
10/09/2023	09:15	45.9	65.4	47.3	43
10/09/2023	09:30	45.7	66.5	46.2	42.7
10/09/2023	09:45	45.4	58.1	47.4	42.7
10/09/2023	10:00	44.6	57.6	46	42.6
10/09/2023	10:15	45.6	56.9	47	43.6
10/09/2023	10:30	45.3	54.8	47.3	43.2
10/09/2023	10:45	45.8	57.6	47.8	43.4

10/09/2023	11:00	45.2	59.9	46.8	43
10/09/2023	11:15	45.9	61.9	47.7	43.3
10/09/2023	11:30	45.6	52.5	47.2	43.9
10/09/2023	11:45	45.4	52.5	46.9	43.5
10/09/2023	12:00	46.4	58.7	48.4	43.8
10/09/2023	12:15	46.2	60.4	47.8	43.8
10/09/2023	12:30	47.8	72.6	47.6	43.4
10/09/2023	12:45	45.6	57	47.2	43.3
10/09/2023	13:00	47.4	70.1	47.6	43.2
10/09/2023	13:15	45.9	67.2	47.4	43.5
10/09/2023	13:30	46.4	62.1	48.3	43.5
10/09/2023	13:45	48.3	68.3	48.8	43.7
10/09/2023	14:00	46.2	58.3	48.2	43.4
10/09/2023	14:15	47.6	74.7	49.3	43
10/09/2023	14:30	46.7	59.2	49.2	42.8
10/09/2023	14:45	45.7	57.2	47.5	42.9
10/09/2023	15:00	46.4	65.2	47.8	42.7
10/09/2023	15:15	45.4	55.8	47.4	42.7
10/09/2023	15:30	52	73	48.3	42.8
10/09/2023	15:45	46.5	59.3	48.4	43.8
10/09/2023	16:00	46.4	54.7	48.6	43.4
10/09/2023	16:15	45.9	58.1	47.8	43.4
10/09/2023	16:30	46.7	62.8	48.8	43.7
10/09/2023	16:45	46.5	61.3	48.9	43.3
10/09/2023	17:00	46.5	60.4	48.5	43.2
10/09/2023	17:15	46.9	63.1	48.8	43.5
10/09/2023	17:30	50.1	72.5	49.8	43.8
10/09/2023	17:45	47.1	62.4	48.3	43.1
10/09/2023	18:00	45.2	56.2	47.3	42.7
10/09/2023	18:15	47.6	67.6	48.8	43.7
10/09/2023	18:30	46.8	60.4	48.9	43.6
10/09/2023	18:45	46.1	64.5	48.3	43.1
10/09/2023	19:00	46.6	61.7	48.7	43
10/09/2023	19:15	51.6	71.5	49.4	43.6
10/09/2023	19:30	45.7	56.1	47.8	43.2
10/09/2023	19:45	45.5	59	46.9	43.2
10/09/2023	20:00	45	57.6	46.7	42.8
10/09/2023	20:15	45.7	56.1	47.8	43.1
10/09/2023	20:30	46	55.4	48.1	43.4
10/09/2023	20:45	45.5	62.3	46.8	42.9
10/09/2023	21:00	45.2	58.9	47.2	42.9
10/09/2023	21:15	45.8	59.8	48	42.8
10/09/2023	21:30	45	51.6	47.3	42.9
10/09/2023	21:45	44.3	57.2	45.9	42
10/09/2023	22:00	45.1	51.9	47.2	42.2
10/09/2023	22:15	47.7	66.3	47.8	43.6
10/09/2023	22:30	49.2	70.8	49.4	45.4
10/09/2023	22:45	48.7	70.4	49.4	45.5
10/09/2023	23:00	44.3	58.9	45.9	41.5

10/09/2023	23:15	48.2	78.2	47.7	42.7
10/09/2023	23:30	46.4	70.4	45.9	42.4
10/09/2023	23:45	44.6	59.6	45.8	42.7
11/09/2023	00:00	54.5	81	50.7	41.5
11/09/2023	00:15	57.5	81.5	56.4	43.4
11/09/2023	00:30	45.1	53.5	46.5	43.3
11/09/2023	00:45	46.1	62.1	47.7	43.1
11/09/2023	01:00	44.5	51.4	45.9	42.9
11/09/2023	01:15	45.5	57.8	46.8	43.2
11/09/2023	01:30	44.8	53.5	46.2	43.1
11/09/2023	01:45	43.9	53.2	45	42.2
11/09/2023	02:00	45.7	50.2	47.2	43.7
11/09/2023	02:15	43.8	53.8	44.9	42.2
11/09/2023	02:30	43.5	54.2	44.9	41.9
11/09/2023	02:45	43.2	49.7	44.3	41.9
11/09/2023	03:00	43.4	49.9	44.4	42.1
11/09/2023	03:15	45.3	65	45.6	42.3
11/09/2023	03:30	43.1	50	44	41.6
11/09/2023	03:45	42.9	52.6	43.5	41.7
11/09/2023	04:00	43.6	65	44.4	41.7
11/09/2023	04:15	43.1	50.3	44.1	41.9
11/09/2023	04:30	43.4	53.4	44.4	41.9
11/09/2023	04:45	42.2	49.7	43.1	38.7
11/09/2023	05:00	44.8	53.8	46.2	42.4
11/09/2023	05:15	43.1	48.3	44.2	41.8
11/09/2023	05:30	43.3	62.4	43.8	41
11/09/2023	05:45	44.3	52.1	45.9	41.5
11/09/2023	06:00	43.8	51.8	45.3	41.9
11/09/2023	06:15	45.2	62.6	46.1	42.1
11/09/2023	06:30	44.1	54.2	45.2	42.3
11/09/2023	06:45	45.8	69	45.4	42.1
11/09/2023	07:00	45.1	59.5	46.9	42.8
11/09/2023	07:15	48	63.4	50.5	43.8
11/09/2023	07:30	46.5	61.3	48.5	43
11/09/2023	07:45	45.5	55.3	47.6	43
11/09/2023	08:00	49.3	78.4	49.7	43.8
11/09/2023	08:15	49.7	78.3	50.8	44.4
11/09/2023	08:30	54.1	81.8	53	45.8
11/09/2023	08:45	57.8	79.3	54.5	46.6
11/09/2023	09:00	54	73.7	56.5	46.9
11/09/2023	09:15	58.7	75.5	61.1	48.9
11/09/2023	09:30	62.3	79.1	62.9	47.2
11/09/2023	09:45	60.3	77.8	61	47.2
11/09/2023	10:00	52	75.6	52.4	47.5
11/09/2023	10:15	48.7	60.1	50.8	46.2
11/09/2023	10:30	52.9	82.1	51.3	46.2
11/09/2023	10:45	55.3	78.8	52.6	46.7
11/09/2023	11:00	56.4	77	59.9	47
11/09/2023	11:15	56.3	79.2	57.4	47.3

11/09/2023	11:30	51.2	71.6	53.3	46.4
11/09/2023	11:45	57	77.6	57.2	46.6
11/09/2023	12:00	62	80.5	66.9	47.6
11/09/2023	12:15	56.1	75.6	56.1	47.9
11/09/2023	12:30	61.6	88.7	59.3	47.5
11/09/2023	12:45	78	86.6	81.6	49
11/09/2023	13:00	77	83.7	80	49
11/09/2023	13:15	48.9	66.8	50	46.6
11/09/2023	13:30	49.3	62.2	50.5	46.2
11/09/2023	13:45	63.8	85.6	58.7	46.7
11/09/2023	14:00	76.6	82.4	78.8	66.5
11/09/2023	14:15	68.2	84.5	74.3	48.3
11/09/2023	14:30	56.3	76.9	56.3	47.1
11/09/2023	14:45	55.2	76.4	54.4	46.1
11/09/2023	15:00	69.6	84.6	69.2	47.4
11/09/2023	15:01	68.4	88.3	71.4	50.6

Note: Data collected between 08:00 – 17:00 on 8/9/2023 and 11/9/2023 has been excluded from the calculations due to constructions works occurring at no. 2 Devonshire Mews South.

APPENDIX H: Equipment

- NTi XL2 Real Time Analyser
- Bruel & Kjaer 4231 Calibrator
- NTi outdoor kit

Calibration certificates are available on request.

APPENDIX I: Acoustic Feature Correction

Tonality
For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. 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.

Impulsivity
A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. 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.

Intermittency
When the specific sound has identifiable on/off conditions, the specific sound level should be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. This can necessitate measuring the specific sound over a number of shorter sampling periods that are in combination less than the reference time interval in total, and then calculating the specific sound level for the reference time interval allowing for time when the specific sound is not present. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

Other sound characteristics
Where the specific sound features characteristics that are neither tonal nor impulsive, nor intermittent, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

A rating penalty has been established based on a subjective assessment of characteristics. Penalties have been applied based on GSAD's previous experience of similar plant units.

Acoustic features are not considered to be audible at 10dB below minimum measured background and have therefore not been applied.

APPENDIX J: Manufacturer's Data

Condensing Unit 1x Daikin VRV IV S-series Compact RXYSCQ6TV1

Outdoor Units			RXYSCQ4TV1	RXYSCQ5TV1	RXYSCQ6TV1
Capacity	Nominal Cooling	kW	12.1	14.0	15.5
	Nominal Heating	kW	12.1	14.0	15.5
ηs,c	Seasonal Efficiency Cooling	%	322.8	303.4	281.3
ηs,h	Seasonal Efficiency Heating	%	182.3	185.1	186
Dimensions	Height x Width x Depth	mm	823 x 940 x 460	823 x 940 x 460	823 x 940 x 460
Weight		kg	89	89	89
Refrigerant Circuit	Refrigerant Type		R410A	R410A	R410A
Sound Pressure (Nom)	Cooling	dBA	51.0	52.0	53.00
Sound Power (Nom)	Cooling	dBA	68.0	69.0	70.00
Maximum No of Connectable Units			8	10	13
Electrical Details	Power Supply	Phase / Hz / V	1 / 50 / 230		
	Running Current	amps	19.6	19.6	23.2
	Fuse Rating	amps	32	32	data book
Piping Limits	Total Piping length	m	300	300	300
	Maximum Length	m	70 (90 equivalent)	70 (90 equivalent)	70 (90 equivalent)
	Maximum Vertical Rise	m	30	30	30
Piping Connections	Liquid	inch (mm)	3/8 (9.5)	3/8 (9.5)	3/8 (9.5)
	Gas	inch (mm)	5/8 (15.9)	5/8 (15.9)	3/4 (19)
Capacity Index Limit			50~130	62.5~162.5	70~182

Example Acoustic Enclosure – ENVIRONLITE by ENVIRON

environ™

Tel: 0870 383 3344
www.environ.co.uk

SELECTION MATRIX

environlite T4-1100

Acoustic enclosures for Split AC/ASHP Unit Applications

CUSTOMER:	SITE / LOCATION / REFERENCE

ORIGINAL EQUIPMENT MANUFACTURERS PUBLISHED DATA					
MAKE, MODEL, DIMENSIONS, AIR FLOW & SOUND PRESSURE LEVEL @1.0m FREE FIELD					
MAKE:		MODEL:		AIR IN	AIR OUT
Fujitsu		ADYG18KBTA3		Rear & 1 Side	Front
WIDTH (MM)	DEPTH (MM)	HEIGHT (MM)	AIRFLOW (m^3s^{-1})	SPL dB(A)	DISTANCE (M)
820	315	716	0.84	49	1

INNER CUBE DIMENSIONS		
1050	450	1035
WIDTH (MM)	DEPTH (MM)	HEIGHT (MM)
0.84	1.0	45
AIRFLOW (m^3s^{-1})	DISTANCE (M)	SPL dB(A)

ENCLOSURE DETAIL		
1650	1000	1100
WIDTH (MM)	DEPTH (MM)	HEIGHT (MM)
0.84	1.0	20-25
AIRFLOW (m^3s^{-1})	DISTANCE (M)	SPL dB(A) Range

INLET AIRWAYS		
1035	250	1
WIDTH (MM)	HEIGHT (MM)	NO.

DESIGN CRITERIA		
OK	OK	OK
UNIT SIZE	OUTLET	INLET

OUTLET AIRWAYS		
250	1035	1
WIDTH (MM)	HEIGHT (MM)	NO.

AIRFLOW INFORMATION		
13	3.2	3.2
PD (N/M^2)	OUTLET (MS^{-1})	INLET (MS^{-1})

Select Inlet & Outlet Airway Sizes to Ensure Airflows are kept Below 6.0m/s

ENCLOSURE INFORMATION	WIDTH (MM)	DEPTH (MM)	HEIGHT (MM)
INLET AIRWAY	250		1035
OUTLET AIRWAY	250		1035
EXTERNAL SIZE	1650	1000	1100
SOUND LEVEL RANGE @ 1.0m (FREE FIELD)	20-25	SPL dB(A) Free Field	

NOTES CONCERNING ENCLOSURE DESIGN

APPENDIX K: Glossary of Acoustic Terms

DECIBEL (dB) - A unit of sound pressure measurement
Sound Pressure Level in dB (*L*p) = 20 log (Measured sound pressure/Reference sound pressure = 20 µPa)

dB(A) - The A -weighted sound pressure level, the weighting network reduces low frequency sound in a similar way to the human ear.

REVERBERATION TIME (RT or *T*) – decay of sound in rooms
The time taken for a sound, once terminated, to fall through 60dB i.e. to one millionth of its original sound intensity. *T*30 – RT for first 30dB of decay. RT_{500} - Mid frequency RT.
HERTZ (Hz) - a unit of frequency measurement. The normal range of hearing is from 20Hz to about 15kHz.

ABSORPTION COEFFICIENT – degree to which a material absorbs sound.
The ratio of absorbed to incident sound energy (perfect absorber = 1)

SOUND REDUCTION INDEX *R* – quantity which describes a material's ability to reduce the sound pressure level across it (e.g. a wall or floor)

$R = L1 - L2 + 10\log (S/A)$

*L*1 - Average sound pressure level in source room (averaged from 100 Hz – 3150 Hz)
*L*2 - Average sound pressure level in receiving room (averaged from 100 Hz – 3150 Hz)
S – Wall Area (m^2)
A – Total absorption in receiving room (m^2 units)

*R*w – weighted sound reduction index

AVERAGE ROOM TO ROOM LEVEL DIFFERENCE – *D*, dB = *L*1 – *L*2, averaged 1/3 octave bands from 100Hz – 3150kHz.

*D*w – weighted value of D (usually 2 - 3dB higher)

*D*nT, w – *D*w corrected for reverberation time of receiving room

NOISE RATING CURVES (NR CURVES) – set of curves used to describe optimum background noise levels for different tasks.

*L*10/90 LEVEL (dB) - The level in dB of a time varying sound pressured level (e.g. traffic) exceeded for 10%/90% of the time of measurement.
*L*90 is usually called the BACKGROUND NOISE LEVEL.

*L*eq AVERAGE SOUND PRESSURE LEVEL – level dB of a time varying sound pressure level with equal amounts of energy above and below it, for the time of measurement.

TONAL NOISE – noise of a single frequency (or a narrow band of frequencies that can be perceived as a tone), audible above the broad band noise background. Noise which is at least 5dB above the average of the 1/3 octave band sound pressure levels immediately on either side of it.