61 Redington Road
London
NW3 7RP

Noise Assessment

On behalf of

Mr and Mrs Burns

Project Reference: 90538 | Revision: 1 | Date: 20th April 2022
Revision Date: 28th April 2022

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

Document Information

Project Name	:	**61 Redington Road, London**
Project Reference	:	**90538**
Report Title	:	**Noise Assessment**
Doc Reference	:	**90538/EBF**
Date	:	**20th April 2022**

	Name	Qualifications	Initials	Date
Prepared by:	Aiden Quinn	BA(Hons), AMIOA	AQ	20th April 2022
Reviewed and approved by:	Nigel Chandler	BSc(Hons), MIOA	NAC	20th April 2022
For and on behalf of Noise Solutions Ltd				

Revision	Date	Description	Prepared	Reviewed/ Approved
1	28/04/2022	Correction to latest guidance and Table numbering	AQ	NAC

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

Contents

Appendices

1.0 Introduction

1.1. Noise Solutions Ltd has been commissioned by Mr and Mrs Burns to undertake a noise assessment for two renovated residential dwellings, and a noise impact assessment of associated plant, at 61 Redington Road, London.

1.2. This report supports a full planning application for amalgamation of three residential units into two units, comprising partial demolition, refurbishment, extension, and plant installation.

1.3. This report presents the results of an environmental noise survey, the applicable policies and guidance, and a noise impact assessment demonstrating the suitability of the site for the proposed development.

1.4. This assessment gives acoustic specifications for the external building fabric of the dwelling, in order that internal noise levels meet recognised national and local guidance.

1.5. To assist with the understanding of this report a brief glossary of acoustic terms can be found in **Appendix A**. A more in-depth glossary of acoustic terms can be assessed at the following web address http://www.acoustic-glossary.co.uk/.

2.0 Site description

2.1. The development site is located at 61 Redington Road, London.

2.2. The site located within a residential area.

2.3. **Appendix B** contains an aerial photograph showing the site and surrounding area.

2.4. The architectural plans contained in **Appendix C** outline the development proposals.

2.5. It is proposed that 2no. heat pumps and a single air conditioning unit (ACU) will be located at the bottom of the garden and housed within an acoustic enclosure.

3.0 Policy context

Noise Policy Statement for England

3.1. The Noise Policy Statement for England (NPSE[1]), published in March 2010, sets out the long-term vision of Government noise policy. The Noise Policy aims, as presented in this document, are: "*Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*

- *avoid significant adverse effects on health and quality of life;*
- *mitigate and minimise adverse effects on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life."*

3.2. The NPSE makes reference to the concepts of NOEL (No Observed Effect Level) and LOAEL (Lowest Observed Adverse Effect Level) as used in toxicology but applied to noise impacts. It also introduces the concept of SOAEL (Significant Observed Adverse Effect Level) which is described as the level above which significant adverse effects on health and quality of life occur.

3.3. The first aim of the NPSE is to avoid significant adverse effects, taking into account the guiding principles of sustainable development (as referenced in Section 1.8 of the NPSE). The second aim seeks to provide guidance on the situation that exists when the potential noise impact falls between the LOAEL and the SOAEL, in which case: *"...all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development."*

3.4. Importantly, the NPSE goes on to state: "This does not mean that such adverse effects cannot occur."

3.5. The NPSE does not provide a noise-based measure to define SOAEL, acknowledging that the SOAEL is likely to vary depending on the noise source, the receptor and the time in question. NPSE advises that: *"Not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available."*

3.6. It is therefore likely that other guidance will need to be referenced when applying objective standards for the assessment of noise, particularly in reference to the SOAEL, whilst also taking into account the specific circumstances of a proposed development.

[1] Noise Policy Statement for England, Defra, March 2010

National Planning Policy Framework

3.7. A new edition of NPPF was published in July 2021 and came into effect immediately. The original National Planning Policy Framework (NPPF[2]) was published in March 2012, with revisions in July 2018 and February 2019 - this document replaced the existing Planning Policy Guidance Note 24 (PPG 24) "Planning and Noise." The 2021 revised edition contains no new directions or guidance with respect to noise, and hence, all previous references remain extant. The paragraph references quoted below relate to the July 2021 edition.

3.8. Paragraph 174 of the NPPF states that the planning system should contribute to and enhance the natural and local environment by, (amongst others) *"preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, water or noise pollution or land stability."*

3.9. The NPPF goes on to state in Paragraph 185:

"planning policies and decisions should ...

a) Mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development, - and avoid noise giving rise to significant adverse impacts on health and quality of life;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason ...

3.10. The NPPF document does not refer to any other documents or British Standards regarding noise other than the Noise Policy Statement for England (NPSE[3]).

3.11. Paragraph 2 of the NPPF states that *"planning law requires that applications for planning permission must be determined in accordance with the development plan unless material considerations indicate otherwise."*

3.12. Paragraph 12 of the NPPF states that *"The presumption in favour of sustainable development does not change the statutory status of the development plan as the starting point for decision making. Where a planning application conflicts with an up-to-date development plan (including any neighbourhood plans that form part of the development plan), permission should not usually be granted. Local planning authorities may take decisions that depart from an up-to-date development plan, but only if material considerations in a particular case indicate that the plan should not be followed".*

[2] National Planning Policy Framework, DCLG, March 2012
[3] Noise Policy Statement for England, DEFRA, March 2010

3.13. Paragraph 119 states that "*Planning policies and decisions should promote an effective use of land in meeting the need for homes and other uses, while safeguarding and improving the environment and ensuring safe and healthy living conditions. Strategic policies should set out a clear strategy for accommodating objectively assessed needs, in a way that makes as much use as possible of previously-developed or 'brownfield' land*".

Planning Practice Guidance – Noise

3.14. An updated Planning Practice Guidance (PPG[4]) for noise was published on 22 July 2019 and provides additional guidance and elaboration on the NPPF. It advises that when plan-making and decision-taking, the Local Planning Authority should consider the acoustic environment in relation to:

- Whether or not a significant adverse effect is occurring or likely to occur;
- Whether or not an adverse effect is occurring or likely to occur; and
- Whether or not a good standard of amenity can be achieved.

3.15. This guidance introduced the concepts of NOAEL (No Observed Adverse Effect Level), and UAEL (Unacceptable Adverse Effect Level). NOAEL differs from NOEL in that it represents a situation where the acoustic character of an area can be slightly affected (but not such that there is a perceived change in the quality of life). UAEL represents a situation where noise is 'very disruptive' and should be 'prevented' (as opposed to SOAEL, which represents a situation where noise is 'disruptive', and should be 'avoided').

3.16. As exposure increases above the LOAEL, the noise begins to have an adverse effect and consideration needs to be given to mitigating and minimising those effects, taking account of the economic and social benefits being derived from the activity causing the noise. As the noise exposure increases, it will then at some point cross the SOAEL boundary.

3.17. The LOAEL is described in PPG[5] as the level above which "noise starts to cause small changes in behaviour and attitude, for example, having to turn up the volume on the television or needing to speak more loudly to be heard".

3.18. PPG identifies the SOAEL as the level above which "noise causes a material change in behaviour such as keeping windows closed for most of the time or avoiding certain activities during periods when the noise is present."

[4] Planning Practice Guidance – Noise, https://www.gov.uk/guidance/noise--2, 22 July 2019
[5] Paragraph: 005 Reference ID: 30-005-20190722

3.19. In line with the Explanatory Note of the NPSE, the PPG goes on to reference the LOAEL and SOAEL in relation to noise impact. It also provides examples of outcomes that could be expected for a given perception level of noise, plus actions that may be required to bring about a desired outcome. However, in line with the NPSE, no objective noise levels are provided for LOAEL or SOAEL although the PPG[6] acknowledges that *"…the subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation."*

3.20. The relevant guidance in the PPG in relation to the adverse effect levels is summarized below:

Table 1: ProPG Effects Table

Response	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not Present	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not Intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and Intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum

[6] Paragraph: 006 Reference ID: 30-006-20190722

Response	Examples of Outcomes	Increasing Effect Level	Action
Significant Observed Adverse Effect Level			
Present and Disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very Disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

3.21. The Planning Practice Guidance[7] states the following in relation to mitigation measures:

> *"For noise sensitive developments, mitigation measures can include avoiding noisy locations in the first place; designing the development to reduce the impact of noise from adjoining activities or the local environment; incorporating noise barriers; and optimising the sound insulation provided by the building envelope."*

3.22. In addition, the Guide notes that it may also be relevant to consider[8]:

> *"... whether any adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time (and the effect this may have on living conditions). In both cases a suitable alternative means of ventilation is likely to be necessary. Further information on ventilation can be found in the Building Regulations".*

[7] Paragraph: 010 Reference ID: 30-010-20190722
[8] Paragraph: 006 Reference ID: 30-006-20190722

4.0 Acoustic standards and guidance

London Borough of Camden

4.1. Section 6 of the Camden Planning Guidance Amenity, published January 2021, gives guidance on noise and vibration.

4.2. Clause 6.8 refers to noise thresholds within Appendix 3 of the Local Plan and 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.*

4.3. 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.*

4.4. 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.*

4.5. 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)."*

4.6. 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.*

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

4.7. 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".

4.8. 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.

4.9. 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.

4.10. 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."

4.11. 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."

4.12. 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.*

4.13. 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."

4.14. 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."

4.15. 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."

4.16. 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.

Notes on BS 4142:2014 and Camden Local Plan Appendix 3

4.17. It should be noted that a plant rating noise level equal to the background sound level would be considered to have a "low impact, depending on the context" using BS 4142, and would fall into the "Amber" category with the Camden Local Plan.

Institute of Acoustics Professional Practice Guidance

4.18. The Institute of Acoustics published a guidance document for new residential development in May 2017, in conjunction with the ANC and the Chartered Institute of Environmental Health, "*to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England*".

4.19. The document advocates a two-stage process for consideration of noise affecting new residential developments. Stage 1 is an initial risk assessment of the proposed development site, based on the ambient noise levels in the area. Stage 2 recommends consideration of four main elements:

- demonstration of a "good acoustic design process"
- observation of internal noise guidelines
- an assessment of noise affecting external amenity areas
- consideration of other relevant issues

4.20. The initial risk assessment considers the indicative day-time and night-time equivalent continuous noise levels which indicates an "increasing risk of adverse effect" with increasing noise levels[9].

4.21. For Stage 2, the ProPG document recommends that the guidance in BS 8233:2014 is followed.

[9] Figure 1, IoA ProPG for New Residential Development, May 2017

BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings

4.22. This Standard provides recommended guideline values for internal noise levels within dwellings which are similar in scope to guideline values contained within the World Health Organisation (WHO) document, Guidelines for Community Noise (1999[10]). These guideline noise levels are shown in Table , below:

Table 2: BS 8233 Desirable Internal Ambient Noise Levels for Dwellings

Activity	Location	07:00 to 23:00 hours	23:00 to 07:00 hours
Resting	Living room	35 dB $L_{Aeq,16h}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16h}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16h}$	30 dB $L_{Aeq,8h}$

4.23. BS 8233:2014 advises that: "regular individual noise events…can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$ depending on the character and number of events per night. Sporadic noise events could require separate values."

4.24. BS8233 also gives general guidance on the expected sound insulation performance of a given building façade, with details of how various elements can affect the overall performance. Concerning windows, it states[11] that:

> *"If partially open windows were relied upon for background ventilation, the insulation would be reduced to approximately 15dB."*

4.25. This implies that should windows on a noise affected façade be openable, a sound insulation value of 15dB should be applied to the whole façade to an internal room being assessed. It should be noted that a sound insulation performance of much greater than 15dB is expected for non-openable standard double glazed windows. However in order to assess the worst case scenario, this report assumes that windows may be opened if desired.

4.26. The standard also provides advice in relation to design criteria for external noise. It states that:

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

[10] World Health Organisation Guidelines for Community Noise, 1999
[11] Paragraph G1 in BS8233:2014

recognized that these guideline values are not achievable in all circumstances where development might be desirable.

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

Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate.

Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation.

In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space."

World Health Organisation, Guidelines for Community Noise, 1999 (WHO)

4.27. The World Health Organisation (WHO) Guidelines for Community Noise (1999) recommends suitable internal and external noise levels based on dose response research. The levels recommended in this guidance could be correlated to the LOAEL. Relevant guidance from this document is presented below.

- Sleep Disturbance (Night-time internal LOAEL): If negative effects on sleep are to be avoided, the equivalent sound pressure level should not exceed 30dBA indoors for continuous noise.

- Interference with Communication (Daytime internal LOAEL): Noise tends to interfere with auditory communication, in which speech is a most important signal. However, it is also vital to be able to hear alarming and informative signals such as door bells, telephone signals, alarm clocks, fire alarms etc., as well as sounds and signals involved in occupational tasks. The effects of noise on speech discrimination have been studied extensively and deal with

this problem in lexical terms (mostly words but also sentences). For communication distances beyond a few metres, speech interference starts at sound pressure levels below 50 dB for octave bands centred on the main speech frequencies at 500, 1 000 and 2 000 Hz. It is usually possible to express the relationship between noise levels and speech intelligibility in a single diagram, based on the following assumptions and empirical observations, and for speaker-to-listener distance of about 1 metre:

a) Speech in relaxed conversation is 100% intelligible in background noise levels of about 35dBA, and can be understood fairly well in background levels of 45dBA.

b) Speech with more vocal effort can be understood when the background sound pressure level is about 65dBA.

World Health Organisation (WHO) 2009

4.28. The introduction of the Directive on Environmental Noise, obliges Member States to assess and manage noise levels. With the support of the European Commission, the WHO Regional Office for Europe has developed night noise guidelines for Europe to help Member States develop legislation to control noise exposure.

4.29. The guidelines are based on scientific evidence on the effects of noise and the thresholds above which these effects appear to harm human health.

4.30. There is limited evidence that night noise is related to hypertension, heart attacks, depression, changes in hormone levels, fatigue and accidents.

4.31. The WHO report summarises the threshold levels of night noise above which a negative effect starts to occur or above which the impact becomes dependent on the level of exposure. For example, the threshold level for waking in the night and/or too early in the morning was 42 dB.

4.32. It also establishes that there are differences in the intensity and frequency of noise depending on the source, which lead to different impacts. Road traffic is characterised by low levels of noise per event, but as there are a high number of events, on average it has a greater effect on awakenings than air traffic, which has high levels of noise per event but fewer events.

4.33. Integrating these findings, the report proposed a guideline target limit of outdoor night noise of 40 dB (annual average defined as 'L_{night}' in the Environmental Noise Directive). There is not sufficient evidence that the biological effects observed below this level are harmful to health but adverse effects are observed above 40 dB.

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

4.34. 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"*.

4.35. 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.

4.36. 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.

4.37. 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."*

4.38. 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."*

4.39. 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.*

4.40. 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."

4.41. 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."

4.42. 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."

4.43. 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.

Building Regulations

4.44. Part L of the Building Regulations mandates that buildings become more airtight, and Part F stipulates ventilation requirements. Even though there appears to be a contradiction in this, Part L limits uncontrollable ventilation, while Part F ensures that ventilation requirements are provided in a controlled manner.

Ventilation requirements for dwellings

Background ventilation

4.45. Three types of ventilation are required under Part F. Whole building ventilation provides nominally continuous air exchange which may be reduced or ceased when the building is not occupied. It can be provided via background ventilators operating alone, or together with:

- passive stack ventilators;
- continuous mechanical extract; or
- continuous mechanical supply and extract with heat recovery.

4.46. Extract ventilation is applicable to rooms where most water vapour and/or pollutants are released (e.g. kitchens and bathrooms). It can be provided by intermittent fans, passive stack or continuous mechanical extract with or without mechanical supply and heat recovery.

4.47. The four systems described in Part F do not present solutions which utilise the use of opening windows for background ventilation. Opening windows do not provide a controllable means of ventilation and also pose security risks.

Purge ventilation

4.48. Purge ventilation is required throughout the building to aid the removal of high concentrations of pollutants and water vapour. It is commonly provided simply by opening windows and doors.

4.49. Even though purge ventilation is recommended via opening windows, the temporary and intermittent occurrence of this does not normally result in an unacceptable increase of internal noise levels.

4.50. Part F goes on to say[12] that "Purge ventilation provisions may also be used to improve thermal comfort, although this is not controlled under the Building Regulations."

Summary in relation to ventilation

4.51. In summary, background ventilation for new residential dwellings should be provided via one of the four systems in Approved Document F. The composite external building fabric should be designed to ensure that appropriate internal noise levels due to external incident noise are met during background ventilation.

4.52. Purge ventilation for new residential dwellings should be provided via open windows. The slight increase of internal noise levels should be considered acceptable.

5.0 Environmental Noise Survey

5.1. Measurements of the existing environmental sound levels were undertaken between 14.00 hours on Monday 7 March and 14.00 hours on Tuesday 8 March 2022. Monitoring locations were located to the east and west of the site, with Position 1 at the rear (west) elevation and Position 2 at the front (east) elevation.

5.2. Full details of the surveys are provided in **Appendix D**.

5.3. The relevant results of the unattended monitoring survey have been summarised in Table 3.

[12] Paragraph 4.15 in Approved Document F

Table 3: Summary of survey results

Position	Measurement period	Range of recorded sound pressure levels (dB)			
		$L_{Aeq(15mins)}$	$L_{Amax(15mins)}$	$L_{A10(15mins)}$	$L_{A90(15mins)}$
P1 (west) Rear elevation	Daytime (07.00 – 23.00 hours)	51 - 92	45 - 58	46 - 58	41 - 49
	Night-time (23.00 – 07.00 hours)	46 - 73	42 - 50	45 - 51	37 - 48
P2 (East) Front elevation	Daytime (07.00 – 23.00 hours)	64 - 84	47 - 62	49 - 65	38 - 53
	Night-time (23.00 – 07.00 hours)	50 - 72	37 - 55	38 - 59	35 - 43

5.4. Octave band sound pressure level measurements were undertaken at both locations in order to assist with the calculations of internal ambient noise levels within the proposed dwellings.

5.5. Based on the results of the measurements and calculations, the input data shown in Table 4 will be used in the subsequent assessment.

Table 4 Incident octave band sound pressure levels at facades

Façades	Period	Incident sound pressure levels (dB) at Octave Band Centre Frequencies (Hz)								dB(A)
		63	125	250	500	1 k	2 k	4 k	8 k	
P1 West	Daytime $L_{eq,\ 16\ hours}$	56	54	52	49	44	38	40	36	51
	Night-time $L_{eq,\ 8\ hours}$	52	49	47	45	41	35	32	28	46
	Highest typical night-time L_{Max}	67	56	54	62	68	62	44	30	70
P2 East	Daytime $L_{eq,\ 16\ hours}$	62	55	54	53	54	49	41	35	57
	Night-time $L_{eq,\ 8\ hours}$	52	47	44	43	43	37	37	30	47
	Highest typical night-time L_{Max}	64	58	57	58	59	56	71	64	73

5.6. The noise levels across the site are currently in the range 51-57dB $L_{Aeq,16hr}$ during the day and 46-47dB $L_{Aeq,8hr}$ at night.

5.7. Night-time L_{Amax} noise levels of the typical highest events are in the range 70-73dB, with noise levels highest to the east of the residence.

Background sound levels

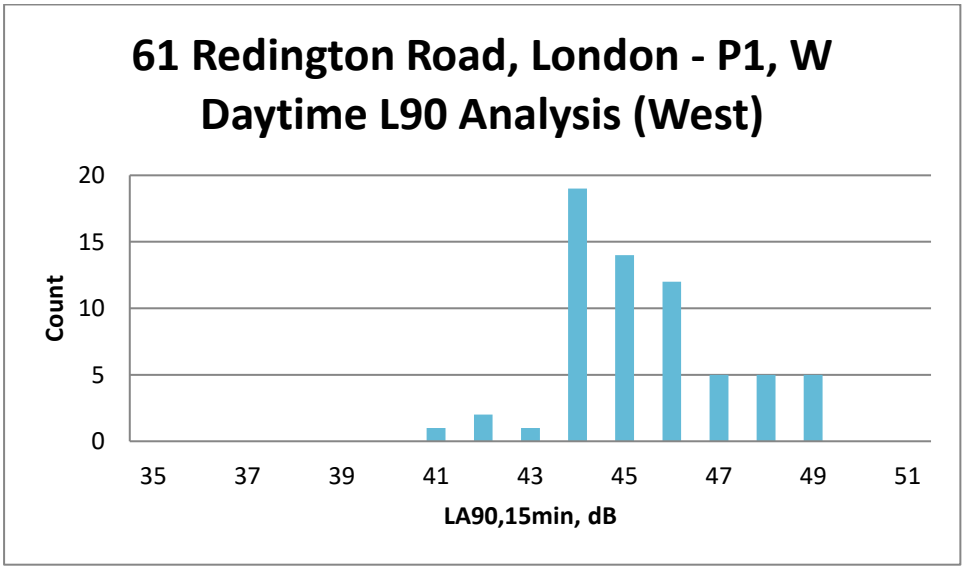
5.8. An environmental noise survey was undertaken to establish the typical background sound levels at a location representative of the noise climate outside the façades of the nearest noise sensitive receptors to the proposed plant area, during the quietest times at which the plant will operate.

5.9. The results of the environmental sound survey are summarised in Table 5 below. The full set of measurement results and details of the survey methodology are presented in **Appendix D**.

Table 5 Summary of survey results

Measurement period	Range of recorded sound pressure levels (dB)			
	$L_{Aeq(15mins)}$	$L_{AFmax(15mins)}$	$L_{A10(15mins)}$	$L_{A90(15mins)}$
Daytime (07.00 – 23.00 hours)	45-58	51-92	46-58	41-49
Night-time (23.00 – 07.00 hours)	42-50	46-73	45-51	37-48

Figure 1 Histogram of daytime L_{A90} background sound pressure levels

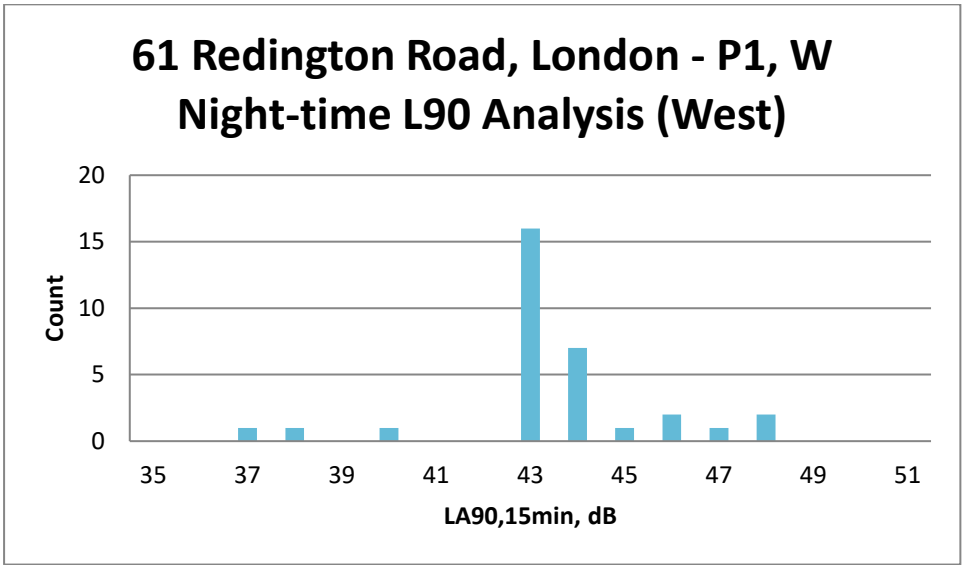


5.10. Further statistical analysis has been carried out on the data, and the mean and median values are shown in Table 6 below.

Table 6 Statistical analysis of $L_{A90,15min}$ levels during the daytime period

dB, L_{A90} daytime period	
mean	45
modal	44
median	45

Figure 2 Histogram of night-time L_{A90} background sound pressure levels



5.11. Further statistical analysis has been carried out on the data and the mean and median values are shown in Table 7 below.

Table 7 Statistical analysis of $L_{A90,15min}$ levels during the night-time period

dB, L_{A90} night-time period	
mean	43
modal	43
median	43

5.12. The following values are considered representative of the existing background sound pressure levels at nearby noise sensitive premises:

- 44dB L_{A90} during the daytime period; and
- 43dB L_{A90} during the night-time period.

6.0 Residential noise assessment

Initial risk assessment

6.1. As noted in Table 3, predicted daytime incident noise levels vary from 51dB $L_{Aeq,16hr}$ at the west to 57dB $L_{Aeq,16hr}$ at the west, while night-time levels are in the range 46dB $L_{Aeq,8hr}$ at the west to 47dB $L_{Aeq,8hr}$ at the east.

6.2. The highest noise levels are in the "low" range of noise levels in Figure 1 of the IoA ProPG document.

6.3. The ProPG document notes that "at low noise levels, the site is likely to be acceptable from a noise perspective".

Building fabric assessment

6.4. In order to assess the suitability of the site for the proposed dwellings it is important to predict the internal noise levels within habitable rooms.

6.5. The composite acoustic performance required of any portion of the building envelope will depend on its location relative to the principal noise sources around the site and the nature of the spaces behind it (noise criteria, size, room finishes etc.).

6.6. The variation in incident noise levels on the different façades, along with differences in internal layouts and size of glazed areas, implies that a number of different sound insulation performance levels may be required in order for a specific internal ambient noise level to be reached. Logistically, this could result in increased costs for the development due to bespoke solutions, effects on programme and increase of errors during construction. National policy on noise does not insist on compliance with a specific level but rather it suggests that reasonable practicable mitigation measures should be put in place in order to approach a certain target level (assuming the non-mitigated impact is predicted to lie above this target level) when this level is below the SOAEL. Slight exceedances of this level are deemed acceptable under national policy on noise which supports sustainable development.

6.7. Therefore, it is not practical to specify a large number of different external building fabric constructions and this is also not supported by national policy on noise.

6.8. The detailed calculation methodology described in BS 8233:2014 has been used in the assessment. Table below presents the input data used to predict the resultant internal noise level in the habitable rooms. To calculate the internal noise levels, and thereby determine the acoustic performance required for glazing, the rooms with the worst-case combination of window area and room volume (and at the loudest elevation) have been assessed.

Table 8 Source data for the noise break-in assessment

Room type	Room type	Floor area (m^2)	Room volume (m^3)	Window area (m^2)
West	Living room / kitchen	56	156.8	14.7
	Bedroom	18.7	48.6	2.7
East	Living room / kitchen	28.4	80.1	8.4
	Bedroom	22.6	61.7	6.5

6.9. Based on the information above, and the noise spectrum data shown in Table 4, the resulting internal sound levels may be calculated. The following paragraphs set out the acoustic performance requirements such that internal sound levels complying with BS 8233:2014 guidance can be achieved. Resultant internal sound levels are summarised in Table 11.

6.10. Different types of glazing will control noise to differing amounts and will vary according to the type of noise that should be reduced. The performance of glazing is established by measurement in the laboratory.

6.11. The minimum glazing and ventilation specifications required to provide the internal noise levels recommended in BS 8233:2014 are shown in Table 9. The minimum acoustic performance required for each glazing and ventilator type is shown in Table 10.

Table 9 Glazing and ventilation types

Facade	Room type	Façade specification	
		Glazing type	Ventilator type
West	Living / dining room	Type A	Non-acoustic trickle ventilator
	Bedroom	Type A	Non-acoustic trickle ventilator
East	Living / dining room	Type A	Non-acoustic trickle ventilator
	Bedroom	Type A	Non-acoustic trickle ventilator

Glazing and ventilator performance

6.12. Octave band performances required for the glazing and ventilator categories above are shown in Table 10. Performance requirements for windows must be met inclusive of frames, seals etc.

Table 10 Octave band performance specification for external building elements

Item		Attenuation (dB) at octave band centre frequency (Hz)					
		125	250	500	1000	2000	4000
Type A Glazing (typically 4/16/4)	SRI	24	20	25	34	37	40
Standard trickle ventilator	D_{ne}	32	32	31	33	31	31
Non-vision wall Cavity brick-block construction (or cladding with similar acoustic performance)	SRI	41	45	45	54	58	55

6.13. These are minimum sound reduction indices and higher acoustic specifications could be used if required for other reasons.

6.14. The results of the assessment are shown in Table 11. The noise levels meet the guidance in BS 8233:2014 and therefore the second aim of the NPPF will be met in relation to internal amenity.

Table 11 Predicted internal sound pressure levels (closed windows, inclusive of minimum glazing and ventilation type)

Facade	Room type	Period/ Parameter	Internal sound level, dB	Criterion, dB	Excess, dB
West	Kitchen-living room	Daytime $L_{Aeq\ 16hr}$	24	35	**-11**
	Bedroom	Night-time $L_{Aeq\ 8hr}$	20	30	**-10**
		Night-time L_{Amax}	38	45	**-7**
East	Kitchen-living room	Daytime $L_{Aeq\ 16hr}$	28	35	**-7**
	Bedroom	Night-time $L_{Aeq\ 8hr}$	18	30	**-12**
		Night-time L_{Amax}	41	45	**-4**

6.15. It should be noted that glazing configurations and other constructions described above are for guidance and costings purposes only. It will be the responsibility of the manufacturer to provide evidence of compliance with the required octave band sound reduction performances.

Noise from and through mechanical ventilators

6.16. Where provided for non-acoustic reasons (such as to provide suitable control of air quality), mechanical ventilators must include suitable attenuation to control intrusive noise. The attenuation must control intrusive noise (entering through fresh air and exhaust ducts) and noise generated by the fan(s) to no higher than 25 dB L_{Aeq} and no higher than 40dB L_{Amax}.

Outdoor noise levels

6.17. The property could expect typical external ambient noise levels of 51dBA. This is well below the upper guideline value (55 dB $L_{Aeq,16hr}$ described in BS 8233:2014). BS 8233:2014 does suggest that:

> *"In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited".*

7.0 Plant noise assessment

Plant noise criteria

7.1. The local authority's usual requirement is that the plant noise level at the nearest noise-sensitive windows should be at least at least 10dB below the representative L_{A90} background sound level.

7.2. A summary of the recommended plant noise limits is given in Table 12.

Table 12 Proposed plant noise level at noise sensitive residential receptors

Period	Cumulative plant noise level, dB(A)
Daytime (07.00 – 23.00 hours)	34
Night-time (23.00 – 07.00 hours)	33

7.3. These limits will result in a plant noise rating level at or below that at which a "low impact" would be expected, according to the method described in BS 4142:2014.

Plant noise predictions

7.4. The cumulative plant sound pressure level at the most affected noise sensitive receptors has been predicted based on manufacturer's data for the proposed equipment.

7.5. For the proposed 2no. heat pumps and 1no. AC unit, the assessment has taken into consideration distance attenuation and the losses attributed to the proposed acoustic plant enclosure.

7.6. The predictions have been based on all plant operating at maximum duty during the daytime and night-time period, with the exception of the AC unit which is only expected to operate in the day period.

7.7. It should be noted that the proposed plant is not anticipated to exhibit any tonal or impulsive characteristics provided it is well maintained. All proposed plant will be inverter driven and, therefore, will gently ramp up and down depending on the demands on the various systems. However, a penalty of 3dB as described in BS 4142:2014 has been applied for the possible presence of "*...characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment...".*

7.8. Table 13, below, summarises the assessment of cumulative sound pressure levels of the proposed plant at the nearest noise-sensitive windows. All other nearby receptors benefit from increased distance/screening to the plant. These predictions are inclusive mitigation being provided to the proposed heat pumps and AC unit in the form an acoustic enclosure. The full set of calculations can be found in **Appendix F**.

Table 13 Assessment of noise levels at nearby receptor due to proposed plant

Receptor	Period	Predicted plant noise rating level at receptor, L_{Aeq} (dB)	Criterion, dB(A)	Difference (dB)
R1 No.59 Rear Façade	Daytime period (07.00 – 23.00 hours)	27	34	**-7**
	Night-time period (23.00 – 07.00 hours)	27	33	**-6**
R1 No.59 Rear Garden	Daytime period (07.00 – 23.00 hours)	34	34	**0**
R2 No. 63 Rear Façade	Daytime period (07.00 – 23.00 hours)	30	34	**-4**
	Night-time period (23.00 – 07.00 hours)	30	33	**-3**
R2 No. 63 Rear Garden	Daytime period (07.00 – 23.00 hours)	34	34	**0**

7.9. The above assessment demonstrates that cumulative plant noise levels will be at or below the proposed noise limits at the nearest residential properties.

Uncertainties

7.10. Where possible, uncertainty in the above assessments has been minimised by taking the following steps:

- The meter and calibrator used have a traceable laboratory calibration and the meter was field calibrated before and after the measurements.
- Uncertainty in the calculated impacts 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 in a position where higher noise levels were present.

7.11. All reasonable steps have been taken to robustly assess noise from the proposed plant.

8.0 Summary

8.1. Noise Solutions Ltd has been commissioned by Mr and Mrs Burns to undertake a noise assessment for two renovated residential dwellings, and a noise impact assessment of associated plant, at 61 Redington Road, London.

8.2. An assessment has been undertaken in accordance with guidance from the Institute of Acoustics *Professional Practice Guidance*, BS 8233:2014 *Guidance on sound insulation and noise reduction for buildings*, BS 4142:2014 *Methods for rating and assessing industrial and commercial sound* and World Health Organisation guidance.

8.3. The assessment has determined that acceptable internal noise levels can be achieved through the selection of suitable glazing. Performance specifications have been provided for the external building fabric elements.

8.4. A plant noise impact assessment has found that installation of the proposed two heat pumps and AC unit, when attenuated as proposed, comply with the presented proposed criteria in accordance with London Borough of Camden guidance.

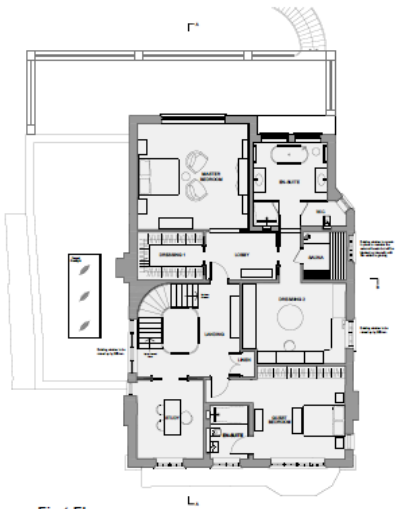
8.5. The proposed development complies with accepted acoustic practice and is acceptable in terms of noise. Noise should not be a reason for refusal of planning permission.

Appendix A Acoustic terminology

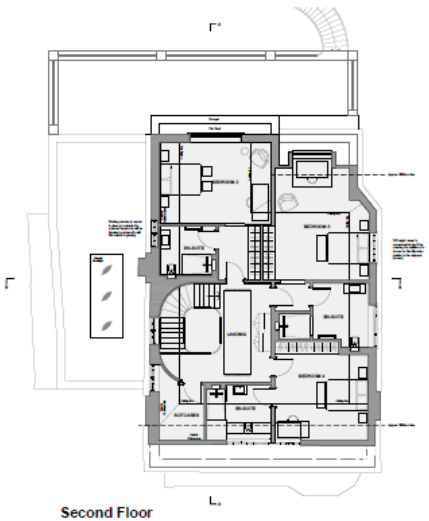
Parameter	Description
Ambient Noise Level	The totally encompassing sound in a given situation at a given time, usually composed of a sound from many sources both distant and near ($L_{Aeq,T}$).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 $\log_{10}$ (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 L_{eq} 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.

Appendix B Aerial photograph of site showing approximate location of monitoring locations

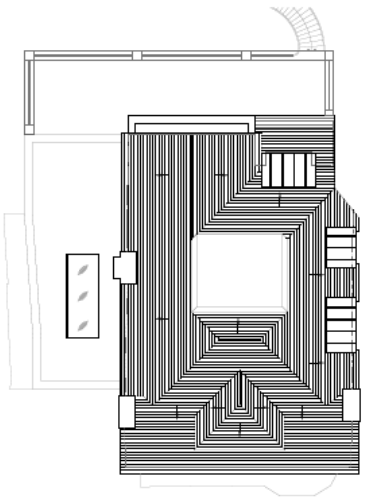
Appendix C Proposed development



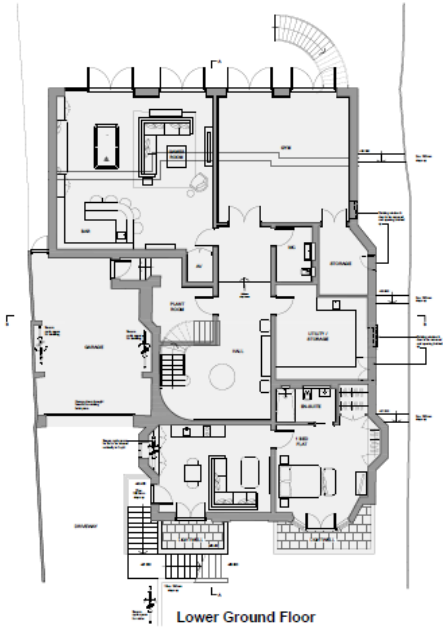
First Floor



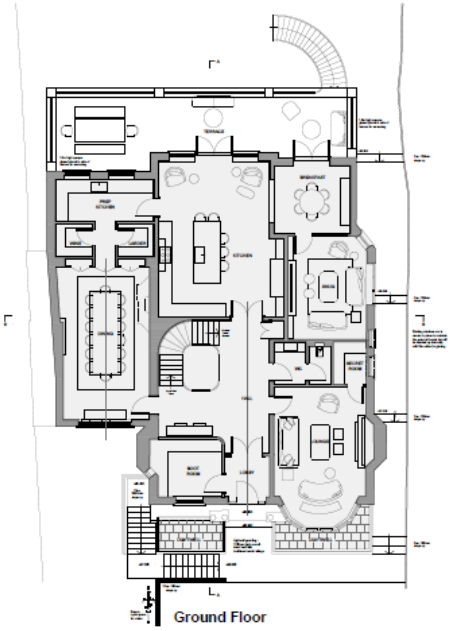
Second Floor



Roof Plan



Lower Ground Floor



Ground Floor

NOTES:
This drawing is the property of GRIGGS and is issued on the condition that it is not reproduced, disclosed or copied to any unauthorised person without written consent.
This drawing is to be read together with the specification and related drawings.

© GRIGGS

REVISIONS:

Rev	By	Check	Date	Description

GROSS INTERNAL
Lower Ground - 224m² (2,410sq ft)
Ground - 219m² (2,361sq ft)
First - 155m² (1,668sq ft)
Second - 132m² (1,421sq ft)
Total - 740m² (7,960sq ft)
Garage - 20m² (209sq ft)

PLANNING

Project
61 Redington Road,
Hampstead, London,
NW3 7RP.

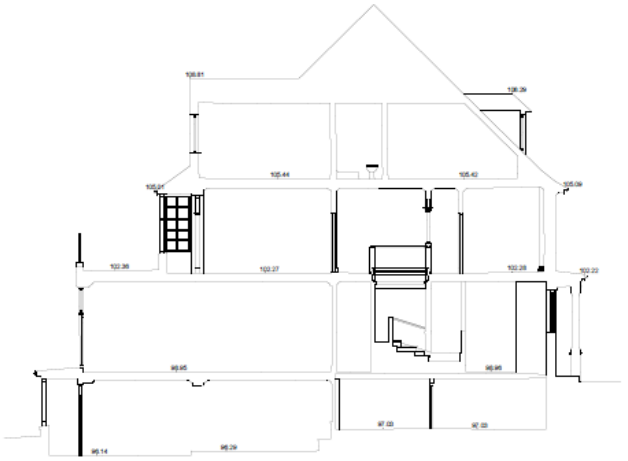
Title
Proposed Floor Plans

Drawn	Checked	Date	Scale	Size
KAT		Mar 2022	1:100	A1
Project No. 1571		Drawing No. PL10		Revision -

GRIGGS
EST. 1968

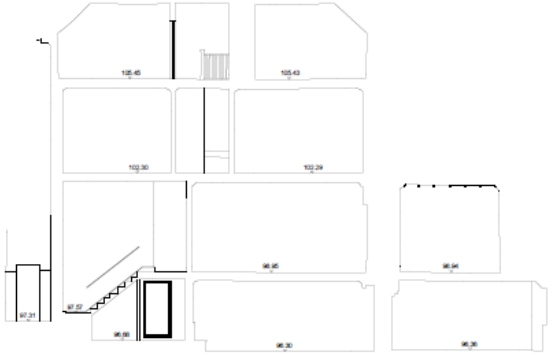

Front Elevation (Through Lightwells)
Front Elevation (Through New Stairs)
Flank Elevation
Side Elevation
Rear Elevation
NOTES:
REVISIONS:
PLANNING
61 Redington Road,
Hampstead, London,
NW3 7RP.
Proposed Elevations.
KAT
Feb 2022
1:100
A1
1571
PL11
GRIGGS
EST. 1968

Proposed Section A-A



Existing Section A-A

Proposed Section B-B



Existing Section B-B

NOTES:
This drawing is the property of GRIGGS and is issued on the condition that it is not reproduced, disclosed or copied to any unauthorised person without written consent.
This drawing is to be read together with the specification and related drawings.

© GRIGGS

REVISIONS:

Rev	By	Chk	Date	Description

PLANNING

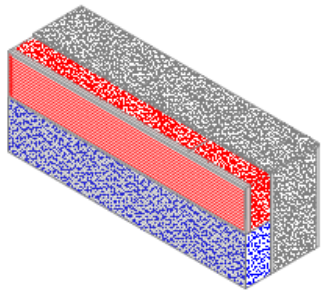
Project
61 Redington Road,
Hampstead, London,
NW3 7RP.

Title
Sections A-A & B-B Comparisons.

Drawn	Checked	Date	Scale	Size
KAT		Mar 2022	1:100	A2
Project No.		Drawing No.		Revision
1557		PL17		-

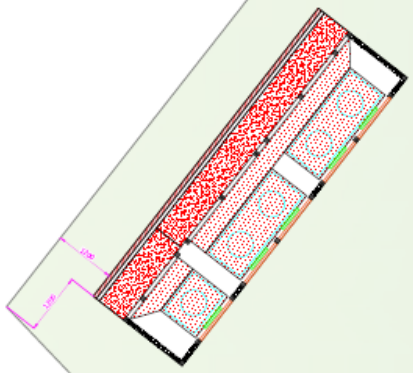
GRIGGS
EST. 1968

ISOMETRIC VIEW



PLEASE NOTE:

FOR FULL ENCLOSURE DETAILS - SEE NSL DRAWING RF90538 SK001B



Project: 61 Redington Road, Hampstead

Title: Proposed Layout of Acoustic Enclosure Location

Client: HGH Consulting

Drawing No: RF90538 SK002B

Scale: N/A | Projection:

Date:	Rev:	Description (DRAWN/CHECKED):
14/04/22	B	Enclosure Location (JM/LQ)
13/04/22	A	Issued For Discussion (JM/LQ)

Notes:

All dimensions in millimetres.

Louvres to be painted to any standard RAL or BS colour.

Noise Solutions Ltd
Unit 5
Oriel Court
Omega Park
Alton
GU34 2YT
Tel. 01252 519881
www.noisesolutions.co.uk

Appendix D Environmental noise surveys

D.1 Measurements of the existing background sound levels were undertaken between 14.00 hours on Monday 7 March and 14.00 hours on Tuesday 8 March 2022. Monitoring locations were located to the west of the site (Position 1, to cover any noise from the adjacent gardens) and at the east (Position 2, to cover the nearby local roads, Redington Road and Templewood Avenue).

D.2 The sound level meters were programmed to record the A-weighted L_{eq}, L_{90}, L_{10} and L_{max} noise indices for consecutive 15-minute sample periods for the duration of the survey.

D.3 The approximate locations of the monitoring positions are shown in the overhead in Appendix B.

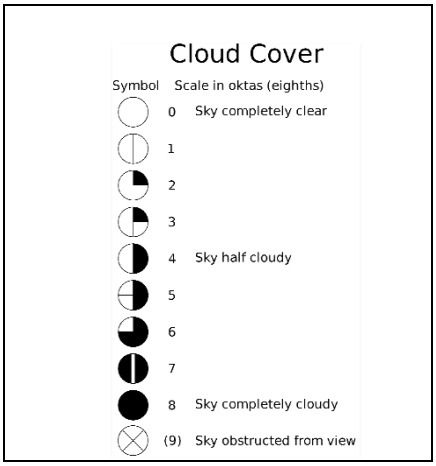
Equipment

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

Location	Equipment Description	Model / serial no.	Calibration date	Certificate no.
1, West	Class 1 Sound level meter	Svantek 971 / 111624	18/06/2021	Factory conformation certificate
	Condenser microphone	ACO Pacific 7052E / 80036		
	Preamplifier	Svantek SV 18 / 112639		
	Calibrator	Svantek SV 33B / 83850	20/10/2021	1500814-1
2, East	Class 1 Sound level meter	Svantek 971 / 111625	18/06/2021	Factory conformation certificate
	Condenser microphone	ACO Pacific 7052E / 80034		
	Preamplifier	Svantek SV18 / 112630		
	Calibrator	Rion NC-74 / 35094453	13/08/2021	1500814-1

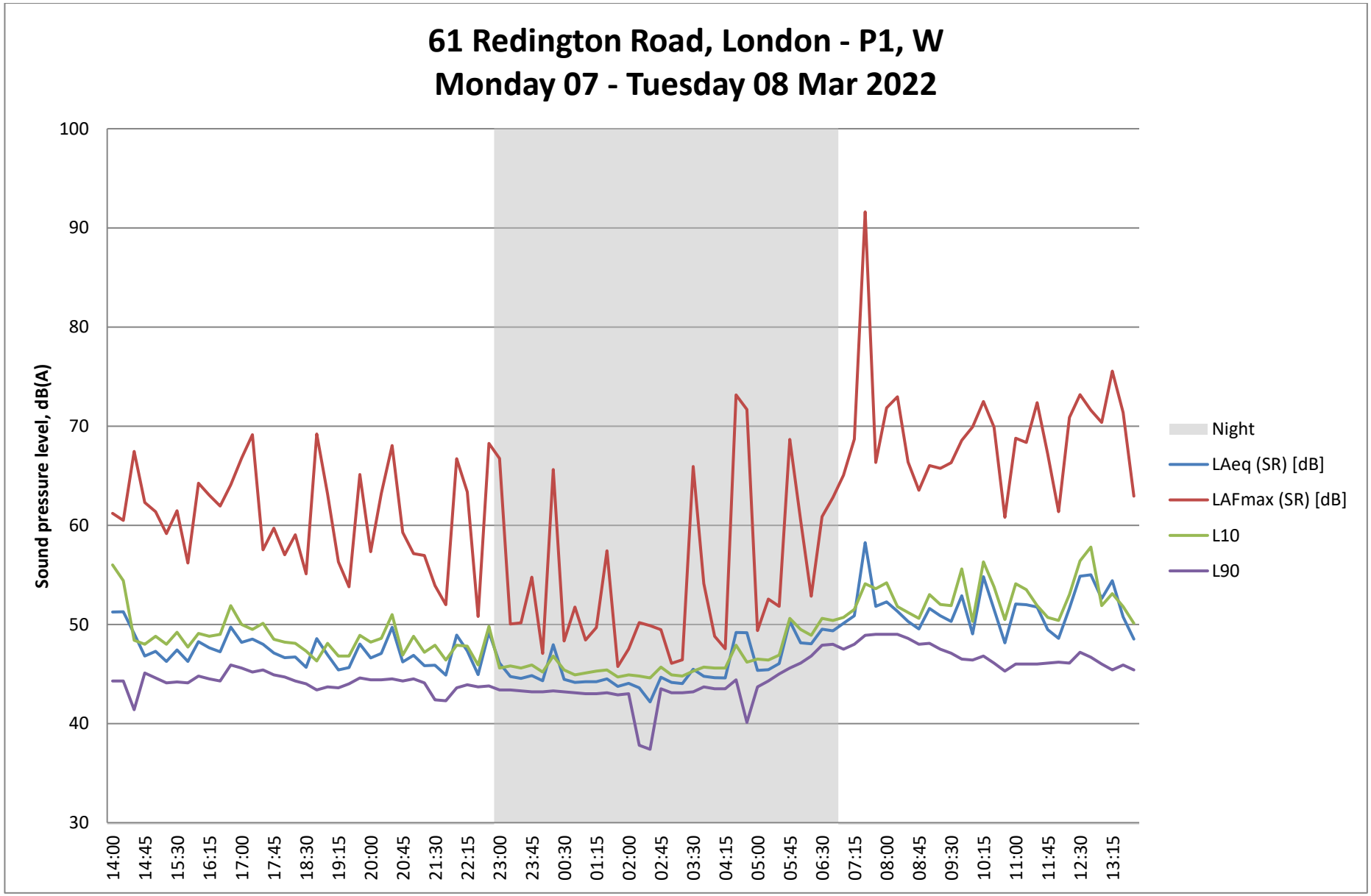
Weather conditions

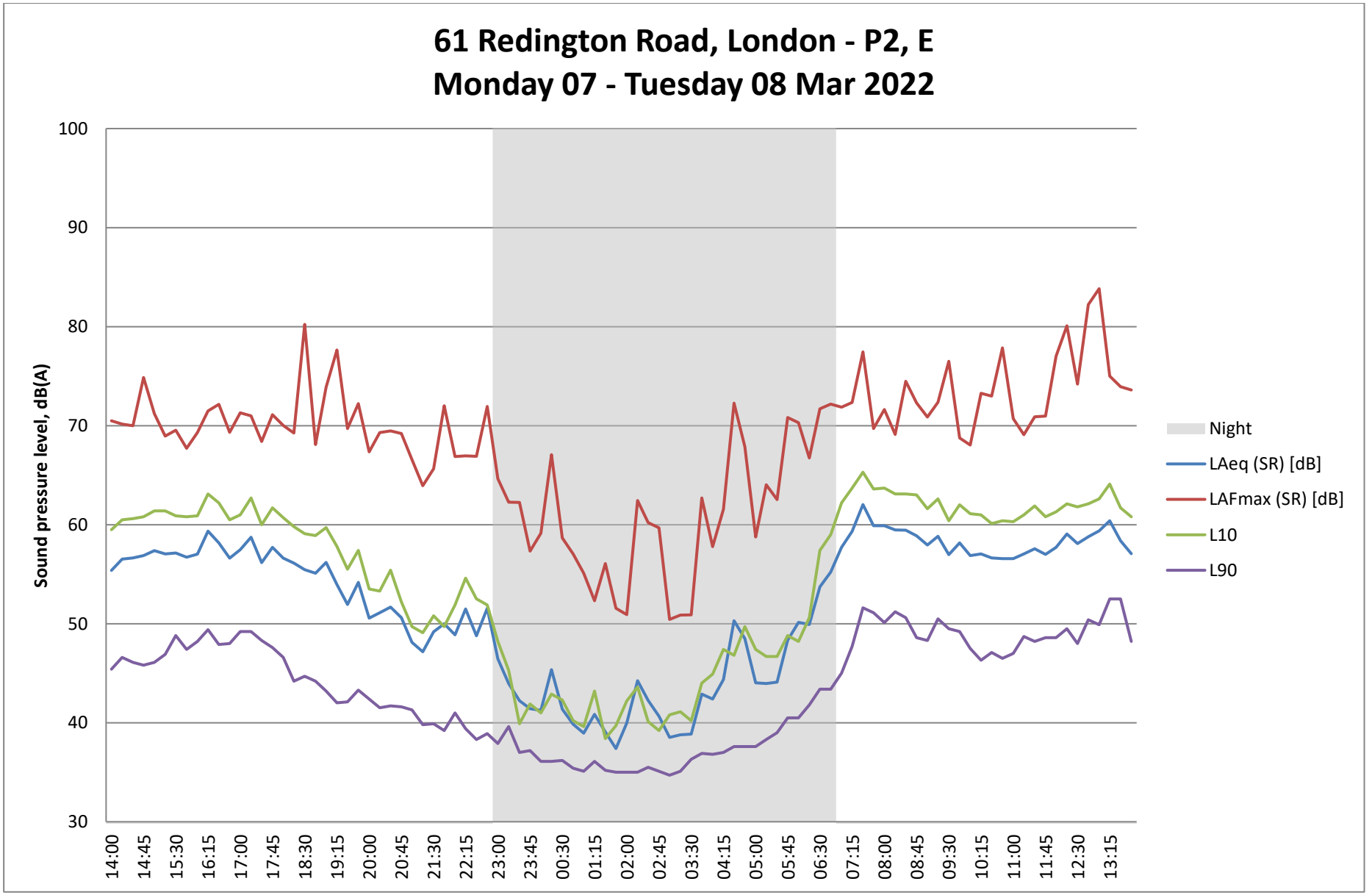
D.5 Weather conditions were determined both at the start and on completion of the survey. It is considered that the meteorological conditions were appropriate for environmental noise measurements. The table below presents the weather conditions recorded on site at the beginning and end of the survey.

Weather Conditions				
Measurement Location	**Date/Time**	**Description**	**Beginning of Survey**	**End of Survey**
As indicated on Appendix B	14.00 7/3/22 - 14.00 8/3/22	Temperature (°C)	7	11
		Precipitation:	No	No
		Cloud cover (oktas - see guide)	2	0
		Presence of fog/snow/ice	No	No
		Presence of damp roads/wet ground	No	No
		Wind Speed (m/s)	2	2
		Wind Direction	From SW	From SW
		Conditions that may cause temperature inversion (i.e. calm nights with no cloud)	-	-

Results

D.6 The noise climate at the beginning and end of the survey period consisted of traffic, birdsong, and aircraft, with occasional noise from children and construction.


61 Redington Road, London - P1, W
Monday 07 - Tuesday 08 Mar 2022
Sound pressure level, dB(A)
100
90
80
70
60
50
40
30
14:00
14:45
15:30
16:15
17:00
17:45
18:30
19:15
20:00
20:45
21:30
22:15
23:00
23:45
00:30
01:15
02:00
02:45
03:30
04:15
05:00
05:45
06:30
07:15
08:00
08:45
09:30
10:15
11:00
11:45
12:30
13:15
Night
LAeq (SR) [dB]
LAFmax (SR) [dB]
L10
L90


61 Redington Road, London - P2, E
Monday 07 - Tuesday 08 Mar 2022
Sound pressure level, dB(A)
100
90
80
70
60
50
40
30
14:00
14:45
15:30
16:15
17:00
17:45
18:30
19:15
20:00
20:45
21:30
22:15
23:00
23:45
00:30
01:15
02:00
02:45
03:30
04:15
05:00
05:45
06:30
07:15
08:00
08:45
09:30
10:15
11:00
11:45
12:30
13:15
Night
LAeq (SR) [dB]
LAFmax (SR) [dB]
L10
L90

Appendix E Plant noise data

Unit / Model	Number of units	Operating Period	Fan side	Sound power level (dB) at octave band centre frequencies (Hz)								$L_{w,A}$ (dB)
				63	125	250	500	1000	2000	4000	8000	
Mitsubishi Electric/ CAHV-P500YB-HPB	2	Day and Night	Intake side	*73**	72.5	72.9	68.7	65.2	60	56.7	51.1	70.8
			Discharge side	*73**	72.5	72.9	68.7	65.2	60	56.7	51.1	70.8
Mitsubishi Electric/ PUHY-P200YNW-A1	1	Day and Night	N/A	77.4	79.4	78.4	75.9	69.9	65.4	65.9	60.9	77.0

** Data not provided at 63Hz, as such it was assumed to be 73dB*

Appendix F Plant noise calculations

Acoustic Enclosure - Daytime/ Night time

Description	Notes	Sound level (dB) at octave band centre frequency								L_{Aeq} (dB)
		63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	
Plant room										
Intake										
Reverberant level in enclosure	Rev Lp	75	75	72	66	56	50	47	40	68
All Plant Running										
Opening area (m2)	9.94	10	10	10	10	10	10	10	10	
SRI of opening	I.L	-5	-6	-11	-20	-27	-26	-25	-20	
Inside-outside correction		-6	-6	-6	-6	-6	-6	-6	-6	
Lw of opening	Lw	74	73	65	50	33	28	26	24	60
R1 Façade										
Directivity correction	(7100,0deg x 1400,170deg)	0	-2	-6	-8	-8	-8	-8	-8	
Distance correction (m)	20	-34	-34	-34	-34	-34	-34	-34	-34	
Screening (δ = /m)	-	0	0	0	0	0	0	0	0	
Resultant at receptor R1	Lp @ R1 Facade	40	38	25	8	-10	-15	-16	-18	23

Description	Notes	Sound level (dB) at octave band centre frequency								L_{Aeq} (dB)
		63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	
R1 Garden										
Directivity correction	(7100,0deg x 1400,180deg)	0	-2	-6	-8	-8	-8	-8	-8	
Distance correction (m)	9.5	-28	-28	-28	-28	-28	-28	-28	-28	
Screening (δ = /m)	-	0	0	0	0	0	0	0	0	
Resultant at receptor R2	Lp @ R1 Garden	47	44	32	15	-3	-8	-9	-11	30
R2 Façade										
Directivity correction	(7100,0deg x 1400,90deg)	2	2	1	-4	-7	-7	-7	-7	
Distance correction (m)	23.5	-35	-35	-35	-35	-35	-35	-35	-35	
Screening (δ = /m)	-	0	0	0	0	0	0	0	0	
Resultant at receptor R3	Lp @ R2 Façade	41	39	31	11	-10	-15	-16	-18	26
R2 Garden										
Directivity correction	(7100,90deg x 1400,0deg)	2	2	1	-4	-7	-7	-7	-7	
Distance correction (m)	15.5	-32	-32	-32	-32	-32	-32	-32	-32	
Screening (δ = /m)	-	0	0	0	0	0	0	0	0	
Resultant at receptor R4	Lp @ R2 Garden	44	43	34	15	-6	-11	-12	-14	30

Description	Notes	Sound level (dB) at octave band centre frequency								L_{Aeq} (dB)
		63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	
2.no Heat Pump Discharge (Total)										
Sound power	Lw	76	76	76	72	68	63	60	54	74
End reflection	6.36	-1	0	0	0	0	0	0	0	
SRI of opening	I.L	-5	-6	-11	-20	-27	-26	-25	-20	
L_w of opening		70	70	65	52	41	37	35	34	59
R1 Façade										
Directivity correction	(5300,0deg x 1200,170deg)	0	-2	-6	-8	-8	-8	-8	-8	
Distance correction (m)	20	-34	-34	-34	-34	-34	-34	-34	-34	
Screening (d = /m)	-	0	0	0	0	0	0	0	0	
Resultant at receptor R1	Lp @ R1 Facade	36	33	25	10	-1	-5	-7	-8	21
R1 Garden										
Directivity correction	(5300,0deg x 1200,180deg)	0	-2	-6	-8	-8	-8	-8	-8	
Distance correction (m)	9.5	-28	-28	-28	-28	-28	-28	-28	-28	
Screening (d = /m)	-	0	0	0	0	0	0	0	0	
Resultant at receptor R1	Lp @ R1 Garden	42	40	31	16	6	1	-1	-1	27

Description	Notes	Sound level (dB) at octave band centre frequency								L_{Aeq} (dB)
		63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	
R2 Façade										
Directivity correction	(5300,0deg x 1200,90deg)	2	1	1	-4	-7	-7	-7	-7	
Distance correction (m)	23.5	-35	-35	-35	-35	-35	-35	-35	-35	
Screening (d = /m)	-	0	0	0	0	0	0	0	0	
Resultant at receptor R1	L_p @ R2 Facade	36	35	30	13	-1	-5	-8	-8	24
R2 Garden										
Directivity correction	(5300,90deg x 1200,0deg)	2	1	1	-4	-7	-7	-7	-7	
Distance correction (m)	15.5	-32	-32	-32	-32	-32	-32	-32	-32	
Screening (d = /m)	-	0	0	0	0	0	0	0	0	
Resultant at receptor R1	L_p @ R2 Garden	40	39	34	16	2	-2	-4	-5	28

Description	Notes	Sound level (dB) at octave band centre frequency								L_{Aeq} (dB)
		63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	
ACU Discharge										
Sound power	Lw	77	79	78	76	70	65	66	61	77
End reflection	2.16	-3	-1	0	0	0	0	0	0	
SRI of opening	I.L	-5	-6	-11	-20	-27	-26	-25	-20	
Lw of opening		69	72	67	56	43	39	41	41	62
R1 Façade										
Directivity correction	(1800,0deg x 1200,170deg)	-1	-3	-7	-8	-8	-8	-8	-8	
Distance correction (m)	20	-34	-34	-34	-34	-34	-34	-34	-34	
Screening (d = /m)	-	0	0	0	0	0	0	0	0	
Resultant at receptor R1	Lp @ R1 Façade	34	36	27	14	1	-3	-1	-1	23
R1 Garden										
Directivity correction	(1800,0deg x 1200,180deg)	-1	-3	-7	-8	-8	-8	-8	-8	
Distance correction (m)	9.5	-28	-28	-28	-28	-28	-28	-28	-28	
Screening (d = /m)	-	0	0	0	0	0	0	0	0	
Resultant at receptor R1	L_p @ R1 Garden	41	42	33	20	7	4	5	5	29

Description	Notes	Sound level (dB) at octave band centre frequency								L_{Aeq} (dB)
		63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	
R2 Façade										
Directivity correction	(1800,0deg x 1200,90deg)	1	1	1	-4	-7	-7	-7	-7	
Distance correction (m)	23.5	-35	-35	-35	-35	-35	-35	-35	-35	
Screening (d = /m)	-	0	0	0	0	0	0	0	0	
Resultant at receptor R1	Lp @ R2 Façade	35	38	32	17	0	-3	-2	-2	26
R2 Garden										
Directivity correction	(1800,90deg x 1200,0deg)	1	1	1	-4	-7	-7	-7	-7	
Distance correction (m)	15.5	-32	-32	-32	-32	-32	-32	-32	-32	
Screening (d = /m)	-	0	0	0	0	0	0	0	0	
Resultant at receptor R1	Lp @ R2 Garden	38	41	36	21	4	1	2	2	30

Appendix G Enclosure drawing