



NOISE IMPACT ASSESSMENT

WELLINGTON ROAD, WOKINGHAM

Kendall Kingscott

2063174-RSKA-RP-001-(02)



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General notes

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Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

This work has been undertaken in accordance with the quality management system of RSK Acoustics Ltd.



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1 Introduction

1.1 Overview

RSK Acoustics Ltd (RSKA) has been instructed by Kendall Kingscott (the Client) to undertake a noise impact assessment to support a planning application to Wokingham Borough Council, for a full planning application to provide 21 no. Class C3 units, including related ancillary functions, amenity space, landscaping, car and cycle parking and refuse storage at Wellington Road, Wokingham.

This report describes the assessment methodology, prevailing baseline conditions at the site and the effect of noise on the proposed development, so that an evaluation can be made of the suitability of the site.

Mitigation measures have been identified where necessary and practicable to achieve appropriate acoustic standards.

1.2 Site Description

The proposed development site is located on land adjacent to Wellington Road which runs along its western boundary. Station Road runs to the north of the proposed site with The Station Tap pub and two takeaway restaurants as well as a furniture store located within the immediate vicinity of the development along the road.

Further to the north is Wokingham train station with the lines into the station running adjacent to Wellington Road west of the site.

Park Road runs to the south of the site which has occasional residential access traffic.

To the east lies Station Car wash and existing commercial unit car parking space/service yard. Further to the east lies residential properties and gardens along both Park Road and Station Road.

1.3 Objectives

The objectives of the assessment are to:

- Identify sources of noise that may impact upon the residents of the Proposed Development;
- Quantify and report the noise climate across the site to determine the suitability for residential use;
- Assess the suitability of the site against the design targets within local and national guidelines and policies; and
- Specify the level of noise mitigation that may be required to reduce the potential for disturbance of future residents of the development.

1.4 Exclusions

Levels of vibration from typical free-flowing traffic and rail line traffic would likely be imperceptible at nearest proposed residential locations and therefore an assessment of road and rail traffic induced vibration has been discounted.



2 Regulatory Framework

2.1 National Planning Policy Framework (NPPF): 2024

The National Planning Policy Framework (NPPF) describes how noise is considered within the planning regime. The NPPF does not contain assessment design targets, instead providing a series of policies, giving local authorities the flexibility in meeting the needs of local communities. The NPPF states:

“Planning policies and decisions should contribute to and enhance the natural and local environment by [...] 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.”

“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 impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the 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.”*

“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.”

2.2 Noise Policy Statement for England (NPSE): 2010

The Noise Policy Statement for England is published by the Department for Environment, Food and Rural Affairs (Defra) and sets out the approach to noise within the Government’s sustainable development strategy.

The significance of impacts from noise within the NPSE are defined as follows:

There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:

NOEL – No Observed Effect Level

- This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level

- This is the level above which adverse effects on health and quality of life can be detected.

Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

SOAEL – Significant Observed Adverse Effect Level

- This is the level above which significant adverse effects on health and quality of life occur.



The three aims of the NPSE are stated as:

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

2.3 Planning Practice Guidance (PPG)

The Department for Communities and Local Government 'Planning Practice Guidance' (PPG) expands upon the NPPF and NPSE. The guidance does not include any specific noise levels but sets out further principles that should underpin a noise assessment. The PPG states¹:

"Plan-making and decision making need to take account of the acoustic environment and in doing so consider:

- 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."

It then refers to the NPSE and states that the aim is to identify where the overall effect of the noise exposure falls in relation to SOAEL, LOAEL and NOEL and presents a table², reproduced below. The implication of the final line of the table is that only the 'noticeable and very disruptive' outcomes are unacceptable and should be prevented. All other outcomes (i.e. all other lines in the table) can be acceptable, depending upon the specific circumstances and factors such as the practicalities of mitigation.

Response	Examples of outcomes	Increasing effect level	Action
NOEL (No Observed Effect Level)			
Not present	No effect	No observed effect	No specific measures required
NOAEL (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 change in the quality of life.	No observed adverse effect	No specific measures required



Response	Examples of outcomes	Increasing effect level	Action
LOAEL (Lowest Observable 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
SOAEL (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

Table 1 Summary of noise exposure hierarchy

2.4 British Standard 8233:2014 'Guidance on sound insulation and noise reduction for buildings'

Guidance on the acceptable noise levels for living rooms and bedrooms within residential buildings is given in BS 8233:2014. Advice is given on the design range of internal noise levels, depending on the use of each room and the sensitivity to noise of the operations expected to be conducted in the rooms. An extract of the indoor ambient noise levels for dwellings is reproduced in **Table 2**.

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

Note: Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{max, F}$, depending on the character and number of events per night. Sporadic noise events could require separate values.

Table 2 Indoor ambient noise levels for dwellings (BS 8233 table 4)

BS 8233 also provides design criteria for external noise and Section 7.7.3.2 states:

"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 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.”

2.5 World Health Organisation – ‘Guidelines for Community Noise’, 1999

The World Health Organisation (WHO) Guidelines for Community Noise was published as a response to a need for action together with a generic need for improvements in legislation at a national level. Although not legislation, this document provides general guidance and guidelines which have been set for different health effects, using the lowest noise level that produces an adverse health effect in specific human environments. The guidelines levels which are relevant to this assessment are set out in **Table 3**.

Activity	Location	L _{Aeq} , dB	Time base, 'T' hours	L _{AFmax} dB
Outdoor Living Area	Serious annoyance, daytime and evening	55	16	--
	Moderate annoyance, daytime and evening	50		
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	8	45 ¹
Inside bedrooms	Sleep disturbance, night-time	30		60
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45		

¹Should not exceed 45 dB L_{AFmax} more than 10-15 times a night

Table 3 WHO guidelines for community noise

2.6 Professional Practice guidance on Planning and Noise (ProPG): 2017

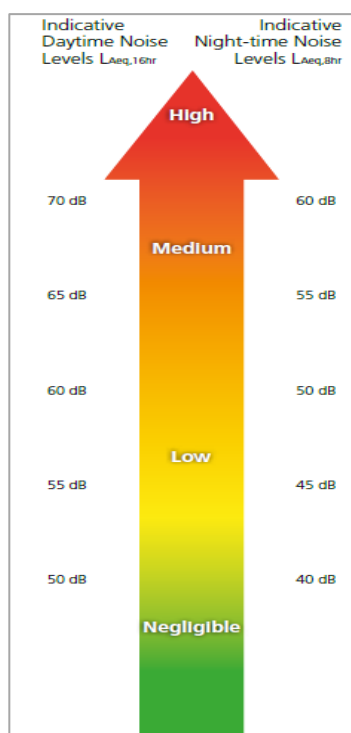


Figure 1 Stage 1 – Initial site noise risk

The Professional Practice Guidance on Planning and Noise is written to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England. The CIEH, IOA and the ANC have worked together to produce the guidance which encourages better acoustic design for new residential development and aims to protect people from the harmful effects of noise. This Professional Practice Guidance is based on the best knowledge available at the time of publication. It does not constitute an official government code of practice and neither replaces nor provides an authoritative interpretation of the law or government policy on which users should take their own advice as appropriate.

In relation with achieving internal noise values with open windows ProPG states that:

“Where it is not possible to meet internal target levels with windows open, internal noise levels can be assessed with windows closed, however any façade openings used to provide whole dwelling ventilation (e.g. trickle ventilators) should be assessed in the “open” position and, in this scenario, the internal L_{Aeq} target levels should not normally be exceeded”.

Stage 1 – Initial Site Noise Risk Assessment

ProPG recommends practitioners to undertake an initial noise risk assessment of the proposed development site to provide an indication of the likely risk of adverse effects from noise were no subsequent mitigation to be included as part of the development proposal. **Figure 1** summarises the Stage 1



Initial Site Noise Risk Assessment providing indicative daytime and night-time noise levels associated with four categories of risk: Negligible, Low, Medium, and High.

The figure illustrates how this initial noise risk assessment is linked with an increasing risk of adverse effect from noise. The assessment should include the acoustic effect of any existing site features that will remain (e.g., retained buildings, changes in ground level) and exclude the acoustic effect of any site features that will not remain (e.g., buildings to be demolished, fences and barriers to be removed) if development proceeds.

Acoustic Design

ProPG encourages the use of acoustic design as a means to inform the site masterplans and is key to avoiding or reducing to a minimum any adverse effects on any sensitive internal or external spaces. In considering acoustic design, consideration should be given by the developer to the management of noise through a hierarchy of potential mitigation measures which may include:

- Maximising the separation distance between source and receiver;
- Incorporate noise barriers (where applicable) to screen the development site (or individual plots) from significant sources of noise;
- Use existing features to reduce noise propagation across the site;
- Orientate the buildings in a manner which reduces the noise levels within habitable rooms (particularly bedrooms);
- Building envelope design to mitigate the noise to acceptable levels, whilst providing adequate ventilation.

2.7 Approved Document O (2021 Edition) – The Building Regulations: 2010

Approved Document O (AD-O), 2021 edition (under Building Regulations 2010) aims to protect the health and welfare of occupants of the building by reducing the occurrence of high indoor temperatures. The document specifies internal noise limits which should be met to ensure the overheating mitigation strategy is usable.

Based on typical assumptions, the resulting outside-to-inside level difference for window openings necessary to satisfy the simplified method of AD-O are expected to be approximately 5 dB for 'high' risk locations and 10 dB for 'medium' risk locations.

A summary of the recommended levels for the most noise-sensitive spaces (bedrooms) are provided below in **Table 4** for average ambient noise levels throughout a given time period (L_{Aeq}) and maximum noise levels (L_{max}) during the night.

Period	Normal condition (as per BS 8233)	Overheating condition (ADO)
Daytime (07:00 to 23:00)	35 dB $L_{Aeq,16hr}$	--
Night-time (23:00 to 07:00)	30 dB $L_{Aeq,8hr}$	40 dB $L_{Aeq,8hr}$
	45 dB L_{AFmax}	55 dB L_{Amax}^*
* L_{AFmax} refers to the level not normally exceeded, and not the 10 th highest level used within WHO guidelines		

Table 4 AD-O overheating condition criteria

The lower ambient noise level thresholds in the overheating condition correspond to the recommendation within BS 8233:2014 for internal noise levels that would be considered "reasonable" under normal conditions.

2.8 BS 4142: 2014 +A1: 2019 'Methods for rating and assessing industrial and commercial sound'

BS 4142: 2014+A1: 2019 describes the methods for rating and assessing noise from industrial or commercial sources, including manufacturing processes, fixed installations and plant equipment, loading of



goods and sound from mobile plant. The standard is applicable for the purpose of assessing sound at proposed new dwellings, through the determination of a rating level of an industrial or commercial noise source.

Where certain acoustic features are present at the assessment location, a character correction should be applied to the specific sound level to give the rating level to be used in the assessment.

- 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 +5dB is likely to be an indication of adverse impact depending on the context.
- 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.

BS 8233 provides good internal design threshold for new developments, including residential. This standard is derived from the WHO Guidelines for Community Noise (see above). For the use of BS 4142 in assessing new residential development applications ProPG (Paragraph 2.43) states that:

“Professional judgement will have to be exercised in addressing these sorts of issues. One possible approach may be to apply BS 4142:2014 character corrections to the noise level guideline values in order to derive suitable effect thresholds and/ or mitigation design targets and to use the same reference time periods recommended in the standard”

2.9 Local Planning Policy

2.9.1 Pre-Application Advice Response Letter

The Pre-Application Advice Response Letter from Wokingham Borough Council (WBC), dated 4 November 2022 for application number 221086, states the following:

“Given the proximity of the proposed dwelling to roads, rail and existing commercial uses as well as the new proposed commercial use (including deliveries), a noise impact assessment will be required. The assessment will need to include the impact on the existing receptors from the noise generated by the proposal, in particular from the commercial units, ventilation and plant room.”

And,

“The following information will need to be provided in support of an application.

2. Noise impact assessment(s) required - for potential sensitive receptors – including, roads, rail, existing commercial uses (car wash /pub/ other commercial uses and proposed new operational noise e.g. commercial deliveries/commercial use. The potential access, to the commercial carparking service area, appears very constrained, and the manoeuvring of commercial vehicles in particular any audible warnings requires consideration.

A variety of sources need to be considered, as noted above.

In respect of existing receptors – noise generated by the development, e.g. the commercial units (any associated ventilation systems) and the plant room should be assessed.”

It should be noted that since the receipt of this letter, proposed new commercial allocation has been removed from the scope of the development.



2.9.2 Wokingham Borough Adopted Core Strategy Development Plan Document (January 2010)

Core Strategy Policy 1 (CP1 – Sustainable development) of the Adopted Core Strategy Development Plan states in relation to noise:

“Planning permission will be granted for development proposals that:

- 1) Maintain or enhance the high quality of the environment;*
- 2) Minimise the emission of pollutants into the wider environment;*
-*
- 8) Avoid areas where pollution (including noise) may impact upon the amenity of future occupiers;*

Paragraph 4.14 states:

“The community, Government and regional policy (PPG24 & SEP Policy NRM10 respectively) recognise the need for proposals to avoid areas of noise. Within the borough, noise issues arise in a variety of locations including alongside the major roads (M4 & A329(M)/A3290) and the railway lines within the Strategic Transport Network (see paragraph 4.56). Proposals should have regard to the advice in PPG24 concerning the suitability of different locations (based on noise exposure levels) for a variety of activities and the Air Quality Management Areas of the borough.”

2.9.3 Wokingham Borough Local Plan Update 2023 – 2040 Proposed Submission Plan

Policy HC8: Noise Pollution of the proposed new local plan update for Wokingham Borough states:

“1. Development proposals must demonstrate how noise impacts have been addressed, to protect sensitive receptors, including existing and proposed dwellings.

2. The noise impact of the proposed development must be assessed. Where there is no adverse impact (no observed effect level), noise pollution will not be a material consideration.

3. Where there is an adverse effect (ranging from the lowest observed adverse effect level to a significant observed adverse effect level), then the following approaches must be taken in the order listed:

a) The development layout must be reviewed. Where this results in there no longer being an adverse impact then design and mitigation measures should be incorporated accordingly;

b) Where there is still an adverse impact, the internal layout must be reviewed. Where this results in there no longer being an adverse impact, then design and mitigation measures should be incorporated accordingly;

c) Where there is still an adverse impact, physical mitigation measures such as barriers/mechanical ventilation must be considered. Where this results in there no longer being an adverse impact, these measures should be incorporated accordingly;

d) Where there is still an adverse impact and the development falls within the significant observed adverse effect level, then planning permission will normally be refused.

4. Adverse impacts on sensitive environmental receptors, such as wildlife corridors, should be avoided or comprehensively mitigated where avoidance is not possible.”

With regards to criteria the proposed plan states:

“Development proposals should aim to meet the internal and external noise standards for residential developments set out in Table 11.



Table 11 Internal and external noise standards.

Room	Time	Noise Level (dB LAmax)
Bedrooms	Night (23.00-07.00)	30 Individual noise events should not exceed 45dB LAmax during the night time
Living Rooms	Daytime (07.00-23.00)	35
Outside amenity space	Daytime (07.00-23.00)	50-55 Balconies will need to meet the same standard unless it is clear they are not intended to be an outdoor living area

Figure 2 Table 11 from the proposed Wokingham Local Plan

These levels are based on Table 4 of BS8233:2014 Guidance on sound insulation and noise reduction for buildings. Where development sites are affected by a non-steady noise source, commercial or industrial noise, or noise that does not follow a typical diurnal pattern, the acceptability of noise levels will be determined on a case-by-case basis. Where noise is of a continuous and/or tonal nature, this should be 5dB below background noise levels."



3 Environmental Sound Survey

3.1 Methodology and Instrumentation

3.1.1 Unattended Noise Survey

An unattended noise survey was undertaken at the site between the following dates and times:

- Start: 11:45 16th April 2025
- End: 13:45 23rd April 2025

Measurements were undertaken at two locations, indicated as MP1 and MP2 within Figure 3 and are described as follows:

- MP1: Positioned 1.5 m above ground level towards the southeastern boundary of the site and directly representative of the proposed building façade facing Wellington Road at the south of the building.
- MP2: Positioned at 1.5 m above ground level towards the eastern site boundary.

MP1 was selected to quantify the existing noise climate adjacent to Wellington Road, the major noise source from the site as well as any contributions from the rail line.

MP2 was selected to quantify the existing noise climate at the rear of the proposed site adjacent to the carwash and carpark/service yard. This position is also to be used as a representative location for background noise levels at nearby noise sensitive receptors to the development.



Figure 3 Measurement locations



Measurements of the L_{Aeq} , L_{A90} , L_{A10} and L_{Amax} indices were recorded over consecutive 15-minute periods (see the glossary of this report for an explanation of the noise units used) for the duration of the survey at both measurement positions using the equipment listed within Table 5 below.

Equipment	Type	Serial number	Calibration date
Class 1 sound level meter	Rion NL-52	00142653	06/09/2024
	Rion NL-52	00553876	31/01/2024
Acoustic calibrator	Rion NC-74	34257026	16/07/2024

Table 5 *Equipment list*

The microphones were fitted within weatherproof windshields and the sound level meters were calibrated before and after the survey to confirm an acceptable level of accuracy. Both positions calibrated with the accepted tolerance of $\pm 0.5\text{dB}$.

The sound level meters used, conform to the requirements of BS EN 61672-1: 2003 Electroacoustics, Sound level meter, Specifications. The calibrator used, conforms to the requirements of BS EN 60942: 2003 Electroacoustics, Sound calibrators. The equipment used, has a calibration history that is traceable to a certified calibration institution.

3.1.2 Attended Noise Survey

An attended noise survey was conducted at the site on the 16th April 2025. Measurements were undertaken at four locations indicated as ATT1 – 4 in the measurement location plan above and described as follows:

- ATT1: Positioned at the northern boundary of the site, to quantify existing noise levels from Station Road at the boundary.
- ATT2: Positioned adjacent to rail line to quantify noise emissions from passing trains.
- ATT3: Positioned at site boundary adjacent to car wash, quantifying noise levels from the facility at peak usage.
- ATT4: Positioned at southeastern site boundary to quantify noise levels at this position and contributions from activity along Park Road.

Measurements of the L_{Aeq} , L_{A90} and L_{Amax} indices were recorded for the duration of the survey at both measurement positions using the equipment listed within Table 6 below.

Equipment	Type	Serial number	Calibration date
Class 1 sound level meter	Rion NL-52	00620866	28/04/2024
Acoustic calibrator	Rion NC-74	34257026	16/07/2024

Table 6 *Attended noise survey equipment*

The microphones were fitted within weatherproof windshields and the sound level meters were calibrated before and after the survey to confirm an acceptable level of accuracy. Both positions calibrated with the accepted tolerance of $\pm 0.5\text{dB}$.

3.2 Survey Weather Conditions

Weather conditions over the duration of the survey are presented in Table 7 below, obtained from Wunderground at the closest weather station to the site (IENGLAND951) at an approximate distance of 600m.



Date	Temperature (°C)	Average Wind Speed (m/s)	Accumulative Precipitation (mm)
Wednesday 16/04/2025	4.6 – 15.6	1.6	0.00
Thursday 17/04/2025	0.5 – 19.2	0.3	0.00
Friday 18/04/2025	4.3 – 16.3	0.6	0.00
Saturday 19/04/2025	7.9 – 16.9	1.7	0.51
Sunday 20/04/2025	5.5 – 15.5	0.5	0.00
Monday 21/04/2025	7.2 – 15.2	0.3	0.51
Tuesday 22/04/2025	4.2 – 17.3	0.3	0.00
Wednesday 23/04/2025	7.7 – 13.3	0.5	9.91

Table 7 Survey weather conditions

Weather conditions were mostly calm with brief periods of precipitation noted on Saturday 19th and Monday 21st April. Periods of heavy rain were noted on Wednesday 23rd April. The following periods have been excluded from the assessment dataset:

- 23:00 22/04/2025 – 13:45 23/04/2025

Noise monitoring data has been analysed outside the excluded periods with no significant change in noise levels when compared against dry periods thus with minimal impact on the adopted averaged noise levels.

3.3 Sound Climate

The following site observations have been noted at the measurement positions.

- MP1 – Noise climate predominantly influenced by traffic along Wellington Road with contributions from passing trains along the rail line when present. Four train movements were noted within a half hour period.
- MP2 – Noise climate predominantly influenced by traffic along Wellington Road and Station Road with a quieter noise environment than MP1. When present, trains passing on the trainline have a greater impact on the noise environment at this location due to the lower levels of road noise.

With the exception of Station Car Wash, no industrial or commercial noise from establishments such as The Station House public house was noted as audible at any measurement position or location across the site and has not been considered dominant in the residual sound climate at the measurement locations.

3.4 Results

3.4.1 Unattended Noise Survey

- 3.4.2 The measured free-field daytime $L_{Aeq,16hr}$ and night time $L_{Aeq,8hr}$ levels at positions MP1 and MP2 along with the typical night time L_{AFmax} levels (taken as the 10th highest 2-minute maximum level measured during the night-time period) are shown in Table 8 below. Any max level occurrences attributed to birdsong and the dawn chorus have been disregarded from the analysis as they are not considered representative of environmental noise sources affecting future living conditions. A time-history describing the full monitoring period for each measurement position are presented in **Appendix C**.



Measurement Position	Period	dB L _{Aeq,T}		dB L _{Amax(f)}	
		Period Range	Typical	Range of 10 th Highest	Typical 10 th highest
MP1	Day (07:00 – 23:00)	64 - 65	65	-	-
	Night (23:00 – 07:00)	56 - 57	57	75 - 78	78
MP2	Day (07:00 – 23:00)	57 - 59	59	-	-
	Night (23:00 – 07:00)	51 - 52	52	71 - 72	72

Table 8 Summary of unattended noise survey

3.4.3 Attended Noise Survey

Table 9 below details the results of the attended noise survey.

Position	Start Time	Duration (hh:mm:ss)	L _{Aeq, T} dB	L _{Amax, F} dB
ATT1	12:31	00:30:00	63	79
ATT2	13:02	00:30:00	67	86
ATT3	13:33	00:00:17*	69	75
ATT4	13:40	00:30:00	56	76
*short measurement of car hand jet wash activity				

Table 9 Summary of attended noise survey



4 Assessment Methodology

4.1 Noise Prediction Model

A computer noise model of the proposed development has been constructed using SoundPLAN v9.1. Noise levels across the proposed development site have been derived from a noise prediction model which has been calibrated against the measured levels at the baseline survey locations. The model has considered the following scenarios:

- Daytime - ambient $L_{Aeq,16hr}$ (07:00 – 23:00);
- Night-time - ambient $L_{Aeq,8hr}$ (23:00 – 07:00); and
- Night-time – individual events L_{AFmax} (23:00 – 07:00).

An overview of the modelling parameters is given in Table 10. Noise contour maps for both daytime and night-time periods are provided in **Appendix E**

Item	Setting
Algorithms	Calculation of Road Traffic Noise (CRTN)
Ground absorption	Assumed 0.6 coefficient
Meteorological conditions	10 degrees Celsius. 70% humidity. Wind from source to receiver.
Receptor height	Ground Floor 1.5 m above ground First Floor 4.5 m above ground Second Floor 7.5 above ground
Site layout	210806-1052-P01-Proposed Site Plan
Source modelling	Existing buildings and intervening structures modelled as structures (heights identified on site or through 3D views). Calibration of the averaged daytime ($L_{Aeq, 16 \text{ hour}}$) and night ($L_{Aeq, 8 \text{ hour}}$) model accounts for the road network and rail line acting as the primary sources of noise impacting the site (line source). The night-time L_{AFmax} levels from road pass-by events calibrated against the representative event levels (i.e. the value typically not exceeded more than 10 times per night). Pass-by events modelled as a line source at 0.5 m height above ground level for road sources and 4m for rail, adopting a point source behaviour at the closest distance between the road/rail line and each receptor location.
Terrain	LiDAR DTM with a 1-metre resolution has been imported into the model.

Table 10 Noise modelling parameters

4.2 Validation of Computer Model

The propagation of maximum noise levels across the proposed development site have been derived from a computer noise prediction model assuming the influence of the surrounding road traffic network and rail line. The model has been validated against the measured levels at the baseline survey locations.

Differences between measured and predicted levels are presented in Table 11.



Location	Measured Noise Level, dB			Predicted Noise Level, dB			Difference, dB		
	Day	Night		Day	Night		Day	Night	
	L _{Aeq, T}	L _{Aeq, T}	L _{AF, max}	L _{Aeq, T}	L _{Aeq, T}	L _{AF, max} *	L _{Aeq, T}	L _{Aeq, T}	L _{AF, max} *
MP1	65	57	78	65	57	78	0	0	0
MP2	59	52	72	61	54	72	+2	+2	0
* 10 th Highest L _{AF, max}									

Table 11 Noise model validation

Calibrated noise levels at all monitoring locations are within ± 2 dB(A) from measured noise levels, providing an acceptable level of confidence to the modelling exercise.

4.3 Design Targets for Residential Development

For the purpose of this assessment, the acoustic design targets presented in Table 12 below have been adopted. The design targets are based on the requirements of the appropriate guidelines for residential development and Wokingham Borough Council local policy.

Condition	Criterion
Internal ambient daytime noise levels within bedroom / living room areas daytime (BS 8233)	35 dB L _{Aeq, 16hrs}
Internal ambient noise levels within bedrooms at night (BS 8233)	30 dB L _{Aeq, 8hrs}
Internal individual event levels within bedrooms during the night (>10 occurrences – WHO/ProPG)	45 dB L _{AF, max}
Noise levels within external amenity areas associated with the proposed dwellings* (BS 8233)	50 to 55 dB L _{Aeq, 16hrs}
* 50 dB L _{Aeq, T} is the desirable threshold level, 55 dB L _{Aeq, T} is the upper guideline level. However, these guideline values may not be achievable in all circumstances where development might be desirable. In such a situation, development should be designed to achieve the lowest practicable noise levels.	

Table 12 Noise design target for residential use

It is considered that these levels are the lowest observed adverse effect level (LOAEL) in line with the Noise Policy Statement for England (NPSE).



5 Site Suitability Assessment

5.1 Initial Site Risk Assessment

The dominant sound source was noted from local road transportation with intermittent rail noise when considering the proposed development site.

Activities from the Station Tap Public House and commercial/retail units along Station Road were not audible within the development site (nor evidenced from the time-history of site measurement data) and are not considered dominant when establishing the site risk.

Station Car Wash is located adjacent to the rear of the proposed development and is understood to operate between the hours of 09:00 and 17:00, six days a week. It was noted during site attendance that only one customer was served with a car wash within a witnessed 3-hour time period in favourable weather. A measurement at ATT3 captured a short sample of jet wash use from the site boundary which was audible above the prevailing climate.

The car wash activity was not evident as clearly dominant from the time-history charts at MP1 or MP2 when considering daytime levels for assessment. It is however relevant to consider potential impacts from car wash activity when considering assessment of baseline levels.

Section 6.5.2 of BS 8233 states, *“Where industrial noise affects residential or mixed residential areas, the methods for rating the noise in BS 4142 should be applied”*. For the use of BS4142 in assessing the design of new residential development, Professional Practice Guidance (ProPG) on Planning and Noise (Paragraph 2.43) expands on this by stating: *“Professional judgement will have to be exercised in addressing these sorts of issues. One possible approach may be to apply BS4142:2014-character corrections to the noise level guideline values in order to derive suitable effect thresholds and/ or mitigation design targets and to use the same reference time periods recommended in the standard”*.

Based on the guidance provided in BS 4142, the context and incorporated design measures should be the primary features of determining suitability and therefore, BS8233, WHO and local policy guidance are considered to be the principle standards for derivation of design targets and to inform facade design. However, the contextual nature of the noise sources (as discussed in BS4142) and the penalty corrections (for tonality, impulsive or intermittent noise sources) should be considered and applied to the noise source predictions or to the design targets.

Rating corrections in accordance with BS 4142 guidance have been applied to the predicted daytime baseline levels at the rear of the proposed development building, for robust assessment. Taking the acoustic features into consideration, the following rating penalties have been added when assessing the nearest building facades:

- Intermittency - It is considered that the car wash activities involve intermittent use of hand jet washes and vehicle movements and a correction of 3 dB has been applied to the rear proposed building façade.
- Tonality - Due to the nature of car wash activities and the possibility of reversing alarms/sirens at the rear of the site, a correction of 2 dB for tonal elements which may be ‘just perceptible’ at the rear building façade has been applied.

Given the distance between the sources and the closest receptors and in order to cover a worse-case scenario, the above penalties (totalling +5 dB during the daytime period at the rear façade) are considered reasonable for the type of operations and observations made during site attendance. These corrections will be applied when judging suitable mitigation measures for those plots nearest to and facing the car wash to the rear.

5.2 Predicted Noise Levels

Incident noise levels at the various facades of the proposed development have been established from the site survey and calibrated computer model and incorporating relevant corrections for commercial noise at the rear for robust assessment.



The following sound pressure levels for the day and night-time periods have been summarised from the environmental survey and computer model and used for an initial site risk assessment following ProPG.

Description	Period	Sound Pressure Levels dB re. 20 µPa
Front elevation facing Wellington Road (north of site closest to Wellington Road)	Day (07:00 – 23:00)	68 dB LAeq, 16 h
	Night (23:00 – 07:00)	61 dB LAeq, 8 h
		80 dB LAmax(F)*
Front elevation facing Wellington Road (south of site)	Day (07:00 – 23:00)	67 dB LAeq, 16 h
	Night (23:00 – 07:00)	60 dB LAeq, 8 h
		77 dB LAmax(F)*
Front elevation facing Wellington Road (middle façade)	Day (07:00 – 23:00)	68 dB LAeq, 16 h
	Night (23:00 – 07:00)	60 dB LAeq, 8 h
		78 dB LAmax(F)*
North/side building elevation	Day (07:00 – 23:00)	66 dB LAeq, 16 h
	Night (23:00 – 07:00)	58 dB LAeq, 8 h
		80 dB LAmax(F)*
South/side building elevation	Day (07:00 – 23:00)	64 dB LAeq, 16 h
	Night (23:00 – 07:00)	57 dB LAeq, 8 h
		75 dB LAmax(F)*
Rear facades	Day (07:00 – 23:00)	50 dB LA _r , 16 h **
	Night (23:00 – 07:00)	42 dB LAeq, 8 h
		66 dB LAmax(F)*
* Value exceeded 10 times during entire night time period, based on typically occurring transient levels.		

Table 13 Summary of environmental sound pressure levels used for initial site risk assessment.

Based on the established sound climate at the site, with dominant transportation noise influencing the front of the proposed development, the site is considered to be 'high noise risk' following ProPG guidance. The pre-planning application advice stated in ProPG is as follows:

"High noise levels indicate that there is an increased risk that development may be refused on noise grounds. This risk may be reduced by following a good acoustic design process that is demonstrated in a detailed ADS. Applicants are strongly advised to seek expert advice."

The site risk at the rear façades of the proposed development has been considered 'low risk' when accounting for transportation noise and applying an additional correction of 5 dB for commercial noise.

5.3 Outline Acoustic Design Assessment

Good acoustic design should be considered at an early stage of the development process, following ProPG Guidance.

The proposed development land space is fixed in its locale, where it is not practical to significantly move receptors relative to incident noise sources.



The orientation of the building and the internal layout plans of the dwellings are proposed in drawing references 210806-120X-P01 (1200 through 1202). Good acoustic design generally requires facing less-sensitive rooms (i.e. kitchens and bathrooms) towards the dominant incident noise sources, where practical. Although the proposed layout has road-facing bedrooms, the layout does minimise habitable rooms directly overlooking commercial activity to the rear. It is acknowledged that there will be other design considerations than just noise when considering layout optimisation.

Balconies are discussed further below and should be considered if the amenity provision is intrinsic to the design in a high risk noise climate.

It is considered that suitable internal conditions can be provided when considering suitable specifications of building façade, glazing and ventilation elements.

5.4 Internal Noise Levels – Façade Treatment

Based on traditional masonry constructions with insulated and tiled roofs, the acoustic performance of glazing and ventilation elements will typically dictate the overall sound insulation of the building envelope, relevant to internal ambient noise levels.

Based on the established incident sound levels at the proposed front development façade, the ventilation options considered appropriate for the development are considered to be as follows, based on Approved Document F ventilation strategies:

- System 3 continuous mechanical extract (MEV) with acoustic performance windows and vents or;
- System 4 continuous mechanical supply and extract with heat recovery (MVHR) with acoustic performance windows.

The ventilation strategies will depend on compatible overheating requirements and acoustic performance requirements of Approved Document of the Building Regulations (discussed further below).

Given the initial site risk assessment as high risk (in the worst-case), it is considered relevant to appraise building façade elements in detail using octave band spectra and following BS 8233 break-in calculation methods.

Assessment spectra have been established directly from the measurements at MP1 representative of dominant transportation sound during the day and night periods and adjusted for façade assessments using the computer model predicted outputs. Transient event levels in terms of L_{AFmax} and associated spectra have been established from the typical 10th highest level during the night periods, based on 2-minute samples.

Location	Time / Period	Free-field sound pressure levels $L_{eq, T} / L_{max(F)}$ dB re. 20µPa						
		125Hz	250Hz	500Hz	1KHz	2kHz	4kHz	A
MP1	Day $L_{Aeq, 16h}$ 07:00 – 23:00	63	60	59	62	57	48	65
	Night $L_{Aeq, 8h}$ 23:00 – 07:00	58	53	53	54	50	43	57
	Night $L_{Amax, F}$ 23:00 – 07:00	65	66	69	76	71	62	78

Table 14 Measurement spectra used for assessment from MP1.

The calculations undertaken assume that double glazing is installed to attenuate road traffic noise in accordance with BS 8233:2014 and World Health Organisation internal noise guidance criteria. The glazing specifications are based on achieving both the internal average and maximum criteria based on a System 3 ventilation strategy.

Calculations have been undertaken based on the architectural layouts and elevations provided, 210806-120X-P01 (X = 0 through 2) and 210806-130X (X = 0 through 1) respectively.



Calculation results are given in **Appendix F** and summarised in the tables below in terms of minimum acoustic specification requirements for window and ventilation elements, based on a System 3 MEV ventilation strategy. The corresponding mark-ups showing the façade treatment references are provided below.

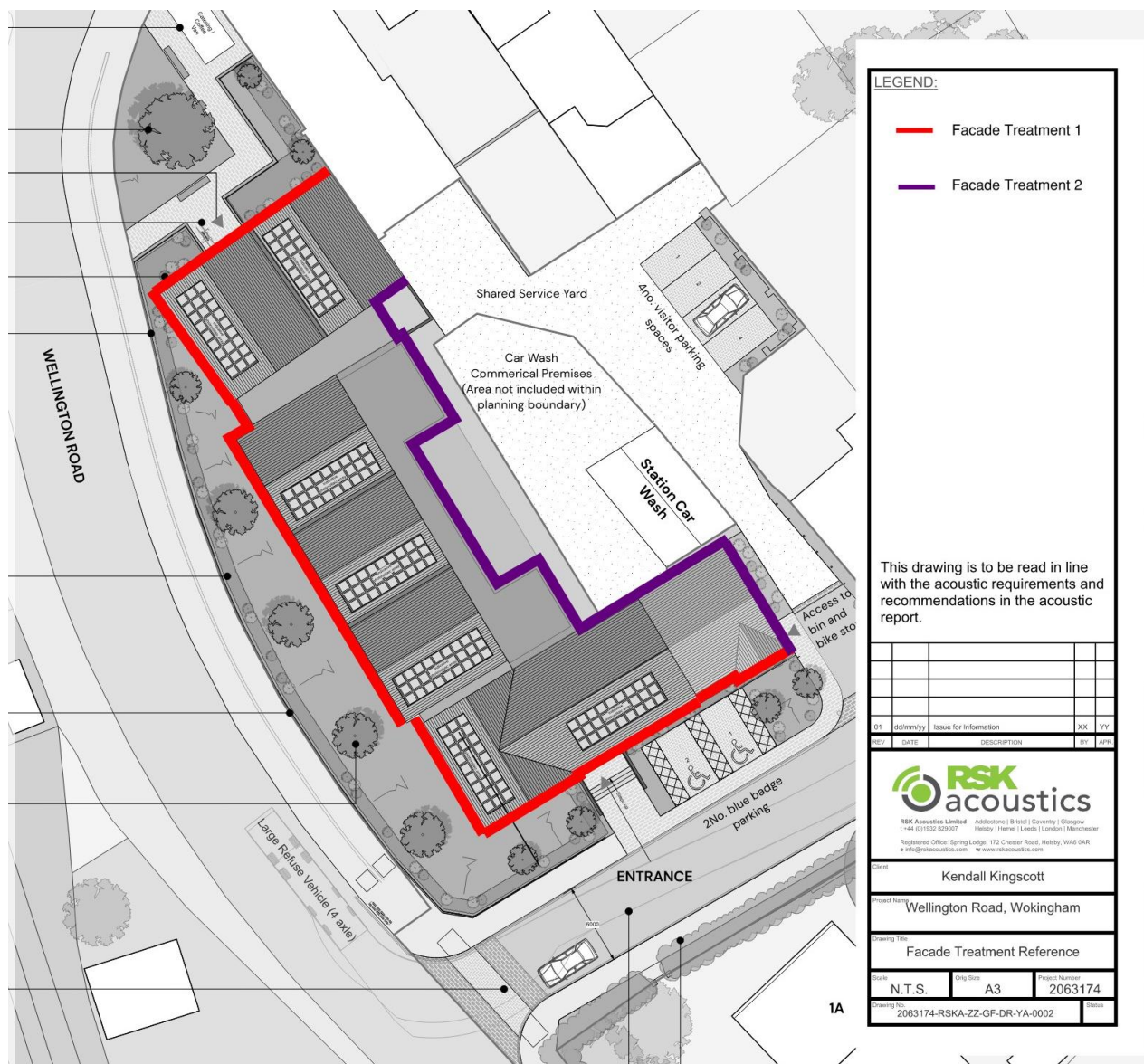


Figure 4 Façade Treatment Reference Mark-Up

Façade	Room type	Example Configuration (glass-gap-glass)	Sound Reduction Index, SRI dB in Octave Band with Centre Frequency, Hz						
			125	250	500	1k	2k	4k	R _w
Front/side (Treatment 1)	Living Rooms	4-12-8.8 lam	24	25	36	40	42	47	38
	Bedrooms	4-14-6.8 lam	23	23	33	39	41	42	36
Rear (Treatment 2)	Living rooms and bedrooms	Standard double glazing							

Table 15 Glazing acoustic performance minimum specifications.



Facade	Vent Configuration	Element Normalised Level Difference, $D_{n,e}$ dB in Octave Band with Centre Frequency, Hz						
		125	250	500	1k	2k	4k	$D_{n,e,w}$
Front/side (Treatment 1)	High spec foam trickle vent	38	35	32	40	46	60	40*
Rear (Treatment 2)	Trickle vent	28	28	28	25	27	32	27*
<i>*Based on one ventilator per habitable room, assuming System 3 ventilation strategy</i>								

Table 16 Ventilation acoustic performance minimum specifications.

Increasing the number of vents to the room or window frame will increase the levels of noise ingress into the room. The above calculations are based on 1 trickle vent per habitable room.

Where louvred or plenum window ventilation systems are proposed, these should be reviewed to meet minimum acoustic requirements.

Selected glazing systems should include a laboratory tested certificate for the glazing and framing system and should be verified by an acoustic consultant at the appropriate design stage.

The above specifications and ventilation strategy must be compatible with the overheating and acoustic requirements of Part O of the Building Regulations which may require occupants to keep windows closed and where a mechanically ventilated solution may be required.

5.5 Internal Noise Conditions – Overheating

Based on the night-time predicted noise levels, additional calculations have been undertaken at each evaluation point to determine the risk of exceeding Approved Document O (AD-O) noise limits. Based on the current industry guidance³ the required window opening area within a single bedroom would correspond to approximately 10 dB reduction from outside to inside; in order to meet an internal ambient level of 40 dB $L_{Aeq,8hr}$ (and 55 dB L_{AFmax} more than 10 times) in line with the requirements of the published AD-O, the external noise limit for night-time hours therefore should not exceed 50 dB $L_{Aeq,8hr}$ and 65 dB L_{AFmax} at night.

Predicted external night-time levels at the front, north and south elevations range between 50 and 61 dB $L_{Aeq,8hr}$ with maximum night-time levels (10th highest) predicted between 71 and 80 dB L_{AFmax} . Predicted levels at the rear elevation range between 37 and 42 dB $L_{Aeq,8hr}$ with maximum night-time levels (10th highest) predicted between 58 and 64 dB L_{AFmax} . Predicted noise levels therefore exceed the AD-O criteria on the northern, western and southern elevations (corresponding to Façade Treatment 1 from Figure 4) of the proposed development and as such, a suitable attenuation strategy for these areas should be developed at the detailed design stage in conjunction with the overheating consultant to ensure suitable internal conditions can be met. This may include:

- Dynamic thermal modelling to determine if partially open windows can be used at night to control overheating. Compliance would be subject to the minimum open area required and the corresponding external to internal sound reduction, achievable alternative means of ventilation may be required for those dwellings.
- Installation of attenuated or plenum windows / louvres to affected bedrooms.
- Mechanical or comfort cooling systems. Where a mechanical solution is required, the impact of the noise generated both internally and externally should be considered to ensure the required internal noise levels can be achieved within dwellings.

³ <https://www.ioa.org.uk/guidance-document-demonstrating-compliance-noise-requirements-approved-document-o>



It is important that the developer consults with an acoustic specialist at the detailed design stage, to ensure compatibility with the proposed ventilation strategy, overheating assessment and the acoustic performance requirements of AD-O.

5.6 External Amenity Noise Levels

External balcony amenity areas are proposed at the front elevation facing Wellington Road and to the north and south elevations shown in the proposed site layout plans. BS 8233:2014 guidance, in relation to external amenity, states that:

“The acoustic environment of external amenity areas that are intrinsic to the overall design should always be assessed and noise levels should ideally not be above the range 50 – 55 dB LAeq,16hr [...] These guideline values may not be achievable in all circumstances where development might be desirable. In such a situation development should be designed to achieve the lowest practicable noise levels in these external amenity spaces but should not be prohibited.”

The proposed front building façade and balcony areas are subject to incident daytime noise levels in the order of 66 – 68 dB LAeq,16 hour from the site survey and model predictions. Side facing balconies to the north and south are subject to incident daytime noise levels predicted in the order of 57 – 66 dB LAeq,16 hour. These levels are above the BS 8233: 2014 recommended guidance range of 50-55 dB LAeq, 16h. The balcony balustrade will provide some level of mitigation when constructed from an impermeable screen but would unlikely be significant enough to reduce the level within the balcony by 10 dB or more.

Regardless of the decision of whether an amenity area is intrinsic to development or not, BS 8233:2014 states that the resulting noise levels are never a reason for refusal, if levels are designed to be as low as practicable. Policy guidance should, however, be followed to ensure the amenity can be enjoyed as intended.

If provision for external amenity is considered intrinsic to the design of development, then consideration should be given to alternative layouts where external balcony areas can be sited to the rear of the building and shielded from Wellington Road.

It is considered that planning should not be refused on grounds of amenity standards, where the external amenity may not be considered intrinsic to the design and this should be clarified by the design team.



6 Fixed Plant Assessment

It is proposed for a plant room to be installed on the ground floor of the development. The type of plant and location of any atmospheric terminations is currently undetermined. According to BS 4142: 2014+A1: 2019, where the rating noise level ($L_{Ar,Tr}$) does not exceed the background sound level ($L_{A90,T}$), this is an indication of the specific sound source having a low impact.

Rating noise limits applicable to likely fixed plant items associated with the Proposed Development have been derived from the analysis of the background noise levels ($L_{A90,T}$) obtained at MP2 the location representative of the nearest noise sensitive receptors to the development, considering the hourly noise levels ($L_{A90,1hr}$) for the daytime period (07:00 – 23:00) and 15-minute samples ($L_{A90,15min}$) for the night-time period (23:00 – 07:00). In accordance with the requirements of BS 4142:2014 + A1: 2019, the rated noise design limits proposed at development receptors are inclusive of any corrections deemed appropriate for acoustic characteristics such as tonality, impulsivity and intermittency of the source.

In order to provide a design target at receptor locations, it is considered that an initial target should comply with a requirement to meet 5 dB below the representative background sound level in line with known previous Local Authority requirements for noise sources which are continuous/tonal in nature. A rating level of below 30 $L_{Ar,Tr}$ is considered very low, and a minimum design target of 30 $L_{Ar,Tr}$ is proposed as a reasonable.

Rating level noise limits, based on the positions of the baseline noise monitors have been provided. The rating noise level from installed fixed plant are recommended not to exceed the following design targets at those nearest sensitive receptors (existing and proposed) positioned to each monitoring position as summarised below.

Receptor Location	Representative background sound level , L_{A90} (dB)	
	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
MP2	48	34

Table 17 Representative background sound level

Receptor Location	Proposed rating noise level limit, $L_{Ar,Tr}$ (dB)	
	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Nearest habitable window of development itself or rear of existing properties on Park Road / Station Road	43	30

Table 18 Proposed rating noise level limits for fixed plant

Should it be determined that the operational regime of any proposed fixed plant is likely to occur on a 24-hour basis, the lower night-time target should be used to inform the design of any fixed plant attached to the operation of this building. Assuming the noise design targets are adhered to as part of the design, the proposed fixed plant would have a low impact on existing and proposed sensitive receptors. Consideration of location and noise source output of any fixed plant items should be sought during the design stage of the commercial area to ensure noise levels meet the proposed rating noise level limits.

Histograms for daytime and night-time periods from which the representative background levels are derived, are provided in **Appendix D**.



7 Conclusions

A noise impact assessment has been carried out with respect to the proposed development of 17 residential dwellings at the land off Wellington Road, Wokingham.

An attended and unattended noise survey has been carried out at the site to establish the environmental sound climate. A computer model has been provided to further predict the effect of dominant noise sources influencing the proposed development facades.

A site suitability assessment has been undertaken to establish the level of risk at locations across the development site. Commercial noise from the car wash premises at the rear of the site has been considered in the assessment when judging suitable façade elements at the rear of the proposed building.

Detailed noise break-in calculations have been carried out based on established assessment spectra from the site survey and using the proposed internal layout plans and window dimensions. Suitable internal amenity can be secured for the development in line with BS 8233 / local policy criteria based on a suitable specification of glazing and ventilation elements which will require high-performing sound insulation ratings for windows and ventilation elements for the worst-affected façades.

An outline overheating appraisal has been given with respect to Building Regulations Approved Document O and industry guidance. It has been recommended that an overheating assessment is carried out which will inform the ventilation and overheating strategy in conjunction with the acoustic strategy at the detailed design stage. This may require the need for a mechanical ventilation and cooling strategy allowing occupants the option to keep windows closed.

The provision for external amenity in the form of private balcony areas will be exposed to noise levels that exceed BS 8233 guidance based on the current layout plans. It is considered that planning should not be refused on grounds of amenity standards, where the external amenity may not be considered intrinsic to the design.

Recommended design targets for building services external plant noise emissions limits have been provided in terms of a rating level relative to the representative background sound level at proposed and existing receptor locations.



Appendix A – Site Plan



Appendix B – Glossary

Term	Definition
Ambient sound	The total sound at a given place, usually a composite of sounds from many sources near and far.
Background sound, $L_{A90,T}$	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval.
dB	Decibel. Scale for expressing sound pressure level. It is defined as 20 times the logarithm of the ratio between the root mean square pressure of the sound field and a reference pressure i.e. 2×10^{-5} Pascal.
dB(A)	A-weighted decibel. This provides a measure of the overall level of sound across the audible spectrum with a frequency weighting to compensate for the varying sensitivity of the human ear to sound at different frequencies. Example sound levels include: 140 dB(A) Threshold of pain 120 dB(A) Threshold of feeling 100 dB(A) Loud nightclub 80 dB(A) Traffic at busy roadside 60 dB(A) Normal speech level at 1m 40 dB(A) Quiet office 20 dB(A) Broadcasting studio 0 dB(A) Median hearing threshold (1000 Hz)
Frequency	The repetition rate of a sound wave. The subjective equivalent in music is pitch. The unit of frequency is the Hertz (Hz), which is identical to cycles per second. A thousand hertz is often denoted as kHz, e.g. 2 kHz = 2000 Hz. Human hearing ranges approximately from 20 Hz to 20kHz.
$L_{Aeq,T}$	This is defined as the notional steady sound level over a stated period of time (T), would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.
Sound absorption	Process whereby sound energy is converted in to heat. Sound absorption properties is expressed as the sound absorption coefficient α or the sound absorption class (A-E).
Sound insulation	The reduction or attenuation of airborne sound by a solid element between source and receiver.
Time Weighting	Sound level meters use various averaging times for the measurement of RMS sound pressure level. The most commonly used are fast (0.125 s averaging time), slow (1 s averaging time) and impulse (0.035 s averaging time). Variables that are measures with time weightings are expressed as L_{AFmax} etc.
Frequency Weighting Networks	Frequency weighting networks, which are generally built into sound level meters, attenuate the signal at some frequencies and amplify it at others. The A-weighting network approximately corresponds to human frequency response to sound. Sound levels measured with the A-weighting network are expressed in dB(A). Other weighting networks also exist, such as C-weighting which is nearly linear (i.e., unweighted) and other more specialised weighting networks. Variables such as L_p and L_{eq} that can be measured using such weightings are expressed as L_{pA} / L_{pC} , L_{Aeq} / L_{Ceq} etc.
L_N - Percentile or Statistical Levels	If a non-steady noise is to be described, it is necessary to know both its level and the degree of fluctuation. The L_N indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L_{10} is the level exceeded for 10% of the time, and the L_{90} is the level exceeded for 90% of the time,
Pre-existing ambient noise	Pre-existing ambient noise means the level of ambient noise, expressed as a level of L_{Aeq} determined with respect to the relevant time period and the relevant L_{Aeq} averaging time, prevailing one metre in front of relevant windows or doors in a façade of a dwelling, immediately before the placing of a contract for the construction.



Term	Definition
Free-field Level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces. Generally, as measured outside and away from buildings.
Façade Level	A sound field determined at a distance of 1 metre in front of a large sound reflecting object such as a building façade.
R_w – Weighted Sound Reduction Index	Single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies. Value, in decibels, of the reference curve at 500 Hz after shifting it in accordance with the method specified in this part of ISO 717.
C; C_{tr} – Spectrum Adaptation Terms	Value, in decibels, to be added to the single-number rating (e.g., R _w) to take account of the characteristics of a particular sound spectra.

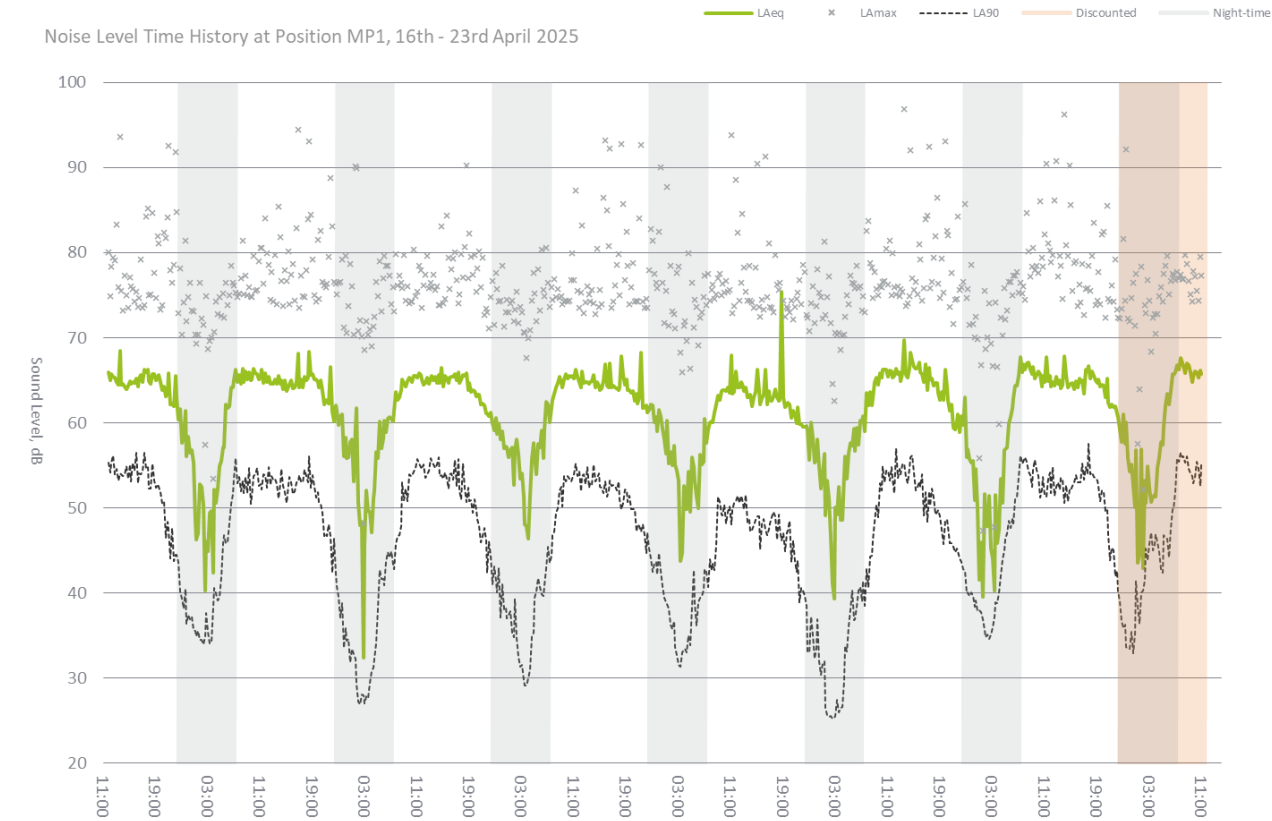
Glossary of terms



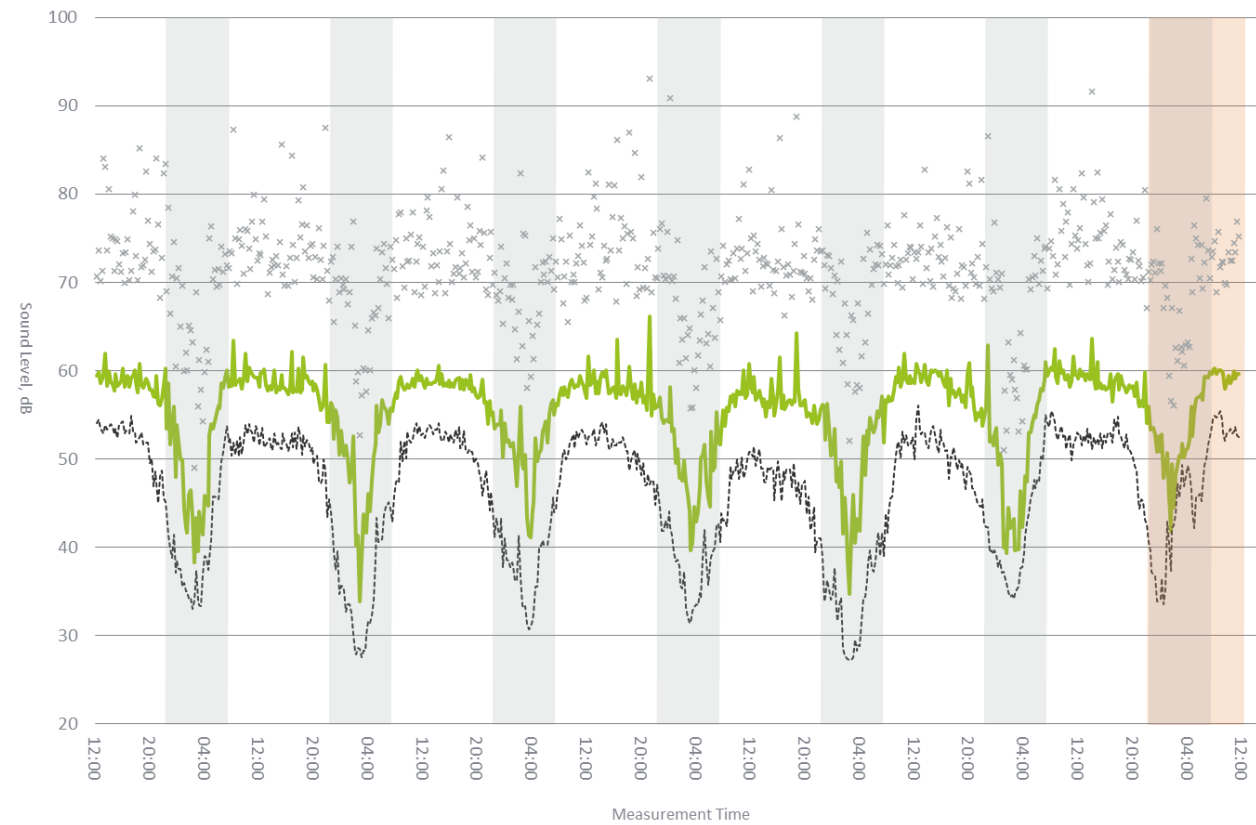


Appendix C – Time Histories

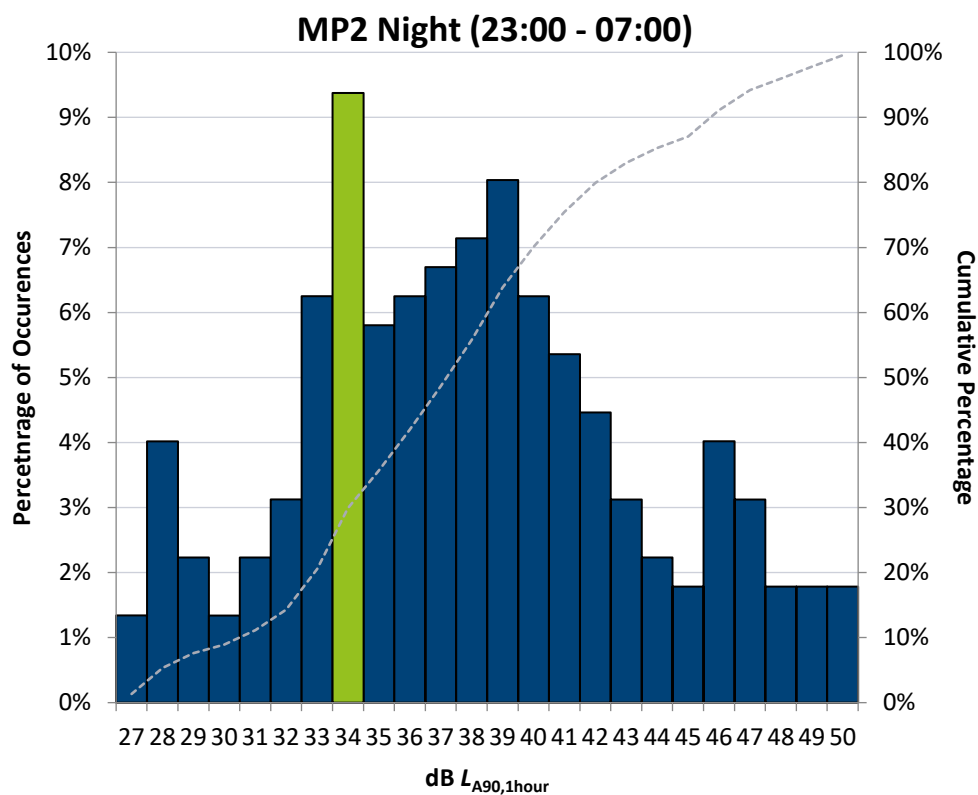
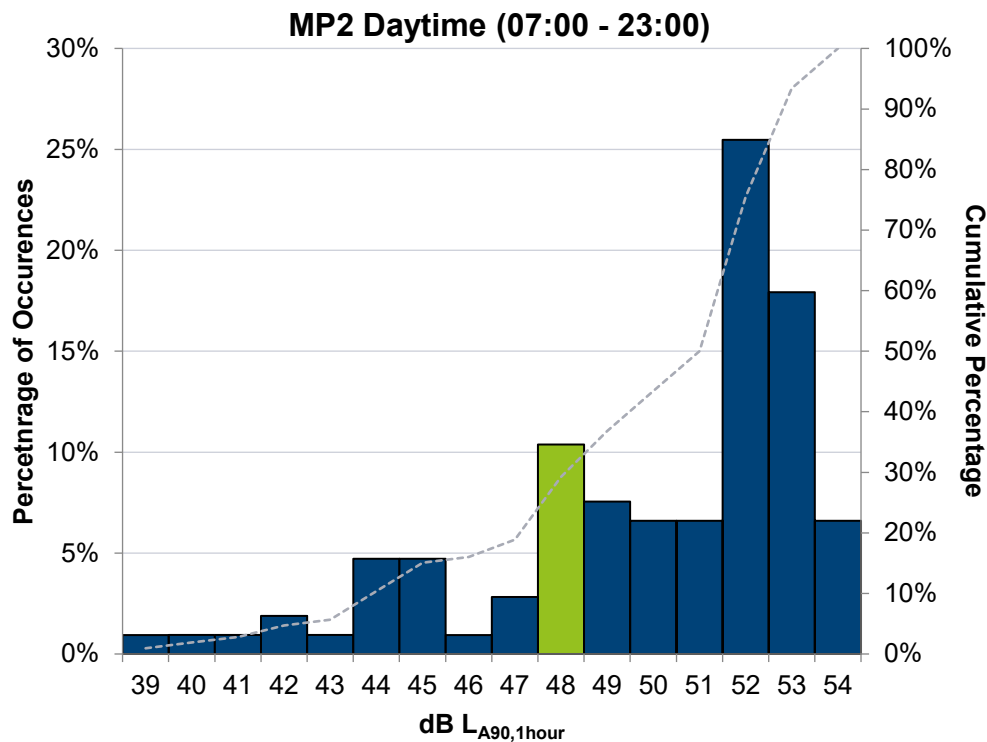
MP1



MP2

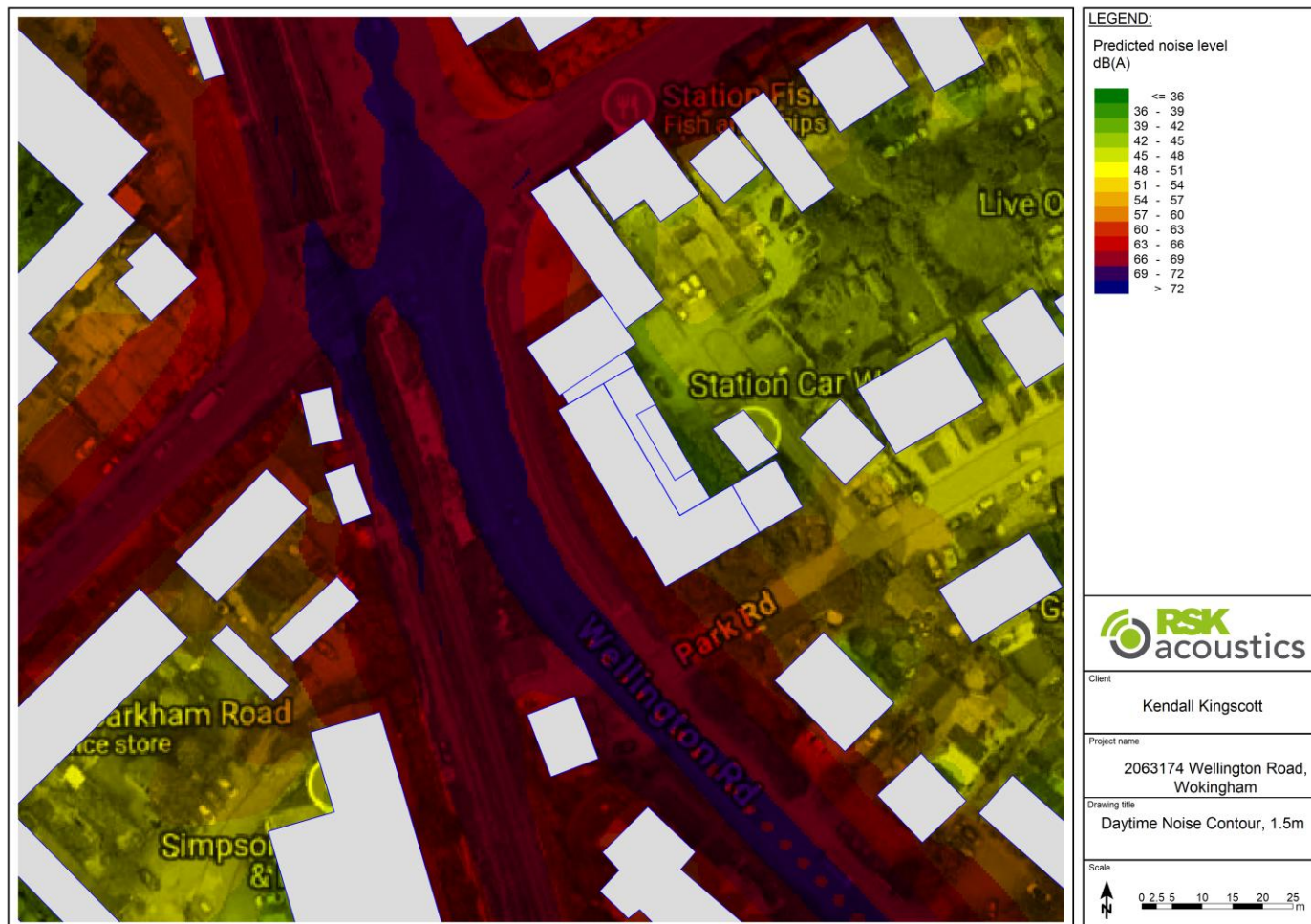


Appendix D – Background Sound Levels

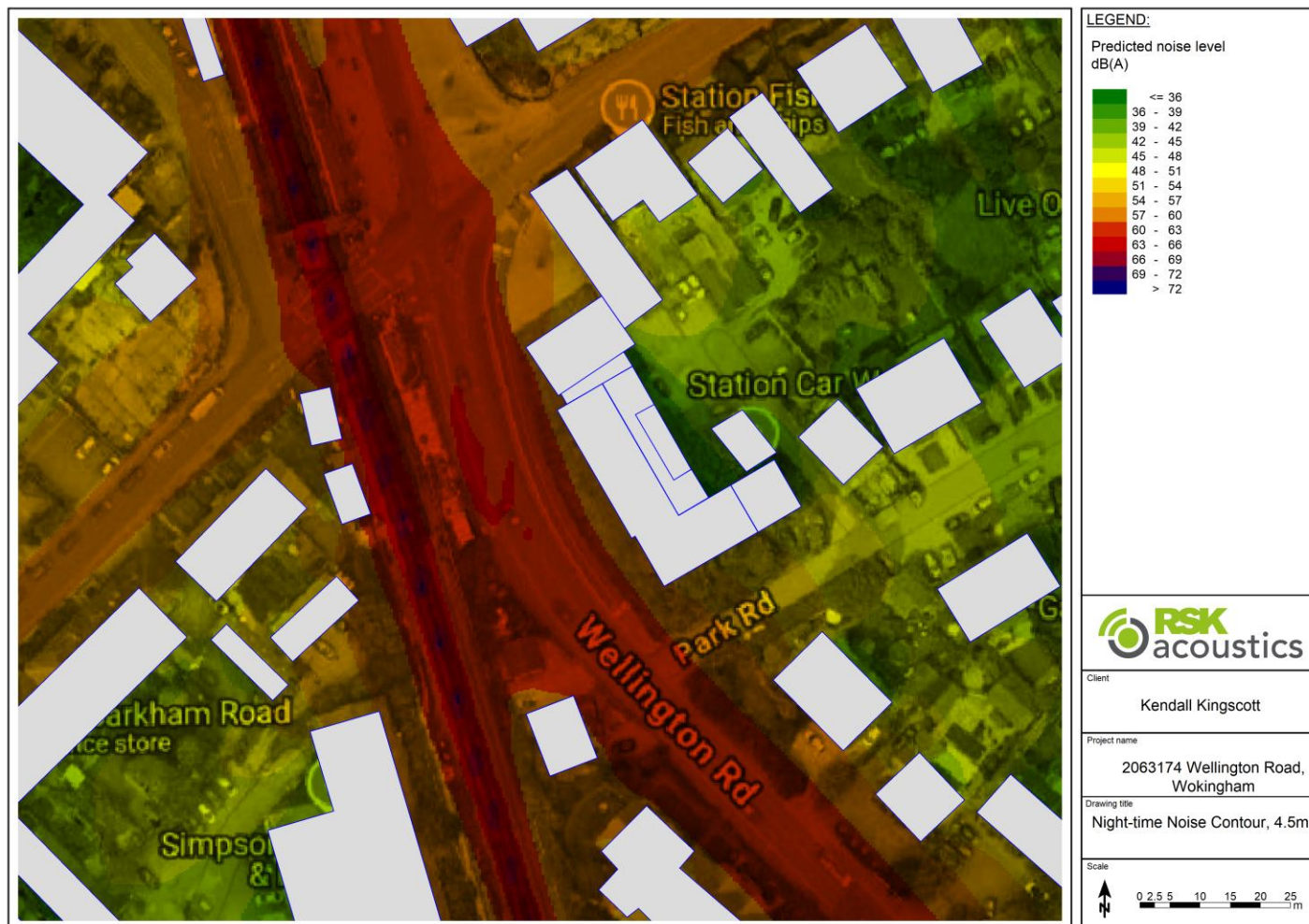


Appendix E – Noise Contours

Daytime



Night-time



Appendix F – Noise Break-In Calculations Summary

Calculation Summary according to BS 8233:2014 Section G2.1, from BS EN 12354-3:2000.									
Ref	Room Name	Sound Insulation Scheme, dB				Criteria, dB(A)			Pass / Fail Design Vs Criteria
		Wall	Glazing	Façade Vent(s)	Roof	35	30	45	
		R _w	R _w	D _{ne,w}	R _w	Day	Night	Max	
1	Flat 6 bedroom	57	36	44	-	35	29	41	PASS
2	Flat 6 living room	57	38	44	-	32	27	-	PASS
3	Flat 2 bedroom	57	36	44	-	35	29	43	PASS
4	Flat 2 living room	57	38	44	-	34	28	-	PASS
5	Flat 1 bedroom	57	36	44	-	33	26	44	PASS
6	Flat 1 living room	57	38	44	-	29	23	-	PASS
7	Flat 21 living room /kitchen (rear)	57	30	27	50	22	15	-	PASS
8	Flat 1 living room /kitchen (rear)	57	30	27	50	24	17	-	PASS



