7TH WAVE ACOUSTICS

Acoustic Report

Land Between 76 - 78 Brighton Road, Lancing, West Sussex
Noise Impact Assessment

Final Report
8th November 2023

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Project **Land Between 76 - 78 Brighton Road, Lancing, West Sussex**
Noise Impact Assessment

Client Southern Rock Property Ltd
6 Grangeways
Brighton
East Sussex
BN1 8XN

Report By 7th Wave Acoustics
Patchway
Wellgreen Lane
Kingston
Lewes
BN7 3NS

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CONTENTS

1	Introduction	4
2	Site and Development Description	5
3	Planning Policy Context	6
4	Noise Units, Methodology and Noise Assessment Criteria	9
5	Noise Survey and Analysis	14
6	Noise Modelling	18
7	Pro-PG Assessment	20
8	Mitigation Options	24
9	Summary and Conclusions	27
10	References	28
Appendix A: Figures		29
Appendix B: Tables		37
Appendix C: Brighton City Airport Noise Maps		50

1 INTRODUCTION

7th Wave Acoustics has been appointed by Southern Rock Property Ltd to prepare a noise assessment to accompany a planning application to Adur and Worthing Councils for the proposed residential development at Land Between 76 - 78 Brighton Road, Lancing, West Sussex.

To accompany this application, a noise impact assessment has been carried out and provides guidance on appropriate façade elements to ensure that desirable internal noise levels are capable of being achieved. The report also presents a noise assessment of the proposed external amenity areas.

The findings of the assessment are reported herein.

2 SITE AND DEVELOPMENT DESCRIPTION

Existing Site

The application site is located in Lancing, within the boundary of Adur and Worthing Councils (AWC), in a predominantly residential area.

The site comprises a wide swathe of grass embankment on the south side of Brighton Road (A259).

A location plan is provided in Figure A1 of Appendix A.

Residential properties are located beyond Brighton Road to the north.

Beach Park caravan park sits directly to the south of the site.

Existing residential dwellings are located directly to the east and west of the site.

Proposed Development

The development proposals are to construct 8 no. residential units in a single terrace block comprising 6 no. townhouses and 2 no. apartments, with parking at ground floor level.

The floor plans for the proposed development are displayed in Figures A2 and A3 of Appendix A.

The proposed elevations are displayed in Figure A4 of Appendix A.

Subjective Observations

The existing ambient noise environment in the area was noted to be influenced by road traffic on Brighton Road and intermittent overhead aircrafts taking off from Brighton City Airport.

No noise was observed to impact the site from the Beach Park caravan park to the south of the site.

3 PLANNING POLICY CONTEXT

3.1 National Planning Policy Framework

The NPPF 2021[1], which refers to the "Explanatory Note in the in the NPSE", does not include specific noise criteria to be applied in planning decisions. It contains the following relevant guidance relating to noise and development:

"174. Planning policies and decisions should contribute to and enhance the natural and local environment by:…

(e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans...

185. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they 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; and

(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...

187. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.

188. The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities."

3.2 Noise Policy Statement for England

This document[2], which has been approved at Government level sets out 3 aims for noise control.

<u>First aim</u>

Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

The first aim of the NPSE states that significant adverse effects on health and quality of life should be avoided while also taking into account the guiding principles of sustainable development.

Second aim

Mitigate and minimise adverse impacts on health and quality of life from environment, neighbourhood noise within the context of Government policy on sustainable development.

The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life whilst also taking into account the guiding principles of sustainable development. This does not mean that such adverse impacts effects cannot occur.

LOAEL – Lowest Observed Adverse Effect Level: This is the level above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level: This is the level above which significant adverse effects on health and quality of life occur.

Third aim

Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy of sustainable development.

This aims seeks, where possible, positively to improve health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

3.3 Local Authority Requirements

Consultee Comments (Ref: AWDM/1247/23)

AWC's Environmental Health Department provided the following consultee comments on the application:

"The development site has been identified by DEFRA as an area affected by traffic noise. There is nothing provided within the application to protect the new residential dwellings from noise.

ProPG: Planning and Noise (recommended by the Sussex Noise and Planning Guidance), describes an acoustic design process which seeks to deliver the best acoustic design for a particular site. A noise assessment will be required for the site and must follow the principles of this guidance to deliver the internal noise level guidelines set out in BS8233:2014. The noise assessment should also consider the maximum night time noise levels the property is exposed to and ensure the final acoustic design is sufficient to mitigate against these peaks.

If windows need to be kept closed to achieve good internal noise levels then any acoustic mitigation scheme shall have to include mechanical MVHR ventilation for the whole development. The Southern facade fronts the coast and if the development is shut up during the day, especially during hot summer months or during storms, passive trickle ventilation alone will be inadequate. The developer should ensure the rooms are not at risk of overheating.

Therefore in summary whilst I have no objections to the development in principle, without an appropriate acoustic assessment or suitable mitigation I am unable to support the application in its current form."

This report has been produced to support the planning application process, to satisfy the above requirements.

Planning Noise Advice Document - Sussex

Local Authorities in Sussex, including Adur & Worthing Councils (AWC), have produced a planning guidance document 'Planning Noise Advice Document – Sussex [3] which sets out the required approach for undertaking a noise assessment, for certain types of development.

For new residential dwellings, the guidance presents information which states:

'Where the noise assessment has shown that habitable rooms will be exposed to noise levels likely to give rise to any adverse impact, noise mitigation will be required.

Design control measures should aim to meet the recommended standards set out in table 4 of BS 8233:2014 and the night time L_{Amax} level recommended in the WHO's Night Noise Guidelines for Europe (2009), unless there are particular reasons why this is not considered appropriate. In such cases, a clear explanation of the reasons should be provided.

While it is acknowledged that noise mitigation measures can be used in a lot of cases to achieve suitable internal levels, it is important that preference is given to criteria based on windows being partially open.

If it is not possible to achieve suitable internal levels with the windows opened then details of alternative ventilation must be supplied. Where the noise assessment has shown that habitable rooms will be exposed to noise levels likely to give rise to any adverse impact, noise mitigation will be required'.

4 NOISE UNITS, METHODOLOGY AND NOISE ASSESSMENT CRITERIA

4.1 Noise Units

There is a million to one ratio between the threshold of hearing and the highest tolerable sound pressure. Noise is therefore measured using a logarithmic scale, to account for this wide range, called the decibel (dB). Noise is defined as unwanted sound and the range of audible sound varies from around 0 dB to 140 dB.

The human ear is capable of detecting sound over a range of frequencies from around 20 Hz to 20 kHz; however, its response varies depending on the frequency and is most sensitive to sounds in the mid frequency range of 1 kHz to 5 kHz. Instrumentation used to measure noise is, therefore, weighted across the frequency bands to represent the sensitivity of the ear. This is called 'A weighting' and is represented as dB(A).

It is generally accepted that a change in noise level of 1 dB is not perceptible by the normal ear under normal conditions, a 3 dB change is just perceptible, whilst a change of 10 dB is perceived as a doubling or halving of the noise level.

An indication of the range of noise levels commonly found in the environment is given below in Table 4.1.

Table 4.1: Typical Noise Levels

Typical Noise Level dB(A)	Example
0	Threshold of hearing
30	Rural area at night
40	Residential area at night
60	Conversation
80	Inside general factory premises
100	Near to pneumatic hammer
120	Near to speaker at rock concert
140	Threshold of pain

A number of different indices are used to describe the fluctuations in noise level over certain time periods. The main indices include:

$L_{A90,T}$ This is the noise level exceeded for 90% of the measurement period and provides a measurement of the quieter 'lull' periods in between noise events. It is often referred to as the background noise level.

$L_{Aeq,T}$ This is the equivalent continuous A-weighted sound pressure level and is the level of a notional steady sound which has the same acoustic energy as the fluctuating sound over a specified time period, T. It is often used for measuring all sources of noise in the environment, which can be referred to as the ambient noise.

$L_{Amax,F}$ This is the maximum sound pressure level measured in a given time period with the sound level meter set to 'fast' response.

4.2 British Standard 8233:2014

BS 8233:2014 *Guidance on sound insulation and noise reduction for buildings* [4] gives recommendations for the control of noise in and around buildings. The Standard suggests appropriate criteria and limits for different situations to guide the design of new or refurbished buildings undergoing a change of use.

Desirable upper noise levels inside residential habitable rooms are specified in the Standard and are reproduced below in Table 4.2.

Table 4.2: BS 8233 Indoor Ambient Noise Levels for Dwellings

Activity	Room	Ambient Indoor Noise Level 07:00 to 23:00 hrs, dB $L_{Aeq,16\ hr}$	Ambient Indoor Noise Level 23:00 to 07:00 hrs, dB $L_{Aeq,8\ hr}$
Resting	Living Room	35	-
Dining	Dining room/ area	40	-
Sleeping (daytime resting)	Bedroom	35	30

For regular individual noise events, such as aircraft, BS 8233 indicates a guideline night-time level in terms of Sound Exposure (L_{AE}) or $L_{Amax,F}$ may be set depending on the character and number of noise events per night.

In external amenity spaces, such as private gardens and patios, BS 8233 indicates that it is desirable that the external noise level in these areas does not exceed 50 dB $L_{Aeq,T}$ with an upper guideline value of 55 dB $L_{Aeq,T}$ in noisier environments.

The standard does recognise that these guideline values for outdoor noise levels are not achievable in all circumstances where development might be desirable. In higher noise areas, such as in city centres or urban areas adjoining a 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.

4.3 World Health Organisation

The most recent WHO guidelines *'Environmental Noise Guidelines for the European Region'*[5] acknowledge that 'single event noise indicators such as the maximum sound pressure level are warranted in specific situations such as night time railway or aircraft noise events that can clearly elicit awakenings', however, the guidance indicates that 'the relationship between different types of single-event noise indicators and long-term health outcomes at the population level remains tentative' and therefore does not make any recommendations for single event noise indicators.
However, guideline values for community noise in specific environments are presented in the WHO's *'Guidelines for Community Noise'*[6] document. The guideline values are presented in Table 4.3.

Table 4.3: Who Guideline Noise Values

Specific Environment	Critical Health Effect(s)	dB $L_{Aeq,T}$	Time Base hours	dB $L_{Amax,F}$
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, night-time	30	8	45

Note: For a good sleep, the WHO states that indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10–15 times per night.

The Night Noise Guidelines (NNG) for Europe[7] is described as an extension of the WHO Guidelines for Community Noise publication. The threshold levels of noise exposure presented in the document are described as milestones in the process of evaluating the health consequences of environmental exposure. The health-based guideline values for the assessment and control of night noise exposure were derived from a review of available scientific evidence on the health effects of night noise. These include the effects and threshold levels for night time $L_{Amax,F,}$ which are lower than those presented in the WHO community noise guidelines. These revised levels are presented in Table 4.4 below.

Table 4.4: WHO Night-Time Noise Guidelines

Effect	Description	Indicator	NOEL Threshold
Sleep Quality	Waking up in night and/or too early in the morning	dB $L_{Amax,F}$	42

4.4 ProPG: Planning & Noise

ProPG[8] (Professional Practice Guidance: Planning and Noise) was jointly developed by the Institute of Acoustics (IOA), the Association of Noise Consultants (ANC) and the Chartered Institute of Environmental Health (CIEH) to guide Local Planning Authorities (LPA's) and Practitioners in assessing the suitability for residential development on sites predominantly exposed to airborne transport noise. Practitioners in assessing the suitability for residential development on sites predominantly exposed to airborne transport noise.

ProPG introduced a sequential 2-stage approach allowing for early consideration of noise issues at Stage 1 followed by more detailed consideration of noise issues at Stage 2, should this be identified as necessary in Stage 1.

Stage 1 introduces the concept of noise risk categories ranging from Negligible Risk to High Risk to help LPAs in making accelerated straightforward decisions for low risk sites and to provide guidance for more detailed consideration associated with challenging higher risk sites.
Following the outcome of Stage 1, Stage 2 then applies to sites assessed as low to high risk. This stage should not be necessary for sites assessed as negligible risk.
Stage 2 requires consideration be given to four key elements:

- Element 1: Good Acoustic Design Process;
- Element 2: Internal Noise Level Guidelines;
- Element 3: External Amenity Area Noise Assessment; and

- Element 4: Other Relevant Issues.

Further details on these elements are discussed in the acoustic design section of this report. Table 4.5 below provides a summary of ProPG's noise risk categories and their associated free-field noise levels, along with the assessment implications.

Table 4.5: ProPG Stage 1 - Initial Site Noise Risk Assessment

Risk Category	Indicative Daytime Noise Levels $L_{Aeq,16hr}$	Indicative Night-time Noise Levels $L_{Aeq,8hr}$	Pre-Planning Application Advice
Negligible Risk	<50 dB	< 40 dB	Indication that the development site is likely to be acceptable from a noise perspective and application need not normally be delayed on noise grounds.
Low Risk	50 - 60 dB	40 - 50 dB	Indication that the development site is likely to be acceptable provided a good acoustic design process is followed and is confirmed in a detailed Acoustic Design Statement confirming how noise will be mitigated.
Medium Risk	60 - 70 dB	50 - 60 dB	
High Risk	> 70 dB	> 60 dB	Indication that the development site may be refused on noise grounds unless a good acoustic design process and detailed Acoustic Design statement can demonstrate the significant noise risk can be mitigated.

Notes:
[1] Noise levels should be assessed without inclusion of the acoustic effect of any scheme specific noise mitigation measures;
[2] Noise levels are the combined free-field noise level from all sources of transport noise and may also include industrial/commercial noise where this is present, but not dominant;
[3] $L_{Aeq,16hr}$ is for daytime 07:00-23:00, $L_{Aeq,8hr}$ is for night-time 23:00 to 07:00; and
[4] An indication that there may be more than ten noise events at night (23:00-07:00) with $L_{Amax,F}$ > 60 dB means the site should not be regarded as negligible risk.

4.5 Approved Document O (AD-O)

Approved Document O 'Overheating'[9] was released in December 2021 and came into effect in England on 15th June 2022. It introduces requirements for various types of residential premises to limit unwanted solar gains in summer and provide an adequate means to remove heat from the indoor environment.

Requirement O1(2)(a) of the regulation requires that account must be taken of the safety of an occupant, and their reasonable enjoyment of the residence. There is also a requirement (O2(b)) that mechanical cooling may only be used where sufficient heat cannot be removed from the indoor environment without it.

The statutory guidance to support Requirement O1(2)(a), Approved Document O contains information relating to noise at night.

Paragraph 3.3 of AD-O states:

Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits:

- *40dB $L_{Aeq,T,}$ averaged over 8 hours (between 11pm and 7am); and*
- *55dB $L_{AFmax,}$ more than 10 times a night (between 11pm and 7am).*

4.6 Criteria Summary for the Noise Assessment

Taking into account AWC's comments and the standard and guideline criteria discussed above, the noise impact assessment in this report will be undertaken following the principles of ProPG to ensure internal noise levels meet BS 8233:2014's desirable criteria set out in Table 4.2 above.

The night-time internal criteria of 42 dB $L_{Amax,F}$ specified by the WHO Night Noise Guidelines will be used for the assessment of regular (more than 10 times per night) individual night-time noise events.

An assessment of internal noise levels inside bedrooms when windows are open, for example, during the summer months, to help combat overheating will also be considered, with the calculated internal noise levels assessed against the noise limits specified in AD-O.

5 NOISE SURVEY AND ANALYSIS

5.1 Overview

Continuous Unattended Noise Measurements

Continuous unattended noise measurements were made at a single location to measure the diurnal variation in noise levels.

Attended Short-term Noise Measurements

Supplementary attended short-term noise measurements were also made at 2 no. locations at the site.

5.2 Continuous Unattended Noise Survey Details

The details of the continuous unattended monitoring of ambient and background noise levels are summarised in Table 5.1 below.

Table 5.1: Summary of Noise Monitoring Locations

Location	Height[1]	Free field / Façade	From	To
LT1	1.5 m	Free-field	11:45 hrs Thursday 26th October 2023	14:30 hrs Tuesday 31st October 2023

Notes: [1] Approximate height above local ground level.

One sound level meter (LT1) was installed in a location representative of the development site, as shown in Figure A1 of Appendix A.

Noise measurements were made using the equipment presented in Table 5.2 below.

Table 5.2: Noise Monitoring Equipment

Monitoring Location	Manufacturer	Model No.	Description	Serial No.	Calibration Due Date
LT1	Norsonic	140	Sound Level Meter	1403236	December 2024
-	Norsonic	1251	Calibrator	0034540	April 2024

The sound level meters were powered by dry cell batteries and stored inside a weatherproof security box.

Measurements were obtained using the 'F' time weighting and A-weighting frequency network. The equipment was calibrated before and after the survey to generate a calibration level of 114.0 dB at 1 kHz, with the noted drift falling within acceptable tolerances.

Consecutive noise measurements consisting of $L_{Amax,F}$, $L_{Aeq,15min}$, and $L_{A90,15min}$ noise levels were obtained over the duration of the survey.

5.3 Attended Short-term Noise Measurements

Short term attended noise measurements were undertaken at two locations, representative of the development site. The short-term attended monitoring locations are labelled as ST1 and ST2 in Figure A1 of Appendix A.

Short term attended noise measurements were obtained between 10:30 hrs and 11:35hrs on Thursday 26th October 2023.

The equipment used for the attended noise monitoring is summarised below in Table 5.3.

Table 5.3: Attended Noise Monitoring Equipment

Monitoring Location	Date	Manufacturer	Model No.	Description	Serial No.	Calibration Due Date
ST1 & ST2	20/07/2023	Larson Davis	LxT	Sound Level Meter	0006489	May 2025
-	14/07/2023 & 20/07/2023	Norsonic	1251	Calibrator	0034540	April 2024

Measurements were obtained using the 'F' time weighting and A-weighting frequency network. The equipment was calibrated before and after the survey to generate a calibration level of 114.0 dB at 1 kHz, with the noted drift falling within acceptable tolerances.

For the attended noise survey, consecutive noise measurements consisting of $L_{Amax,F}$, $L_{Aeq,5min}$, and $L_{A90,5min}$ noise levels were obtained over the duration of the surveys.

The clocks on the unattended sound level meter and attended sound level meters were synchronised to enable simultaneous measurements.

5.4 Weather Conditions

Weather conditions during the site visits are presented below in Table 5.4.

Table 5.4: Weather Conditions during Site Visits

Site Visit	Date and Time	Noted Weather
Setup of unattended noise equipment and attended noise monitoring	26/10/2023 11:00hrs	Dry and clear; 15°C; Average windspeed <1.5m/s; 84% humidity.
Collection of unattended noise equipment and attended noise monitoring	31/10/2023 14:30hrs	Dry with 50% cloud cover; 14°C; Average windspeed <2m/s; 85% humidity.

A history of the weather conditions during the continuous noise survey period has been obtained from an internet source (www.wunderground.com).

Analysis of the data shows that during the survey period, the weather was unsettled with periods of rainfall on all of the days surveyed.

Analysis of the noise dataset indicates that the periods of rainfall may not have significantly influenced the measured ambient $L_{Aeq,T}$ noise levels, with daily $L_{Aeq,16hr}$ and $L_{Aeq,8hr}$ noise levels remaining relatively steady for the duration of the survey. As such, no periods have been removed from the noise dataset.

A summary of the weather data obtained for the survey period is presented in Figure A5 of Appendix A.

5.5 Survey Analysis

The full results of the unattended noise monitoring survey are presented in graphical form in Figure A6 of Appendix A and are tabulated in Table B1 in Appendix B.

The measured daily ambient $L_{Amax,F,}$ $L_{Aeq,T}$ and background $L_{A90,T}$ noise levels during daytime and night-time hours, are summarised in Table 5.5 below.

Table 5.5: Summary of Measured Noise Levels

Date	Measured Façade Noise Levels, dB					
	Daytime (07:00 - 23:00)			Night-time (23:00 - 07:00)		
	$L_{Amax,F}$	$L_{Aeq,16hr}$	$L_{A90,16hr}$	$L_{Amax,F}$	$L_{Aeq,8hr}$	$L_{A90,8hr}$
Thursday 26/10/2023 [1]	78(72-96)	66	58	75(72-81)	61	45
Friday 27/10/2023	78(72-91)	67	59	76(73-85)	61	46
Saturday 28/10/2023	77(72-94)	67	59	77(74-83)	61	48
Sunday 29/10/2023	76(71-94)	66	58	71(57-78)	58	52
Monday 30/10/2023	77(71-95)	66	58	75(71-88)	60	45
Tuesday 31/10/2023 [1]	79(72-94)	69	60	-	-	-
Average	***78(76-79)***	***67***	***59***	***75(71-77)***	***60***	***47***

Notes:
[1] incomplete daytime periods due to equipment installation and collection.

The results of the unattended noise measurement show that daytime ambient day time $L_{Aeq,16hr}$ noise levels ranged from 66 to 69 dB with an arithmetic mean average of 67 dB $L_{Aeq,16hr}$. The night-time $L_{Aeq,8hr}$ noise levels ranged from 58 to 61 dB, with an arithmetic mean average of 60 dB.

Night-time average maximum noise levels ranged from 71 to 77 dB $L_{Amax,F,}$ with an arithmetic average of 75 dB.

5.6 Attended Noise Survey Results

The results of the attended noise measurements obtained on Thursday 26th October 2023 are summarised below in Table 5.6 and 5.7, respectively.

Table 5.6: Summary of Attended Noise Measurement at ST1 on Thursday 26th October 2023

Monitoring Location	Date	Start Time	Duration (mins)	Measured Free-field Noise Levels, dB			Observations
		(hh:mm)		$L_{Amax,\ F}$	$L_{Aeq,T}$	$L_{A90,T}$	
ST1	26/10/2023	10:30	5	85.9	69.4	58.6	Road traffic dominates; aircraft take offs in period 1 and 6; emergency vehicle siren in period 2 increases $L_{Amax,F}$ values.
		10:35	5	89.0	69.3	59.6	
		10:40	5	74.3	67.8	61.4	
		10:45	5	75.9	67.7	60.8	
		10:50	5	77.6	68.5	62.1	
		10:55	5	80.7	68.1	58.7	
Cumulative				**89.0**	**68.5**	**60.2**	

Table 5.7: Summary of Attended Noise Measurement at ST2 on Thursday 26th October 2023

Monitoring Location	Date	Start Time (hh:mm)	Dur. (mins)	Measured Free-field Noise Levels, dB			Observations
				$L_{Amax, F}$	$L_{Aeq,T}$	$L_{A90,T}$	
ST2	26/10/2023	11:05	5	72.7	68.2	63.2	Road traffic dominates; aircraft take offs in periods 3, 5 and 6; emergency vehicle siren in period 6 increases $L_{Amax,F}$ values.
		11:10	5	72.9	67.4	61.0	
		11:15	5	75.1	67.0	58.5	
		11:20	5	73.2	67.1	61.3	
		11:25	5	80.3	67.8	59.3	
		11:30	5	90.2	70.0	61.6	
Cumulative				**90.2**	**68.1**	**60.8**	

Analysis of the synchronised attended and unattended measurements indicates there is <1 dB variation in noise levels across the development site.

5.7 Analysis of Brighton City Airport Noise Maps

Brighton City Airport is located approximately 1.2km to the northeast of the proposed development site.

The airport provides flight training, flights for business and pleasure and is an "Executive Jet Centre" for business travel.

The airport's operational hours are summarised in Table 5.8 below.

Table 5.8: Brighton City Airport Operating Hours

Monday - Friday	Saturday	Sunday
Winter		
08:00hrs to 20:00hrs	09:00hrs to 20:00hrs	09:00hrs to 19:00hrs
Summer		
07:00hrs to 19:00hrs	08:00hrs to 19:00hrs	08:00hrs to 18:00hrs

Daytime $L_{Aeq,16hr}$ and L_{den} noise maps, produced by Brighton City Airport [9], are presented in Appendix C.

Analysis of the noise contours indicate that the proposed development falls inside of the 50 dB $L_{Aeq,16hr}$ and 50 dB L_{den} noise contour areas.

The $L_{Aeq,16hr}$ aircraft noise level of 50 dB is 17 dB lower than the mean $L_{Aeq,16hr}$ noise levels measured at LT1. It is therefore considered unlikely that noise from aircrafts will significantly influence the $L_{Aeq,16hr}$ noise levels at the front of the site and road traffic on Brighton Road will be the dominating noise source. However, the façade and external amenity areas at the rear of site are screened from the road traffic and the aircraft noise may be more dominant. To account for this, 50 dB will be logarithmically applied to the calculated $L_{Aeq,16hr}$ noise levels at the calculation receptors on the rear façade of the development (R4, R5, R6, Ext1 and Ext2).

6 NOISE MODELLING

6.1 Calculation of Noise Levels Across the Site

Noise Prediction Model

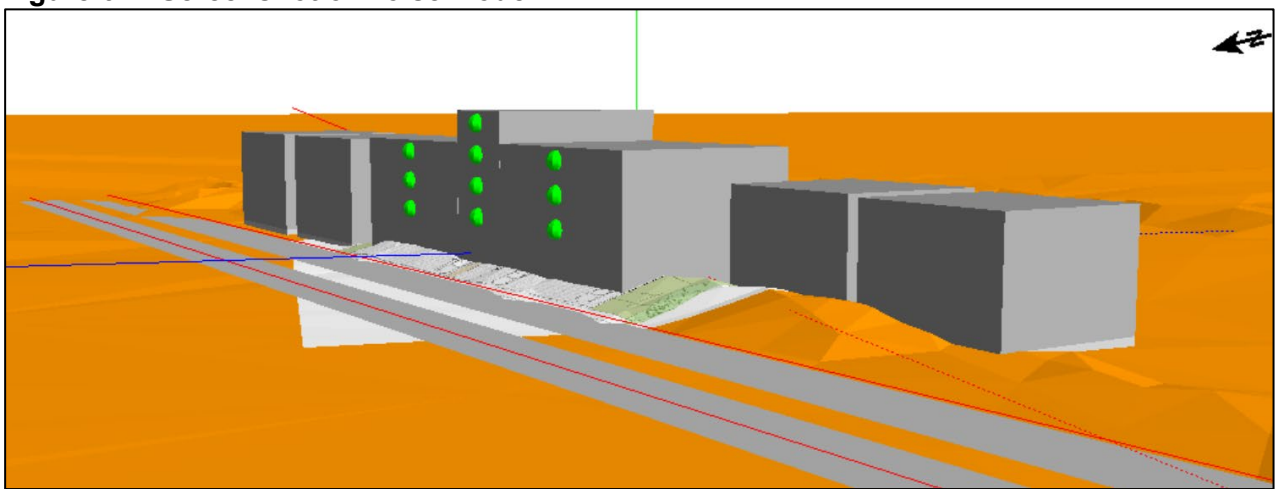
A computer model of noise propagation has been constructed using SoundPLAN version 5.1. This commercial software package implements complex calculations using acoustical ray-tracing techniques, taking into account the acoustically reflective and absorptive properties of the building elements. The noise levels calculated in the noise model are based on the calculation procedures set out in '*Calculation of Road Traffic Noise*,*1988*'.

Using the unattended and attended noise measurements, the noise model was calibrated to within 0.1 dB and 0.2 dB respectively, of the measured mean average $L_{Aeq,16hr}$ and $L_{Aeq,8hr}$ values recorded during the baseline noise survey, as shown in Table 5.5 above.

Following calibration, the proposed development has then been constructed in the model, with calculation receptor positions included. These receptors are displayed in Figure A7 of Appendix A and are labelled as R1 to R6 and Ext1 to Ext2.

A screenshot of the computer noise model is presented below in Figure 6.1.

Figure 6.1: Screenshot of Noise Model



The following assumptions have been considered in the computer model:

- ground cover has been modelled as a mixture of hard and soft ground;
- The topography of the surrounding area has been modelled using a LIDAR Digital Terrain Model (DTM) data available online from Bluesky Mapshop;
- Based on the floor plans for the development, no habitable rooms are located on the ground floor. As such, receivers have been modelled at a height of 4m above local ground, with a floor height of 2.5m, in free-field conditions. The maximum calculated floor level has been taken to provide a worse case assessment;
- no boundary fencing has been assumed at the development; and
- buildings and any other solid barriers, are modelled as reflective acoustic screens.

The results of the calculated noise levels across the development site are presented in Table 6.1 below.

Table 6.1: Estimated Daytime & Night-Time Noise Levels Across the Development Site

Receptor	Façade	Daytime Free-Field Noise Level $L_{Aeq,16hr}$	Night-Time Free-Field Noise Level $L_{Aeq,8hr}$
R1	Front	71	64
R2	Front	71	64
R3	Front	71	64
R4	Rear	53[1]	42
R5	Rear	53[1]	42
R6	Rear	52[1]	41
Ext1	Rear	50[1]	-
Ext2	Rear	50[1]	-

Notes:
[1] calculated daytime noise level plus 50 dB aircraft noise level.

7 PRO-PG ASSESSMENT

7.1 ProPG Stage 1 Assessment

Following ProPG guidance, a Stage 1 – Initial Site Noise Risk assessment has been undertaken to characterise the application site in terms of the likely risk of adverse effects from noise on the future occupants of the development.

Analysis of the measured site noise levels presented in Table 5.5 indicates a 'Medium Risk' for both daytime (60 – 70 dB L_{Aeq}) and night-time (50 – 60 dB L_{Aeq}) periods, according to ProPG's Stage 1 – Initial Site Risk Assessment.

Based on the results of the unattended noise monitoring, a Full Stage 2 Assessment is required.

7.2 ProPG Stage 2 Assessment

Element 1 - Good Acoustic Design Process

Section 5 of BS 8233: 2014 contains guidance on the sequence of stages to be followed in the planning and early acoustic design of a new development. Section 5.4 of BS 8233:2014 outlines a general approach to determining appropriate noise control measures including the following suggested steps:

a) Check the feasibility of reducing noise levels and/or relocating noise sources;

b) Consider options for planning the site or building layout;

c) Consider the orientation of proposed building(s);

d) Select construction types and methods for meeting building performance requirements;

e) Examine the effects of noise control measures on the requirements for ventilation, fire regulation, health and safety, cost, CDM (construction, design and management), etc; and

f) Assess the viability of alternative solutions.

The designer should then decide which of the following options can be applied to reduce noise levels:

a) Quietening or removing the source of noise;

b) Attenuating the sound on its path to the receiver;

c) Obstructing the sound path between source and receiver;

d) Improving the sound insulation of the building envelope; and

e) Using agreements to manage noise.

The main source of noise affecting the proposed development is road traffic noise from Brighton Road.

The road is c. 5m from the northern façade of the development building and it is not practicable to attenuate the noise at source.

It is recommended that the developer adopt, where practically possible, a good acoustic design which should include careful consideration of the internal layouts to minimise noise sensitive rooms facing onto the dominant road noise source.

Element 2 – Internal Noise Level Guidelines

Internal Ambient Noise Level Assessment

BS 8233:2014 contains recommended guideline levels of 35 dB $L_{Aeq,T}$ for resting inside bedrooms and living rooms during the daytime, 40 dB $L_{Aeq,T}$ for dining areas during the daytime and 30 dB $L_{Aeq,T}$ for sleeping inside bedrooms at night.

The approximate sound reduction value for standard thermal double glazing is 30dB R_w.

Taking this typical sound reduction performance into consideration, and on the understanding that the external façade of the new dwellings will provide a similar sound reduction to a brick/block type construction, initial internal noise levels have been predicted inside the habitable rooms at the assessment positions listed.

Noise levels have been calculated using the sound reduction values discussed above. The results for each receptor location are summarised in Table 7.1.

Table 7.1: Assessment of Estimated Daytime Noise Levels

Receptor	Façade	Daytime Free-Field Noise Level $L_{Aeq,16hr}$	Estimated Daytime Internal Noise Level, dB $L_{Aeq,16hr}$	Night-Time Free-Field Noise Level $L_{Aeq,8hr}$	Estimated Night-Time Internal Noise Level, dB $L_{Aeq,8hr}$
			Windows Closed		Windows Closed
R1	Front	71	41	64	34
R2	Front	71	41	64	34
R3	Front	71	41	64	34
R4	Rear	53	19	42	12
R5	Rear	53	19	42	12
R6	Rear	52	18	41	11

Notes:
[1] assuming a 30dB(A) reduction for windows closed; and
[2] red text indicates an exceedance of the BS8233:2014 internal guideline values.

Based on the assumed typical façade reduction described above, the noise predictions show that internal noise levels exceed the daytime guideline levels on the front façade of the development during the daytime period.

During the night-time period, the night-time guideline level of 30 dB $L_{Aeq,T}$ is exceeded within bedrooms on the front façade, assuming glazing with a sound level difference of 30dB.

The daytime and night-time guideline levels are achieved within habitable rooms on the rear façade.

Internal Maximum Noise Level Assessment

Single event noise indicators such as maximum $L_{Amax,F}$ noise levels generated at night have also been considered at the proposed development site.
The WHO 2009 guidance sets an internal sleep disturbance noise limit of 42 dB $L_{Amax,F}$ for the onset of critical health effects, which is a level which should not be exceeded on a regular basis. Based on an interpretation that for a noise to be regular, it needs to occur several (i.e. more than two) times per hour, the $L_{Amax,F}$ noise needs to be based upon an average of at least 10-15 events that are typical in nature.

The 90th percentile of 78 dB $L_{Amax,\ F}$, calculated using the 15-minute night-time $L_{Amax,F}$ noise levels measured at LT1, has been used to determine internal $L_{Amax,\ F}$ noise levels within bedrooms located at the front and rear the development site.

This $L_{Amax,\ F}$ noise level has then been used to calibrate the road source noise level in the noise prediction model, with the site in its current form, prior to adding the proposed development to the noise model to allow an estimate of $L_{Amax,\ F}$ noise levels across the site.

The typical facade reduction described above are then used to estimate internal $L_{Amax,F}$ noise levels across the development and presented in Table 7.2 below.

Table 7.2: Assessment On Estimated $L_{Amax,F}$ Levels Based On Typical Maximum Events

Receptor	Façade	Derived Free-field Night-Time Noise Level $L_{max,F}$	Predicted Night-Time Internal Noise Level, dB $L_{Amax,F}$[1]
			Windows Closed
R1	Front	82	52
R2	Front	82	52
R3	Front	82	52
R4	Rear	60	30
R5	Rear	60	30
R6	Rear	59	29

Notes:
[1] assuming a 30dB(A) reduction for windows closed; and
[2] red text indicates an exceedance of the WHO guideline value.

The results indicate that the WHO $L_{Amax,F}$ criteria is exceeded within bedrooms on the front façade, assuming glazing with a sound level difference of 30dB.

The WHO $L_{Amax,F}$ criteria is met within habitable rooms on the rear façade, again assuming glazing with a sound level difference of 30dB.

Suitable glazing products, to ensure the internal noise criteria can be achieved, are provided in Section 7.

Element 3 – External Amenity Area Noise Assessment

BS 8233 indicates that it is desirable that the external noise level in these areas does not exceed 50 dB $L_{Aeq,T}$ with an upper guideline value of 55 dB $L_{Aeq,T}$ in noisier environments.

The predicted noise level in the external garden areas has been assessed. The assessment locations are highlighted as Ext1 to Ext2 in Figure A7 of Appendix A.

The results of the assessment shows that the external noise levels are equal to the lower guideline level of 50 dB $L_{Aeq,\ 16hrs}$ set out on BS8233.

Element 4 – Assessment of Other Relevant Issues

Element 4 is intended to consider other potential noise issues and/or sources that may be introduced by the proposed development.

It is understood that at this stage, no other noise source such as fixed plant is proposed at this stage, however, should plant such as air source heat pumps be installed as part of the project proposals, the potential impact could cause disturbance when in operation. This will require consideration and will likely be subject to Local Authority requirements.

The Local Authority criteria for external plant is usually a rating noise level to be no greater than the existing background sound level when assessed in accordance with BS 4142:2014+A1:2019.

8 MITIGATION OPTIONS

8.1 Glazing Strategy

Based on the noise assessment, to ensure desirable internal noise conditions can be achieved, it is considered that:

- Enhanced double glazing with a minimum sound level difference of 40 dB should be considered for bedrooms on the front façade of the development;
- Enhanced double glazing with a minimum sound level difference of 36 dB should be considered for living rooms on the front façade of the development;
- Enhanced double glazing with a minimum sound level difference of 31 dB should be considered within dining rooms on the front façade of the development; and
- Standard double glazing with a minimum sound level difference of 30dB will be suitable for all habitable rooms on the rear façade of the development.

An example of suitable glazing product is presented in Table 8.1 below:

Table 8.1: Appropriate Glazing Specification for the Development

Room	Minimum Sound Insulation Requirements	Typical Glazing Specification
Bedrooms on the front (north) façade of the development	40dB	10mm glass – 1mm air cavity – 8.8mm acoustic laminate
Living rooms on the front (north) façade of the development	36dB	4mm glass – 12mm air cavity – 6.6mm acoustic laminate
Dining rooms on the front (north) façade of the development	31dB	4mm glass – 14mm air cavity – 6mm
All habitable rooms on the rear (south) south façade of the development	30dB	4mm glass – 16mm air cavity – 4mm

The information provided in Table 8.1 is based on a broad assessment to provide an early indication of glazing requirements for the residential development site and does not account for the volume of glazing required for each facade. It is possible that a more enhanced glazing product may be required, depending on the quantity of glazing and the final ventilation strategy selected. Detailed internal calculations should be undertaken for the worst affected facades once final façade information has been determined to ensure the glazing and ventilation selection is suitable.

8.2 Ventilation Strategy

The results have shown that with appropriate glazing, desirable internal conditions can be achieved. The development will also need to incorporate a background ventilation system, in compliance with Approved Document F[11] .

The ventilation requirements set out in Approved Document F can be delivered by a natural ventilation system or a mechanical ventilation system or a combination of both.

Continuous mechanical supply and extract with heat recovery (MHRV re. Approved Document F, system 4) could be used to provide background ventilation across the proposed building. The ventilation system can be used to supply and extract air from all rooms of the houses via ductwork venting to atmosphere.

The MVHR system alleviates the need for additional trickle ventilation to be built into the apartment facades, however, the following should be considered to ensure that internal noise levels are not compromised:

- operating noise from the ventilation unit;
- vibration isolation to ensure the mechanical system does not transmit vibration into building elements; and
- inlet/outlet attenuators should be incorporated.

Alternatively, adequate ventilation can also be provided with the implementation of mechanical ventilation to wet rooms and the provision of trickle vents to the glazing units.

This direct air path trickle ventilation can be fitted into the windows to provide a means of passive ventilation to allow windows to be kept closed if required.

Examples of trickle ventilation and in-wall ventilator manufacturers include Passivent, Greenwood, Glidevale and Timloc. Other manufacturers are also available.

8.3 Overheating

Consideration has also been given to the internal noise levels when windows to habitable rooms are open, for example, during the summer months, to help combat overheating.

Paragraph 3.3 of AD-O states that windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.

- 40dB $L_{Aeq,T,}$ averaged over 8 hours (between 11pm and 7am); and
- 55dB L_{AFmax}, more than 10 times a night (between 11pm and 7am).

The development site is categorised as having a ‘moderate risk’ of overheating, according to information presented within AD-O. Where windows are open to combat overheating within a ‘moderate risk’ area, AD-O indicates a 9dB level difference is expected between an external free-field noise level and an internal noise level. Using this assumption, internal $L_{Aeq,8hr}$ and $L_{Amax,F}$ noise levels have been estimated. The results are presented below in Tables 8.2 and 8.3 for the calculated internal ambient and maximum noise levels, respectively.

Table 8.2: Estimate of Internal $L_{Aeq,T}$ Noise Levels – Windows Open

Receptor	Façade	Night-Time Free-Field Noise Level $L_{Aeq,8hr}$	Estimated Night-Time Internal Noise Level, dB $L_{Aeq,8hr}$
			Windows Open
R1	Front	64	55
R2	Front	64	55
R3	Front	64	55
R4	Rear	42	33
R5	Rear	42	33
R6	Rear	41	32

Notes:
[1] allows for 9dB reduction through a partially open window; and
[2] red text indicates an exceedance of AD-O internal noise limit.

The predicted internal $L_{Aeq,8hr}$ noise levels in the proposed bedrooms on the front façade are estimated to exceed the noise limits set-out in AD-O. The AD-O limits are met on the rear façade.

Table 8.3: Estimate of Internal $L_{Amax,F}$ Noise Levels – Windows Open

Receptor	Façade	Derived Free-field Night-Time Noise Level $L_{max,F}$	Predicted Night-Time Internal Noise Level, dB $L_{Amax,F}$[1]
			Windows Open
R1	Front	82	73
R2	Front	82	73
R3	Front	82	73
R4	Rear	60	51
R5	Rear	60	51
R6	Rear	59	50

Notes:
[1] allows for 9dB reduction through a partially open window; and
[2] red text indicates an exceedance of AD-O internal noise limit.

The results of the assessment have shown that during the night-time period, the estimated internal $L_{Amax,F}$ noise levels in bedrooms on the front façade exceeds the limit set-out in AD-O.

Therefore, should the overheating strategy for the development rely on opening windows during the summer months for cooling purposes, there may be a risk of an adverse noise impact within bedrooms on the front façade.

The degree of adverse impact will depend on a number of factors including the time, duration and frequency for which the windows would need to remain open, which would be considered as part of the overheating assessment. Should the risk be determined as significant, consideration of alternative options to provide summer cooling may need to be considered.

9 SUMMARY AND CONCLUSIONS

7th Wave Acoustics has been appointed by Southern Rock Property Ltd to prepare a noise assessment to support a planning application to Adur and Worthing Councils for the proposed residential development at Land Between 76 - 78 Brighton Road, Lancing, West Sussex.

The existing noise environment at the development site has been established, through unattended and attended noise monitoring.

Subjective observations undertaken on site indicate that road traffic on Brighton Road (A259) is the dominant noise source impacting the site. Aircraft movements from Brighton City Airport were also noted as a noise source impacting the site.

The noise conditions on site indicate that it would be categorised as a 'Medium Risk' site according to ProPG Stage 1 - Initial Site Risk assessment guidelines. Following this, a Stage 2 – Full Assessment has been undertaken and advice has been given on the design of the building envelope to ensure that internal noise levels inside habitable rooms fall within guideline values recommended in ProPG, BS 8233: 2014 and WHO Guidelines. A glazing and ventilation strategy, to ensure desirable internal conditions can be achieved in all habitable rooms on the development, is presented in Section 7.

The results indicate external levels will meet the lower guideline criteria recommended in ProPG and BS8233 of 50dB $L_{Aeq,\ 16hr}$ in external locations in the rear garden areas.

With windows open to help combat overheating, bedrooms on the front façade of the development may experience internal noise levels which could lead to adverse impact. This risk should be considered further when the overheating strategy for the development is finalised.

Based on the ProPG approach followed in this assessment, our recommendation to the decision maker with regard to noise is that "Planning consent may be granted subject to the inclusion of suitable noise conditions". These would be expected with regard to the achievement of appropriate internal noise levels within habitable spaces intended for residential use, as well as for noise emissions from building services plant associated with the development to nearby sensitive properties, although it is acknowledged that at this stage this is not proposed.

10 REFERENCES

1. Department of Communities and Local Government. National Planning Policy Framework, 2021

2. Department for Environment, Food and Rural Affairs (DEFRA). Noise Policy Statement for England (NPSE), 2010.

3. The Planning Noise Advice Document: Sussex.2021.

4. British Standard BS 8233: 2014: Guidance on Sound Insulation and Noise Reduction for Buildings.

5. World Health Organisation. 2018. Environmental Noise Guidelines for the European Region.

6. World Health Organisation. 1999. Guidelines for Community Noise.

7. World Health Organisation. Night Noise Guidelines for Europe. 2009.

8. Institute of Acoustics (IOA), Association of Noise Consultants (ANC) and Chartered Institute of Environmental Health (CIEH), “Professional Practice Guidance on Planning & Noise,” 2017.

9. Approved Document O – Overheating (2021). HM Stationary Office. 2021.

10. Brighton City Airport Noise Maps. Document reference J1583. 2014.

11. The Building Regulations 2010. Approved Document F – Means of Ventilation

APPENDIX A: FIGURES

Figure A1: Site Location Plan and Noise Monitoring Locations

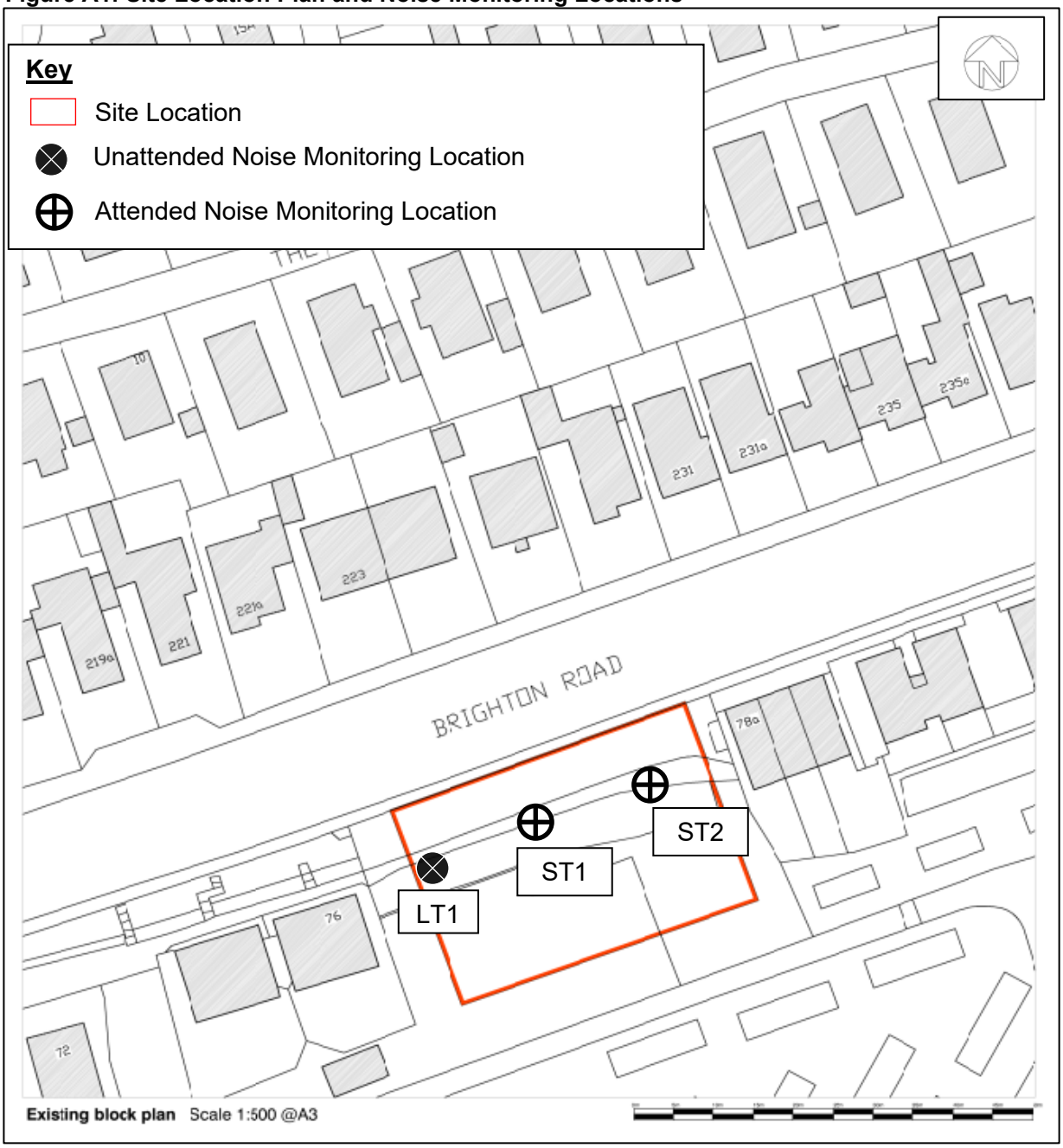
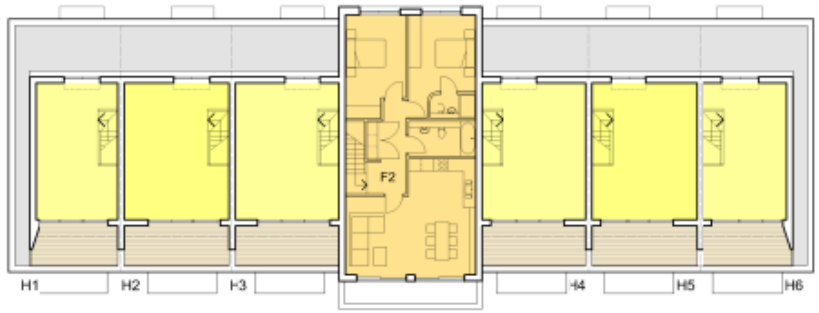


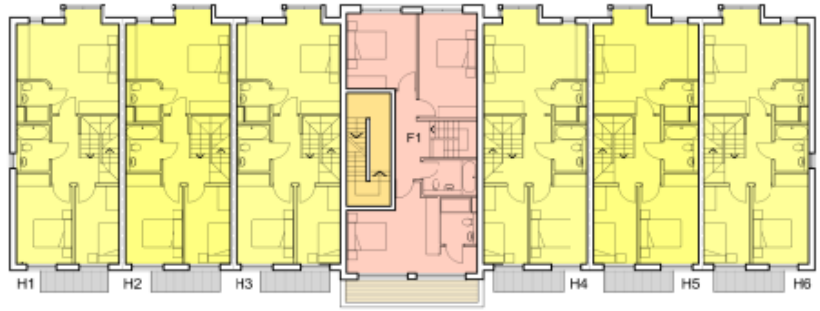
Figure A2: Proposed Ground & First Floor Plans



Figure A3: Proposed Third and Fourth Floor Plans



Proposed third floor plan scale 1:200 @A3



Proposed second floor plan scale 1:200 @A3

Accommodation

H1	3/4 bedroom house	202 sqm
H2	3/4 bedroom house	207 sqm
H3	3/4 bedroom house	207 sqm
H4	3/4 bedroom house	207 sqm
H5	3/4 bedroom house	207 sqm
H6	3/4 bedroom house	202 sqm
F1	3 bedroom apartment	143 sqm
F2	2 bedroom apartment	96 sqm

Planning issue

C 161023 Fourth floor omitted
B 180923 Schedule of accommodation updated
A 200723 Minor amendment

Southern Rock

Land adjacent to 76 Brighton Rd Lancing, West Sussex

Proposed Plans

Turner Associates
Architects and Planning Consultants

TA 1405 /12 C

Figure A4: Proposed North Elevation and Street Scene to Brighton Road



Figure A5: Weather Data Obtained for Unattended Noise Monitoring Period

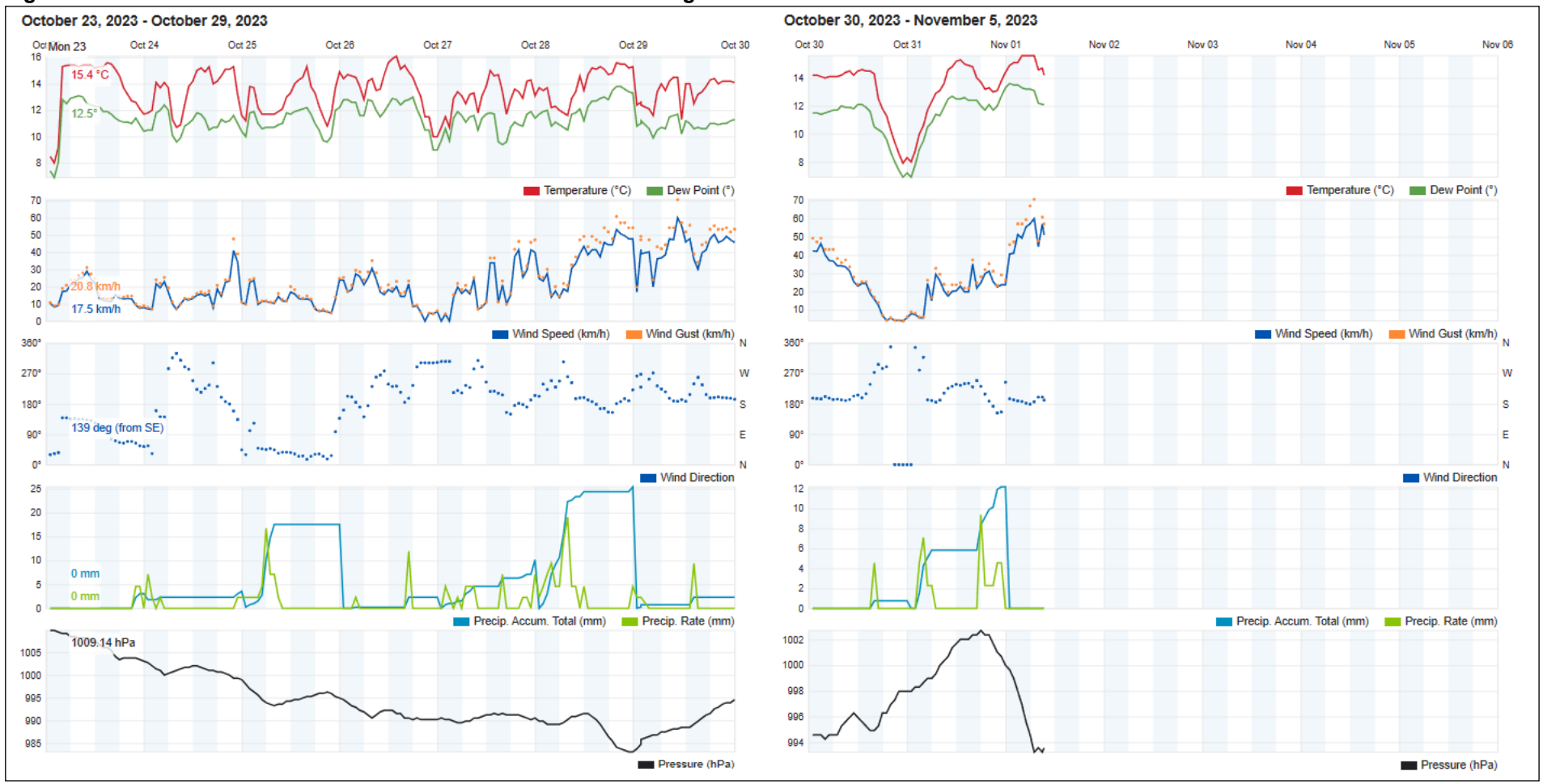


Figure A6: Time History of Unattended Noise Monitoring Data – LT1

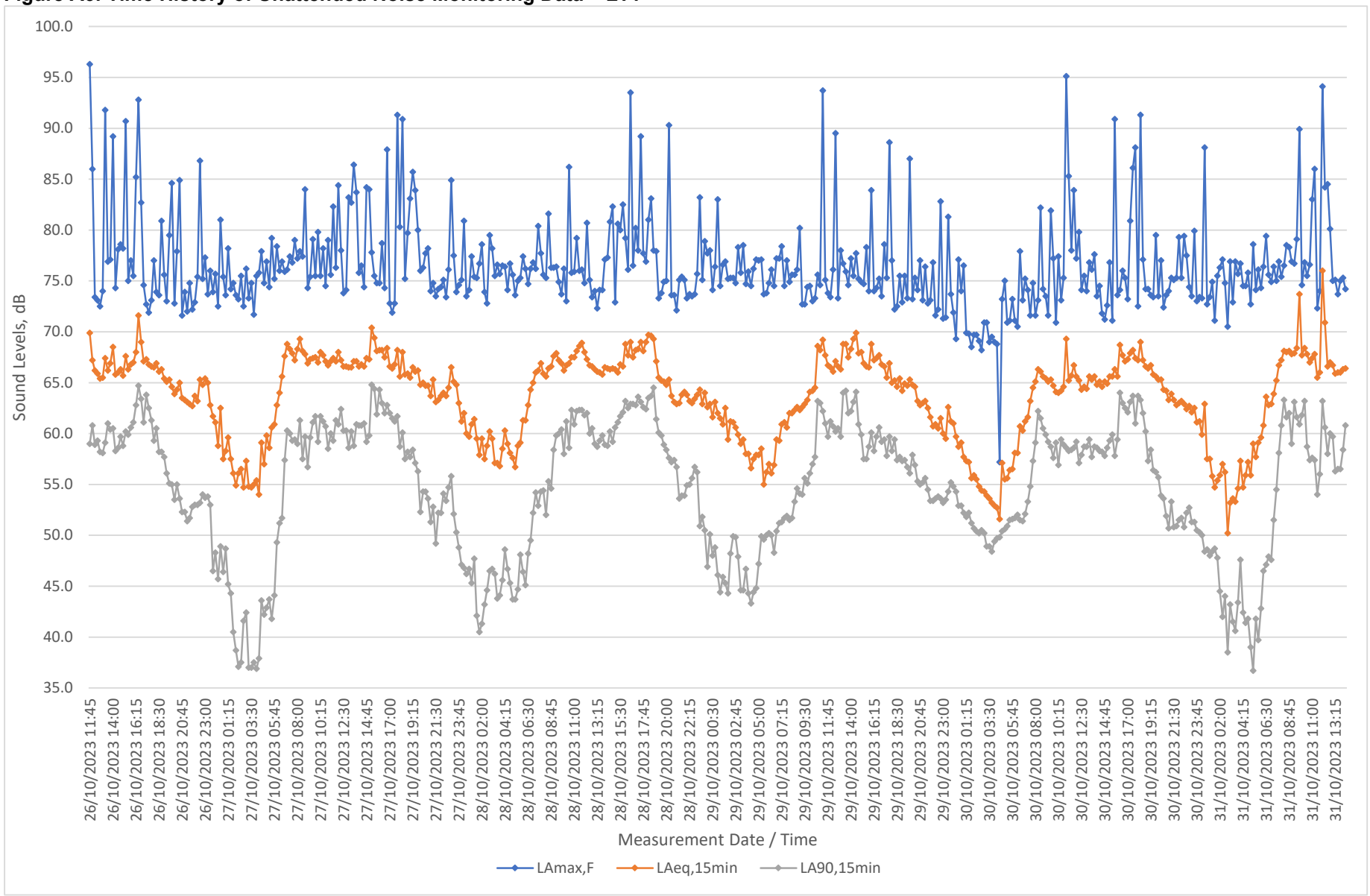
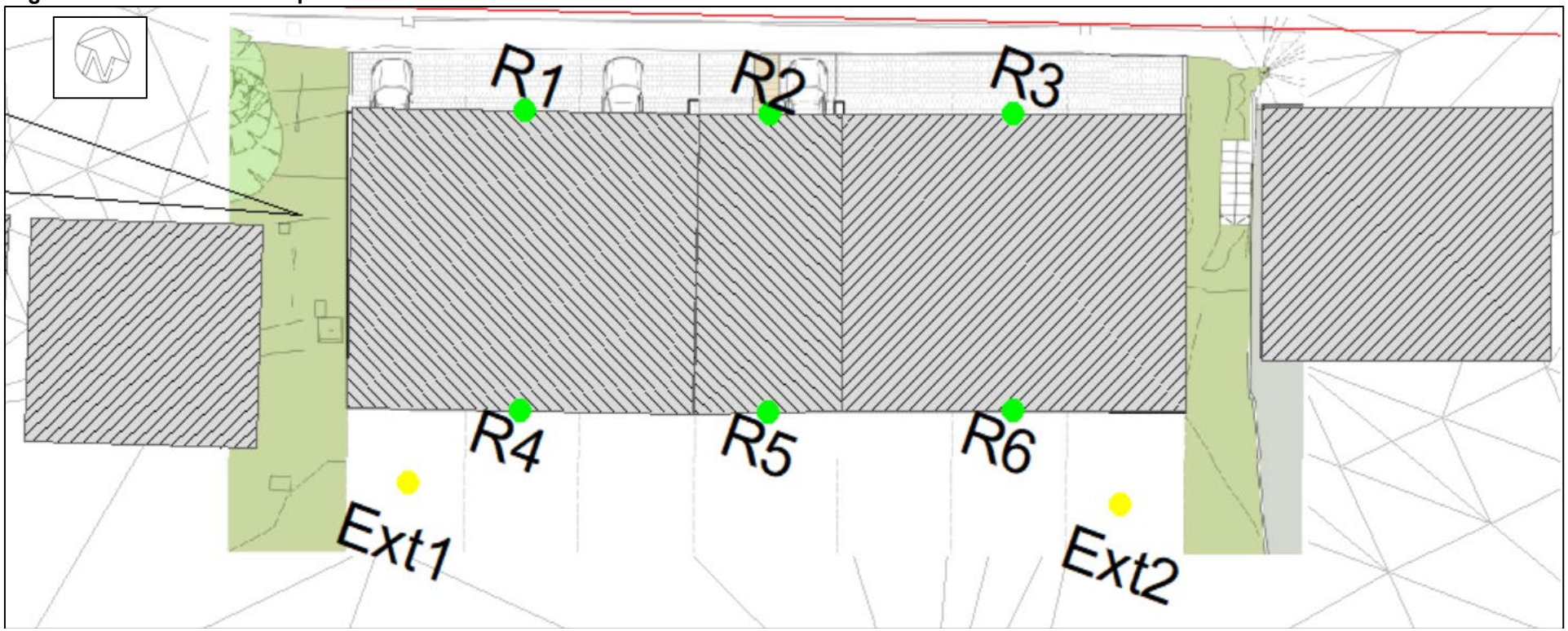


Figure A7: Calculation Receptor Locations



APPENDIX B: TABLES

Table B1: Unattended Noise Monitoring Data – LT1

Date of Meas.	Start Time	Measured Sound Levels, dB		
		$L_{Amax,F}$	$L_{Aeq,15min}$	$L_{A90,15min}$
Thursday 26th	11:45	96.3	69.9	59.0
October 2023	12:00	86.0	67.2	60.8
	12:15	73.4	66.2	58.9
	12:30	73.1	65.9	59.3
	12:45	72.5	65.4	58.2
	13:00	74.0	65.5	58.1
	13:15	91.8	67.4	59.1
	13:30	76.9	66.2	61.0
	13:45	77.1	66.9	60.4
	14:00	89.2	68.5	60.5
	14:15	74.3	65.8	58.3
	14:30	78.1	66.0	58.6
	14:45	78.6	66.3	59.7
	15:00	78.2	65.7	58.8
	15:15	90.7	67.6	60.2
	15:30	75.0	66.3	59.9
	15:45	77.0	66.8	60.6
	16:00	75.5	67.0	61.1
	16:15	85.2	68.0	62.8
	16:30	92.8	71.6	64.7
	16:45	82.7	69.0	63.4
	17:00	74.6	67.1	61.1
	17:15	72.7	67.3	63.8
	17:30	71.9	66.8	62.5
	17:45	73.1	66.6	61.3
	18:00	77.0	66.5	59.3
	18:15	73.9	66.9	60.5
	18:30	73.6	66.1	58.2
	18:45	80.9	66.3	58.2
	19:00	75.6	65.4	57.7
	19:15	73.0	65.1	56.1
	19:30	79.5	65.3	55.1
	19:45	84.6	64.6	55.0
	20:00	72.8	63.9	53.5
	20:15	77.9	64.3	55.0
	20:30	84.9	65.0	53.6
	20:45	71.6	63.5	52.3
	21:00	73.9	63.3	52.3
	21:15	72.0	63.1	51.4
	21:30	74.8	62.9	51.7
	21:45	72.2	62.7	52.8
	22:00	72.9	63.7	53.0
	22:15	75.4	63.2	53.0
	22:30	86.8	65.3	53.2

Table B1: Unattended Noise Monitoring Data – LT1

Date of Meas.	Start Time	Measured Sound Levels, dB		
		$L_{Amax,F}$	$L_{Aeq,15min}$	$L_{A90,15min}$
Thursday 26th	22:45	75.2	64.8	54.0
October 2023	23:00	77.3	65.4	53.7
	23:15	73.7	65.0	53.8
	23:30	76.0	62.8	53.0
	23:45	73.9	61.7	46.5
Friday 27th	00:00	75.7	61.1	48.3
October 2023	00:15	72.5	58.8	45.7
	00:30	81.0	62.5	48.9
	00:45	75.4	57.5	46.4
	01:00	73.6	58.3	48.7
	01:15	78.2	59.6	45.2
	01:30	74.2	57.5	44.3
	01:45	74.8	56.1	40.5
	02:00	73.6	54.9	38.7
	02:15	73.2	56.1	37.1
	02:30	75.5	56.5	37.5
	02:45	72.5	54.7	41.6
	03:00	76.2	57.3	42.4
	03:15	73.3	54.8	37.0
	03:30	74.8	54.7	37.0
	03:45	71.7	55.0	37.5
	04:00	75.5	55.4	36.9
	04:15	75.8	54.0	37.9
	04:30	77.9	59.1	43.6
	04:45	74.8	57.0	42.2
	05:00	76.9	59.8	42.9
	05:15	74.4	58.6	43.7
	05:30	79.2	60.6	41.8
	05:45	75.2	60.9	44.1
	06:00	78.4	62.8	49.3
	06:15	76.0	64.0	51.2
	06:30	76.9	65.6	51.7
	06:45	75.9	67.6	57.4
	07:00	76.1	68.8	60.3
	07:15	77.4	68.3	60.0
	07:30	76.8	67.9	59.3
	07:45	79.0	67.2	59.4
	08:00	77.2	68.3	59.0
	08:15	77.9	69.3	61.3
	08:30	77.4	68.1	57.5
	08:45	84.0	67.8	59.7
	09:00	74.3	66.9	56.7
	09:15	75.4	67.3	59.6
	09:30	79.1	67.4	61.1

Table B1: Unattended Noise Monitoring Data – LT1

Date of Meas.	Start Time	Measured Sound Levels, dB		
		$L_{Amax,F}$	$L_{Aeq,15min}$	$L_{A90,15min}$
Friday 27th	09:45	75.5	67.5	61.7
October 2023	10:00	79.8	67.0	59.2
	10:15	75.5	68.0	61.7
	10:30	78.2	67.7	61.2
	10:45	74.5	67.1	60.7
	11:00	79.0	66.7	58.5
	11:15	75.6	67.1	60.0
	11:30	82.3	67.4	59.3
	11:45	76.3	67.1	61.3
	12:00	84.4	68.0	60.9
	12:15	78.0	67.2	62.4
	12:30	73.8	66.6	60.3
	12:45	74.1	66.6	60.3
	13:00	83.2	66.5	58.6
	13:15	82.7	66.5	60.2
	13:30	86.4	67.1	58.8
	13:45	83.7	67.1	60.9
	14:00	75.8	66.6	60.8
	14:15	76.5	66.8	60.8
	14:30	74.4	66.6	61.0
	14:45	84.2	67.4	59.2
	15:00	84.0	67.3	59.8
	15:15	77.8	70.4	64.8
	15:30	75.5	69.4	64.4
	15:45	74.8	68.1	61.9
	16:00	74.8	68.2	64.3
	16:15	78.7	68.2	63.0
	16:30	74.3	67.5	62.0
	16:45	87.9	68.4	62.8
	17:00	72.8	66.6	62.0
	17:15	71.9	66.4	61.5
	17:30	72.8	66.8	61.2
	17:45	91.3	68.2	61.7
	18:00	80.3	65.6	58.7
	18:15	90.9	68.0	60.1
	18:30	75.2	65.8	57.5
	18:45	79.7	65.9	58.2
	19:00	83.1	65.5	57.7
	19:15	85.7	66.5	58.4
	19:30	83.9	66.1	57.1
	19:45	80.0	66.2	56.3
	20:00	76.0	64.8	52.3
	20:15	76.3	65.0	54.3
	20:30	77.7	64.7	54.3

Table B1: Unattended Noise Monitoring Data – LT1

Date of Meas.	Start Time	Measured Sound Levels, dB		
		$L_{Amax,F}$	$L_{Aeq,15min}$	$L_{A90,15min}$
Friday 27th	20:45	78.2	64.7	53.6
October 2023	21:00	74.0	63.7	51.3
	21:15	74.8	65.3	52.8
	21:30	73.5	63.1	49.2
	21:45	74.2	63.3	52.2
	22:00	74.4	63.7	52.2
	22:15	75.1	64.0	54.1
	22:30	73.4	63.7	53.4
	22:45	76.1	64.5	54.7
	23:00	84.9	66.5	55.8
	23:15	77.5	65.1	52.1
	23:30	73.9	64.8	50.3
	23:45	74.6	63.0	48.8
Saturday 28th	00:00	75.1	61.2	47.1
October 2023	00:15	80.9	62.0	46.8
	00:30	73.5	60.0	46.2
	00:45	74.1	59.7	46.7
	01:00	77.4	60.9	45.3
	01:15	75.4	61.4	47.7
	01:30	75.3	59.5	42.1
	01:45	76.7	57.9	40.5
	02:00	78.6	59.5	41.3
	02:15	73.9	57.5	43.2
	02:30	72.8	58.8	44.6
	02:45	79.5	60.2	46.5
	03:00	78.2	59.5	46.7
	03:15	75.5	57.1	46.2
	03:30	76.6	57.1	43.8
	03:45	75.7	56.8	44.1
	04:00	76.5	58.5	45.6
	04:15	76.4	60.3	48.6
	04:30	74.1	59.0	46.7
	04:45	76.7	58.1	45.3
	05:00	75.6	57.6	43.7
	05:15	73.6	56.7	43.7
	05:30	75.0	58.8	44.7
	05:45	75.3	59.1	48.1
	06:00	77.4	61.3	46.4
	06:15	76.2	61.3	45.1
	06:30	74.7	62.8	48.2
	06:45	76.2	64.3	49.5
	07:00	76.8	65.0	52.2
	07:15	76.2	66.0	54.2
	07:30	80.4	66.2	52.9

Table B1: Unattended Noise Monitoring Data – LT1

Date of Meas.	Start Time	Measured Sound Levels, dB		
		$L_{Amax,F}$	$L_{Aeq,15min}$	$L_{A90,15min}$
Saturday 28th	07:45	77.7	66.9	54.3
October 2023	08:00	75.6	65.9	54.4
	08:15	75.3	65.6	52.0
	08:30	81.6	66.4	55.3
	08:45	76.3	66.6	54.6
	09:00	76.3	67.6	58.4
	09:15	76.4	67.9	59.8
	09:30	74.9	67.2	60.0
	09:45	73.7	66.9	60.4
	10:00	76.2	66.2	58.0
	10:15	73.0	66.7	61.2
	10:30	86.2	66.9	58.6
	10:45	75.8	67.5	62.3
	11:00	75.9	67.5	60.9
	11:15	79.2	68.1	62.2
	11:30	76.0	68.6	62.3
	11:45	76.1	68.9	62.3
	12:00	74.8	68.0	61.8
	12:15	80.7	67.3	62.0
	12:30	75.1	66.7	60.0
	12:45	73.4	66.6	60.5
	13:00	74.0	66.3	59.0
	13:15	72.3	66.1	58.7
	13:30	74.1	66.0	59.3
	13:45	74.1	65.8	59.8
	14:00	77.1	66.5	58.9
	14:15	77.3	66.4	58.8
	14:30	80.8	66.3	60.2
	14:45	82.3	66.4	59.2
	15:00	72.9	66.3	60.6
	15:15	80.6	66.0	61.1
	15:30	80.0	66.8	61.7
	15:45	82.5	66.6	62.1
	16:00	79.2	68.8	63.2
	16:15	76.1	67.7	62.5
	16:30	93.5	69.0	62.9
	16:45	76.5	67.5	62.9
	17:00	80.2	68.2	62.8
	17:15	78.0	68.3	63.6
	17:30	89.2	69.0	63.1
	17:45	77.7	68.1	62.6
	18:00	76.9	69.0	62.4
	18:15	81.0	69.7	63.5
	18:30	83.1	69.6	63.7

Table B1: Unattended Noise Monitoring Data – LT1

Date of Meas.	Start Time	Measured Sound Levels, dB		
		$L_{Amax,F}$	$L_{Aeq,15min}$	$L_{A90,15min}$
Saturday 28th	18:45	78.0	69.3	64.5
October 2023	19:00	77.9	67.1	61.4
	19:15	73.3	65.5	60.1
	19:30	73.8	65.2	59.8
	19:45	74.9	65.1	58.9
	20:00	75.0	64.8	58.4
	20:15	90.3	65.3	57.6
	20:30	73.6	63.7	57.2
	20:45	73.6	63.1	57.4
	21:00	72.1	62.9	56.7
	21:15	75.1	63.0	53.6
	21:30	75.4	63.8	53.9
	21:45	75.1	64.1	53.9
	22:00	73.3	63.8	54.9
	22:15	73.7	63.2	55.0
	22:30	73.5	63.0	55.6
	22:45	73.7	63.4	56.7
	23:00	75.7	63.8	56.2
	23:15	83.2	64.3	50.9
	23:30	75.1	62.9	51.8
	23:45	78.9	64.0	50.5
Sunday 29th	00:00	77.7	62.6	46.9
October 2023	00:15	78.0	62.9	50.1
	00:30	74.1	61.6	48.0
	00:45	76.4	63.1	48.8
	01:00	83.0	62.0	46.1
	01:15	74.5	61.5	44.4
	01:30	76.6	60.9	45.9
	01:45	76.9	62.5	45.3
	02:00*	78.3*	59.9*	47.9*
	02:15	75.8	59.0	44.6
	02:30	78.5	59.4	44.6
	02:45	74.7	58.0	46.7
	03:00	75.9	58.0	44.3
	03:15	74.5	56.6	43.3
	03:30	76.2	57.5	44.4
	03:45	77.1	57.9	44.8
	04:00	77.0	57.9	47.2
	04:15	77.1	58.5	49.9
	04:30	73.7	55.0	49.6
	04:45	73.8	56.2	50.0
	05:00	74.8	57.0	50.2
	05:15	76.1	56.1	50.0
	05:30	74.5	56.9	48.3

Table B1: Unattended Noise Monitoring Data – LT1

Date of Meas.	Start Time	Measured Sound Levels, dB		
		$L_{Amax,F}$	$L_{Aeq,15min}$	$L_{A90,15min}$
Sunday 29th	05:45	77.2	59.4	50.4
October 2023	06:00	77.2	59.3	51.2
	06:15	78.4	60.9	51.3
	06:30	74.5	61.1	51.7
	06:45	77.0	60.6	51.9
	07:00	74.9	62.0	51.5
	07:15	75.6	62.0	51.7
	07:30	75.6	62.3	53.3
	07:45	76.1	62.6	54.6
	08:00	80.2	62.3	54.1
	08:15	72.7	62.6	54.0
	08:30	72.7	62.9	55.6
	08:45	74.4	63.3	55.1
	09:00	74.5	64.1	56.1
	09:15	73.0	64.2	57.0
	09:30	73.3	64.5	57.7
	09:45	75.6	68.6	63.2
	10:00	74.6	68.2	63.0
	10:15	93.7	69.2	62.2
	10:30	75.1	67.7	61.0
	10:45	73.8	66.7	59.7
	11:00	73.4	66.5	61.2
	11:15	76.1	66.1	60.7
	11:30	89.5	67.1	60.2
	11:45	73.3	66.6	60.5
	12:00	78.0	66.3	59.7
	12:15	76.7	68.8	64.0
	12:30	75.9	68.8	64.2
	12:45	74.6	67.5	62.0
	13:00	77.2	68.3	62.2
	13:15	75.5	69.3	63.1
	13:30	77.7	69.9	64.1
	13:45	75.2	67.9	60.9
	14:00	74.9	68.0	59.9
	14:15	74.7	66.9	57.5
	14:30	78.3	66.6	57.5
	14:45	74.0	66.5	58.7
	15:00	83.9	68.8	60.1
	15:15	74.0	67.2	58.3
	15:30	74.3	67.4	59.7
	15:45	75.2	67.7	60.6
	16:00	73.5	66.8	59.2
	16:15	78.6	66.6	59.4
	16:30	75.3	65.5	57.8

Table B1: Unattended Noise Monitoring Data – LT1

Date of Meas.	Start Time	Measured Sound Levels, dB		
		$L_{Amax,F}$	$L_{Aeq,15min}$	$L_{A90,15min}$
Sunday 29th	16:45	88.6	66.9	59.7
October 2023	17:00	77.0	65.0	58.3
	17:15	72.2	65.2	59.4
	17:30	72.5	64.6	57.4
	17:45	75.5	65.4	57.7
	18:00	72.9	64.2	57.3
	18:15	75.5	64.9	57.4
	18:30	73.3	64.7	56.7
	18:45	87.0	65.3	56.1
	19:00	73.2	64.8	57.9
	19:15	75.3	64.6	56.9
	19:30	74.1	63.2	55.3
	19:45	77.0	62.8	55.0
	20:00	73.1	63.0	55.2
	20:15	76.4	63.2	55.6
	20:30	72.8	62.5	54.5
	20:45	73.1	61.6	53.4
	21:00	76.8	60.7	53.4
	21:15	71.6	60.9	53.6
	21:30	72.2	60.5	53.8
	21:45	82.8	61.5	53.6
	22:00	71.3	60.0	53.2
	22:15	71.4	59.5	53.5
	22:30	81.3	62.6	54.3
	22:45	73.7	61.2	55.2
	23:00	71.9	61.0	54.8
	23:15	69.3	59.7	54.3
	23:30	77.1	58.7	52.9
	23:45	74.0	59.1	52.9
Monday 30th	00:00	76.5	57.7	52.2
October 2023	00:15	69.9	57.3	51.8
	00:30	69.8	57.2	52.2
	00:45	68.5	55.6	51.2
	01:00	69.7	55.9	50.7
	01:15	69.7	55.5	50.4
	01:30	69.1	54.8	50.2
	01:45	68.2	54.4	50.5
	02:00	70.9	54.3	50.2
	02:15	70.9	53.9	48.9
	02:30	69.0	53.6	48.9
	02:45	69.5	53.2	48.4
	03:00	69.0	52.9	49.4
	03:15	68.8	52.7	49.7
	03:30	57.2	51.6	49.8

Table B1: Unattended Noise Monitoring Data – LT1

Date of Meas.	Start Time	Measured Sound Levels, dB		
		$L_{Amax,F}$	$L_{Aeq,15min}$	$L_{A90,15min}$
Monday 30th	03:45	73.2	57.1	50.4
October 2023	04:00	75.0	55.5	50.6
	04:15	70.9	55.6	50.9
	04:30	71.1	56.4	51.5
	04:45	73.2	56.5	51.6
	05:00	71.1	58.1	51.7
	05:15	70.5	58.1	52.0
	05:30	77.9	60.7	51.5
	05:45	73.1	60.3	51.4
	06:00	75.2	61.2	52.1
	06:15	74.1	61.6	53.3
	06:30	71.6	63.2	54.8
	06:45	74.8	64.5	57.3
	07:00	71.6	65.1	59.1
	07:15	73.1	66.3	62.2
	07:30	82.2	66.1	61.5
	07:45	74.2	65.6	60.5
	08:00	73.5	65.4	59.9
	08:15	71.6	65.1	59.2
	08:30	81.9	65.3	58.7
	08:45	77.2	64.7	57.6
	09:00	70.9	64.1	59.1
	09:15	77.4	64.0	56.9
	09:30	73.1	64.2	59.4
	09:45	75.3	64.6	58.9
	10:00	95.1	69.3	58.6
	10:15	85.3	65.2	58.3
	10:30	78.0	65.7	58.4
	10:45	83.9	66.7	58.6
	11:00	77.2	65.6	59.2
	11:15	79.8	65.2	57.1
	11:30	74.1	64.3	57.9
	11:45	75.5	64.6	58.7
	12:00	74.0	64.4	58.7
	12:15	76.8	65.6	59.4
	12:30	76.1	65.3	57.7
	12:45	77.6	65.6	58.7
	13:00	73.5	64.8	58.6
	13:15	74.5	65.1	58.3
	13:30	71.8	64.6	58.2
	13:45	71.2	65.1	57.8
	14:00	72.6	64.9	58.6
	14:15	76.8	65.6	59.3
	14:30	71.1	65.6	59.9

Table B1: Unattended Noise Monitoring Data – LT1

Date of Meas.	Start Time	Measured Sound Levels, dB		
		$L_{Amax,F}$	$L_{Aeq,15min}$	$L_{A90,15min}$
Monday 30th	14:45	90.9	66.3	57.8
October 2023	15:00	73.6	65.6	59.4
	15:15	74.1	68.7	64.0
	15:30	76.0	67.7	63.0
	15:45	75.3	67.1	62.5
	16:00	73.2	67.3	62.1
	16:15	80.9	67.9	63.1
	16:30	86.1	68.2	63.7
	16:45	88.1	67.4	61.0
	17:00	72.5	67.2	63.7
	17:15	91.3	69.0	63.3
	17:30	77.1	67.2	62.0
	17:45	74.2	66.6	60.2
	18:00	74.2	66.4	57.3
	18:15	73.6	66.7	58.4
	18:30	73.4	65.8	56.4
	18:45	79.5	65.6	56.2
	19:00	73.5	65.3	55.7
	19:15	77.0	65.3	53.9
	19:30	72.4	64.3	53.6
	19:45	73.6	64.2	51.9
	20:00	74.0	63.3	50.7
	20:15	75.3	63.9	53.3
	20:30	75.1	63.3	50.8
	20:45	75.3	62.8	50.9
	21:00	79.3	63.0	51.5
	21:15	75.3	63.2	51.7
	21:30	79.4	62.9	50.8
	21:45	77.5	62.4	52.2
	22:00	74.4	62.7	52.7
	22:15	73.5	62.1	51.3
	22:30	79.9	62.5	51.3
	22:45	73.0	61.1	50.5
	23:00	73.4	61.2	50.3
	23:15	73.3	59.9	50.0
	23:30	88.1	62.9	48.4
	23:45	72.7	57.5	48.6
Tuesday 31st	00:00	73.4	57.5	48.0
October 2023	00:15	74.9	55.8	48.4
	00:30	71.1	54.7	48.7
	00:45	75.5	55.4	47.8
	01:00	76.3	55.9	44.5
	01:15	77.1	57.0	42.0
	01:30	74.8	56.2	44.0

Table B1: Unattended Noise Monitoring Data – LT1

Date of Meas.	Start Time	Measured Sound Levels, dB		
		$L_{Amax,F}$	$L_{Aeq,15min}$	$L_{A90,15min}$
Tuesday 31st	01:45	70.5	50.2	38.5
October 2023	02:00	76.9	53.2	43.2
	02:15	72.9	53.6	41.5
	02:30	76.9	53.3	40.6
	02:45	75.7	54.6	43.4
	03:00	76.7	57.3	47.6
	03:15	74.5	54.7	42.4
	03:30	74.5	55.9	41.4
	03:45	75.8	57.2	41.8
	04:00	72.7	55.9	39.0
	04:15	78.6	59.0	36.7
	04:30	74.1	57.7	41.8
	04:45	76.1	59.1	39.7
	05:00	74.3	59.6	42.8
	05:15	76.4	60.8	46.5
	05:30	79.4	63.6	47.1
	05:45	75.6	62.8	47.9
	06:00	74.9	62.9	47.6
	06:15	76.4	63.9	51.5
	06:30	75.0	65.2	54.5
	06:45	76.9	66.7	58.1
	07:00	75.4	67.2	60.8
	07:15	76.5	68.1	63.3
	07:30	78.5	68.0	61.6
	07:45	78.3	68.1	62.0
	08:00	76.9	67.8	59.0
	08:15	76.7	67.9	63.1
	08:30	79.1	68.4	61.6
	08:45	89.9	73.7	60.9
	09:00	74.6	67.7	61.8
	09:15	76.8	68.4	63.2
	09:30	75.5	67.8	58.7
	09:45	76.6	67.0	57.4
	10:00	83.0	67.4	57.6
	10:15	86.0	67.8	57.4
	10:30	72.3	65.5	54.0
	10:45	74.0	66.0	56.0
	11:00	94.1	76.0	63.2
	11:15	84.2	70.9	60.6
	11:30	84.5	66.6	58.0
	11:45	80.1	67.0	60.0
	12:00	75.0	66.7	59.7
	12:15	75.1	65.9	56.3
	12:30	73.7	66.0	56.5

Table B1: Unattended Noise Monitoring Data – LT1

Date of Meas.	Start Time	Measured Sound Levels, dB		
		$L_{Amax,F}$	$L_{Aeq,15min}$	$L_{A90,15min}$
Tuesday 31st	12:45	75.0	66.0	56.5
October 2023	13:00	75.3	66.3	58.4
	13:15	74.2	66.4	60.8

Note: * clocks manually adjusted to account for BST to GMT clock change

APPENDIX C: BRIGHTON CITY AIRPORT NOISE MAPS

Figure C1: Brighton City Airport $L_{Aeq,16hr}$ Noise Map

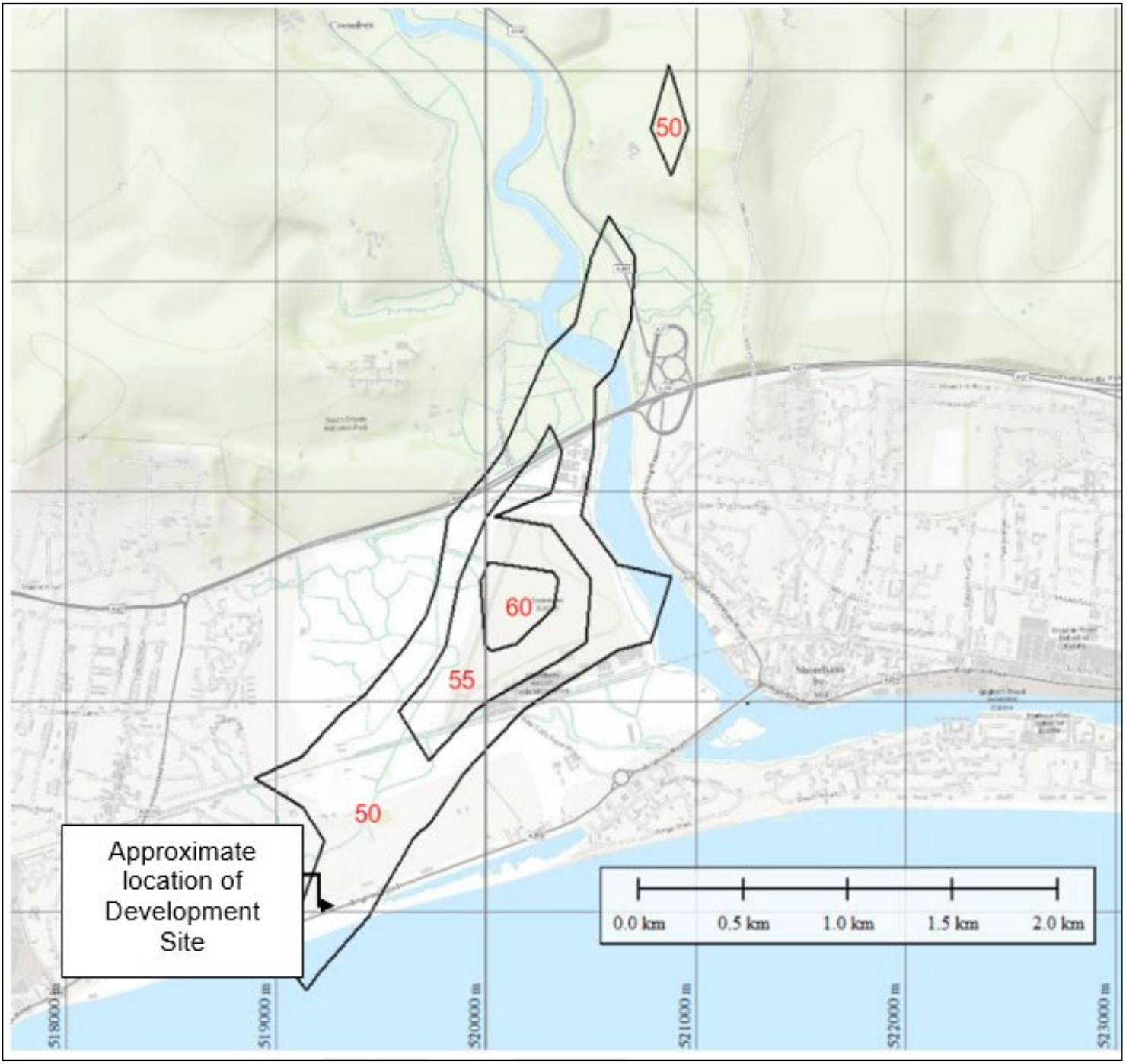


Figure C2: Brighton City Airport L_{den} Noise Map

