A Noise Assessment for Radwinter Road, Saffron Walden

On behalf of Rosconn Strategic Land

November 2021

resound acoustics

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Resound Acoustics Limited is a
Member of the Association of Noise Consultants

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1 INTRODUCTION

1.1 Rosconn Strategic Land has appointed Resound Acoustics Limited to undertake a noise assessment for a site at Radwinter Road, Saffron Walden. Rosconn Strategic Land is seeking planning permission for residential development at the site.

1.2 This noise report has been updated to include the results of a further noise survey, undertaken at the request of the Environmental Health Department of Uttlesford District Council, to investigate the potential impact of noise from commercial facilities to the west of the site.

1.3 The noise climate at the site has been established by a combination of direct measurement and calculation, and the suitability of the site for the proposed development considered against national and local planning policy, and guidelines on noise. Where necessary, mitigation measures have been recommended so that a noise climate suitable for the proposed development can be achieved.

1.4 It is noted that this assessment was partly undertaken during a period where restrictions were in place as part of the Government's response to coronavirus/Covid-19. The implications of these restrictions are considered in this report, where appropriate.

1.5 Whilst reasonable efforts have been made to produce a report that is easy to understand, it is technical in nature. To assist the reader, an introduction to noise and an explanation of the terminology used in this report is contained in Appendix A.

2 SITE DESCRIPTION

Existing Site Conditions

2.1 The site is located to the east of Saffron Walden, Essex and is bounded by Radwinter Road to the north, agricultural land to the south and east, and by a recently-constructed residential development to the west.

2.2 The site is currently an open agricultural field and slopes down from the south-east to north-west.

2.3 A site location plan is included as Figure B.1 in Appendix B.

Proposed Site Conditions

2.4 Rosconn Strategic Land proposes to develop the site for residential use.

2.5 The current proposals are shown in the Define drawing *Illustrative Masterplan* (reference DE_436-005 Rev N). This drawing is included as Figure B.2 in Appendix B.

3 GUIDANCE

Local Authority Consultation Response

3.1 The Environmental Health Department of Uttlesford District Council provided a response to the first revision of this report on 7th September 2021:

> *"Noise*
>
> *This service has viewed the Resound Acoustics Noise Impact Assessment Ref: RA00693 - Rep 1 dated 28th July 2021 and broadly agree with the road noise findings, however, no investigation was undertaken to assess the noise that may arise from the neighbouring commercial units (NW of site), including a taxi firm which may operate for 24 hours. The activities at these units have the potential to cause noise disturbance to future residents and should be looked at in more detail during normal conditions (not lockdown). This needs to be done prior to designing final plans as it may have an impact on the ability to develop this part of the site."*

3.2 The commercial units identified by the EHO did not generate any noise during the baseline survey undertaken at the site in May 2021, as described in Section 4 of this report.

3.3 Notwithstanding this, a further survey has been undertaken at the site to meet the requirements of UDC's EHO.

National Planning Policy Framework

3.4 The Department for Communities and Local Government published the *National Planning Policy Framework* (NPPF) on 27th March 2012 and upon its publication, the majority of planning policy statements and guidance notes were withdrawn, including Planning Policy Guidance (PPG) 24 *Planning and Noise*, which until the emergence of the NPPF, set out the Government's position on how noise should be dealt with in the planning system.

3.5 The NPPF was most recently revised on 20th July 2021.

3.6 The general guiding principle in the NPPF is contained in Section 15 under the heading *Conserving and enhancing the natural environment*. Paragraph 174 states:

> *"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;"*

3.7 The noise planning policy is contained in paragraph 185, which also appears in Section 15 of the NPPF:

"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 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;"

3.8 A footnote to the point paragraph 185(a) refers to the *Explanatory Note of the Noise Policy Statement for England*, which defines both *"significant adverse impacts on health and quality of life"* and *"adverse impacts on health and quality of life"*.

Noise Policy Statement for England

3.9 The Department for Environment, Food and Rural Affairs published the *Noise Policy Statement for England* (NPSE) in March 2010. The explanatory note of the NPSE defines the terms used in the NPPF:

"2.20 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.

2.21 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."

3.10 The NPSE does not define the SOAEL numerically, stating at paragraph 2.22:

"2.22 It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from

noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available."

3.11 There is no local or national guidance on how the three terms should be defined numerically.

3.12 There are three aims in the NPSE, two of which relate to the first bullet point in paragraph 180 of the NPPF:

"The first aim of the Noise Policy Statement for England

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.

2.23 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 (paragraph 1.8).

The second aim of the Noise Policy Statement for England

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.

2.24 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 while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such adverse effects cannot occur.

The third aim of the Noise Policy Statement for England

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.

2.25 This aim seeks, where possible, positively to improve health and quality of life through the pro-active management of noise while also taking into account the guiding principles of sustainable development (paragraph 1.8), recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim."

Planning Practice Guidance

3.13 In March 2014, the Government released Planning Practice Guidance (PPG) on noise, titled *Noise*. This document sets out a number of principles in the form of questions and answers, and reinforces the guidance set out in the NPPF and the NPSE. The most recent version of this document was published in July 2019.

3.14 The noise PPG notes that:

> *"Noise needs to be considered when new development may create additional noise and when new developments would be sensitive to the prevailing acoustic environment (including any anticipated changes to that environment from activities that are permitted but not yet commenced)."*

3.15 It goes on to note that:

> *"Plan-making and decision taking 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."*

3.16 The noise PPG broadly repeats the NPSE definitions of the NOEL, LOAEL and SOAEL and it provides a summary table to explain how the terms relate to each other and to typical human reactions to sound. The table is replicated below in Table 3.1.

Table 3.1: Planning Practice Guidance summary of noise exposure hierarchy

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

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

3.17 It is noted that the text in paragraph 005 of the PPG for noise reiterates the point illustrated in Table 3.1, that there are degrees of adverse effect above the SOAEL. Table 3.1 defines two degrees of significant adverse effect: a significant observed adverse effect, which is deemed noticeable and disruptive, and an unacceptable adverse effect, which is deemed noticeable and very disruptive.

3.18 The distinction between these two degrees of significant adverse effect is expanded upon in the text in paragraph 005 of the PPG for noise:

> *"005 Increasing noise exposure will at some point cause the 'significant observed adverse effect' level boundary to be crossed. Above this level the noise causes a material change in behaviour such as keeping windows closed for most of the time or avoiding certain activities during periods when the noise is present. If the exposure is predicted to be above this level the planning process should be used to avoid this effect occurring, for example through the choice of sites at the plan-making stage, or by use of appropriate mitigation such as by altering the design and layout. While such decisions must be made taking account of the economic and social benefit of the activity causing or affected by the noise, it is undesirable for such exposure to be caused.*
>
> *At the highest extreme, noise exposure would cause extensive and sustained adverse changes in behaviour and / or health without an ability to mitigate the effect of the noise. The impacts on health and quality of life are such that regardless of the benefits of the activity causing the noise, this situation should be avoided."*

3.19 The PPG, which is the most recent manifestation of Government advice on how noise should be treated within the planning system, is clear that a significant adverse effect, which lies above the SOAEL but below an unacceptable adverse effect, can be addressed

(or 'avoided' in the terms of the PPG) through the provision of mitigation, including noise insulation; it is not until an unacceptable adverse effect is reached that the cause of the effect should be prevented.

3.20 The noise PPG provides advice on how to mitigate the effects of noise, noting that there are options to reduce noise at source, to optimise site layouts, to use planning conditions, and providing insulation within affected properties.

3.21 The noise PPG also notes that:

> *"The noise impact may be partially offset if the residents of those dwellings have access to:*
>
> - *a relatively quiet façade (containing windows to habitable rooms) as part of their dwelling, and/or*
> - *a relatively quiet external amenity space for their sole use, (e.g. a garden or balcony). Although the existence of a garden or balcony is generally desirable, the intended benefits will be reduced with increasing noise exposure and could be such that significant adverse effects occur, and/or*
> - *a relatively quiet, protected, nearby external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings, and/or*
> - *a relatively quiet, protected, external publically accessible amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minutes walking distance)."*

Local Planning Policies

3.22 Uttlesford District Council (UDC) is currently developing a new Local Plan. Until the new plan is adopted, planning decisions will be determined against saved policies in the *Local Plan 2005*.

3.23 Policy ENV10 – *Noise Sensitive Development and Disturbance from Aircraft* states:

> *"Housing and other noise sensitive development will not be permitted if the occupants would experience significant noise disturbance. This will be assessed by using the appropriate noise contour for the type of development and will take into account mitigation by design and sound proofing features."*

3.24 The supporting text refers to aircraft taking off from Stansted Airport; however, the development site is approximately 13km from Stansted Airport. Therefore, noise from aircraft, and Policy ENV10, is unlikely to be relevant to the proposed development.

ProPG

3.25 *Professional Practice Guidance on Planning and Noise* (ProPG) was released in May 2017. A joint publication by the Chartered Institute of Environmental Health, the Institute of Acoustics, and the Association of Noise Consultants, the document sets out a recommended approach for the management of noise within the planning system in England.

3.26 ProPG sets out a two-stage risk based approach for new residential development:

- **Stage 1:** initial noise risk assessment of the proposed development;
- **Stage 2**: a systematic consideration of four key elements:
  - *Element 1*: demonstrating a '*Good Acoustic Design Process*';
  - *Element 2*: observing internal *'Noise Level Guidelines'*;
  - *Element 3*: undertaking an *'External Amenity Area Noise Assessment'*; and
  - *Element 4*: consideration of *'Other Relevant Issues'*.

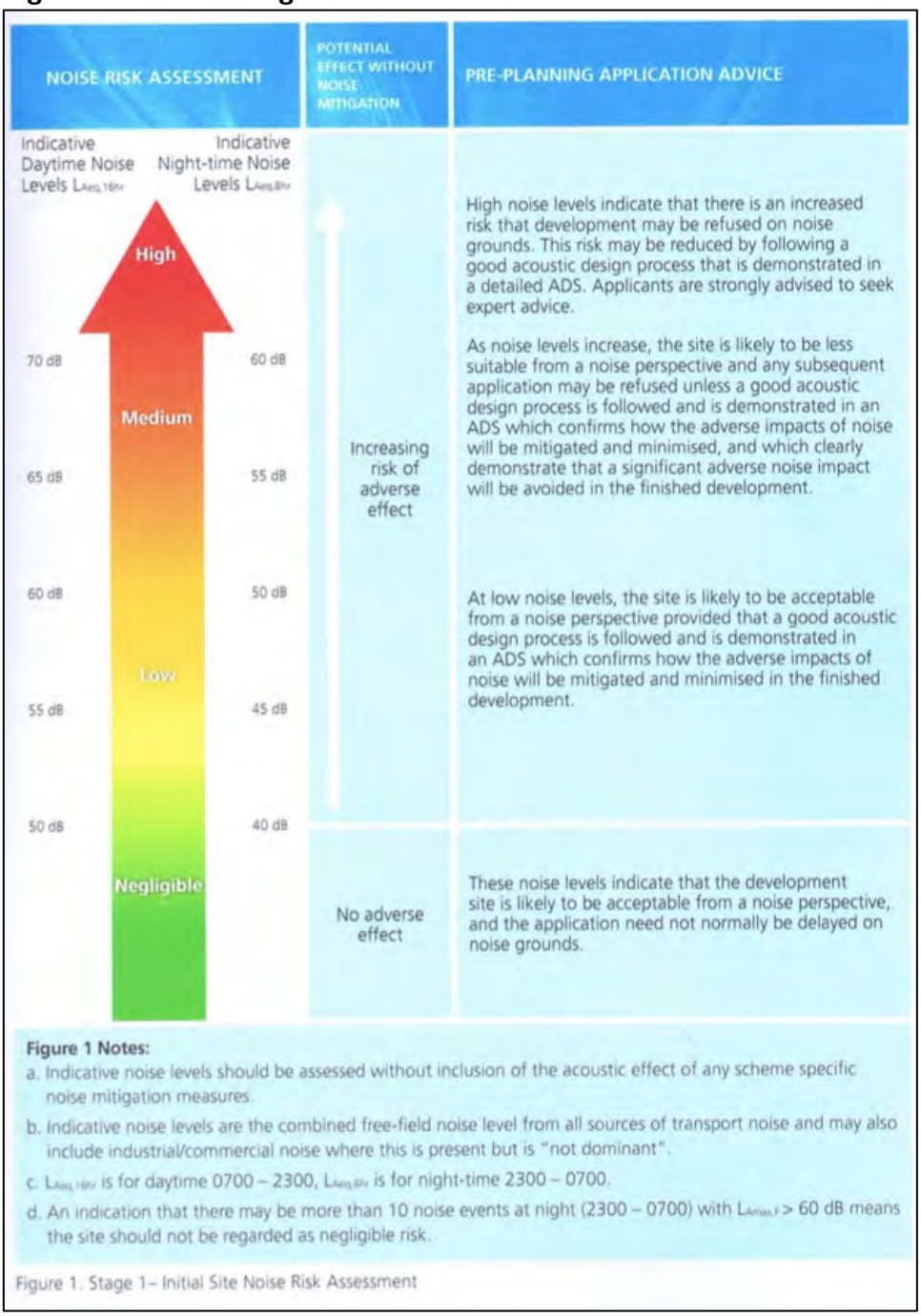
3.27 The Stage 1 initial noise risk assessment should provide an indication of the likely risk of adverse effects from noise should no mitigation be included as part of the development proposals.

3.28 ProPG provides an illustrative noise risk scale, derived from current guidelines values and experience. The scale suggests that the risks are negligible where noise levels are below 50dB L_{Aeq} during the daytime and 40dB L_{Aeq} during the night-time. The scale suggests that a site would start to tend from a medium to a high risk when noise levels are above approximately 70dB L_{Aeq} during the daytime and above approximately 60dB L_{Aeq} during the night-time. Between these values, the level of risk increases through low to medium as noise levels increase. These values are all stated as indicative in the ProPG.

3.29 The ProPG states that this initial noise risk assessment is intended to support wider Government planning and noise policies and guidance, i.e. the NPPF, NPSE and PPG-*Noise*.

3.30 Figure 1 of the ProPG, which is replicated here as Figure 3.1, presents the risk hierarchy, with indicative noise levels that broadly equate to the different risk categories.

Figure 3.1: ProPG Stage 1 Risk Assessment



3.31 The Stage 2 full assessment should consider good acoustic design, internal noise levels, external amenity area noise levels, and assessment of any other issues.

3.32 The ProPG states that good acoustic design should consider factors suggest as reducing noise at source, site layouts, and building orientation. Solely relying on the sound insulation of building fabric to achieve acceptable acoustic conditions is not considered good acoustic design. Noise control measures should be considered against other requirements, such as ventilation, fire regulation and cost.

3.33 The ProPG refers to the criteria set out in BS8233: 2014 and the World Health Organisation's *Guidelines for Community Noise* for internal noise levels and noise levels in

external amenity areas. The ProPG notes that internal noise levels should always be considered alongside requirements for ventilation and overheating. Note 5 under Figure 2 in the ProPG, which sets out the internal noise level guidelines replicated from BS8233: 2014 and the WHO guidelines, states:

> *"Designing the site layout and the dwellings so that the internal target levels can be achieved with open windows in as many properties as possible demonstrates good acoustic design. 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, subject to the further advice in Note 7."*

3.34 It is clear that the internal noise guidelines should be met for 'whole dwelling ventilation' conditions, which are effectively background ventilation. 'Whole dwelling ventilation' is defined in Approved Document F of the Building Regulations 2010.

3.35 Note 7 under Figure 2 of the ProPG states:

> *"Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal L_{Aeq} target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved."*

3.36 The ProPG allows for the relaxation of the internal guideline noise levels by up to 5dB and the internal noise levels would still be regarded as reasonable.

3.37 For 'purge ventilation' conditions, the ProPG does not specify internal noise criteria, stating at paragraph 2.35:

> *"It should also be noted that the internal noise level guidelines are generally not applicable under "purge ventilation" conditions as defined by Building Regulations Approved Document F, as this should only occur occasionally (e.g. to remove odour from painting and decorating or from burnt food)."*

3.38 For thermal control, i.e. overheating conditions, ProPG states that the potential noise levels should be assessed, stating at paragraph 2.38:

> *"Where mechanical services are used as part of the ventilation or thermal comfort strategy for the scheme, the impact of noise generated by these systems on occupants should also be assessed."*

3.39 The ProPG goes on to state in paragraph 2.72(h):

> *"Reasonable steps should be taken to minimise overheating during summer months through good design. Where openable windows / ventilators are proposed to mitigate overheating and where the internal noise level guidelines are likely to be exceeded when they are open a more detailed assessment of the potential impact on occupants during the overheating condition should be provided in the ADS. This more detailed assessment may include: (i) the alternative design measures considered / applied to reduce noise impact on occupants, (ii) the expected internal noise levels when windows / ventilators are opened to provide relief from overheating, and (iii) an estimate of the amount of time that windows are likely to be open to provide relief from overheating."*

3.40 Consideration of overheating issues is outside the scope of this noise assessment. However, it is clear that while the ProPG does require internal noise levels to be considered under thermal control conditions, no internal noise criteria are applied.

3.41 The ProPG states that other relevant issues include compliance with relevant national and local policies, magnitude of compliance with the ProPG itself, the likely occupants of the development, acoustic design against unintended adverse consequences and acoustic design against wider planning objectives.

British Standard 8233

3.42 The scope of British Standard (BS) 8233: 2014 *Guidance on sound insulation and noise reduction for buildings* is the provision of recommendations for the control of noise in and around buildings. It suggests appropriate criteria and limits for different situations, which are primarily intended to guide the design of new or refurbished buildings undergoing a change of use rather than to assess the effect of changes in the external noise climate.

3.43 BS8233: 2014 suggests suitable internal noise levels within different types of buildings, including residential dwellings, as shown in Table 3.2.

Table 3.2: BS8233 recommended internal noise levels, dB

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

3.44 BS8233 contains the following relevant guidance in footnotes to the above information:

> *"Note 4: 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 $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values.*
>
> *Note 5: If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level.*
>
> *Note 7: Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved."*

3.45 Although Note 4 above refers to setting a guideline value for maximum noise levels, BS8233: 2014 does not provide any guidance on a suitable criterion.

3.46 Placing the BS8233: 2014 guidance into the context required by the NPPF and the NPSE, it is considered that where the internal noise levels meet the guideline values set out in Table 3.2, there is considered to be no observed effect.

3.47 Since BS8233: 2014 allows for a 5dB relaxation in the guideline values in Table 3.2 (Note 7 above), it is considered that internal noise levels up to 5dB above the guideline values in Table 3.2 may still be acceptable.

3.48 Section 7.7.3.2 of BS8233, titled *Design criteria for external noise* 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 50dB $L_{Aeq,T}$, with an upper guideline value of 55dB $L_{Aeq,T}$ which would be acceptable in noisier environments."*

3.49 BS8233: 2014 goes on to note that the upper guideline value may be exceeded in certain circumstances:

> *"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."*

3.50 Achieving the lowest practicable noise levels in gardens is deemed acceptable in BS8233: 2014 in circumstances where development is needed in areas where the upper 55dB limit cannot be achieved.

3.51 As BS8233: 2014 states that it is desirable that garden noise levels do not exceed 50dB $L_{Aeq,T}$, this implies some adverse effect above this level. Therefore, an external daytime noise level of 50dB $L_{Aeq,16hrs}$ can be defined as the LOAEL.

3.52 However, it would not be appropriate to equate the 55dB criterion with the SOAEL, since it is clear from BS8233: 2014 that 55dB is not a threshold that should never be exceeded. Equating the 55dB criterion to the SOAEL would mean that, in national policy terms, exceeding this threshold should be avoided, which is not what the standard requires.

3.53 BS8233: 2014 states that road traffic noise calculations can be undertaken using the *Calculation of Road Traffic Noise*, together with the Defra-commissioned TRL study *Method for Converting the UK Road Traffic Noise Index $L_{A10,18h}$ to the EU Noise Indices for Road Noise Mapping*. The standard states at Section 6.2.2:

> *"A Defra-commissioned study, prepared by TRL and entitled "Method for Converting the UK Road Traffic Noise Index $L_{A10,18h}$ to the EU Noise Indices for Road Noise Mapping", is the source of the method promulgated in Highways Agency document HD 213/11 for estimating night-time noise levels from the calculated or measured $L_{A10,18h}$.*
>
> *This study, however, also provides methods for the conversion of $L_{A10,18h}$ index to other indices, including various period $L_{Aeq,T}$ values. Whilst these conversions have been developed primarily for compliance with strategic EU noise mapping requirements, they provide one potential approach to estimating the range of noise indicators which are relevant to modelling traffic noise."*

World Health Organisation

3.54 The World Health Organisation (WHO) *Guidelines for Community Noise* (1999) also sets out guidance on suitable internal and external noise levels in and around residential properties. The guidance on internal and external noise levels is the same as set out in

BS8233: 2014 in terms of L_{Aeq} values, but the WHO guidelines also provide guidance on night-time maximum noise levels, stating:

> *"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{AFmax} more than 10-15 times per night."*

3.55 The WHO guidelines suggest the possibility of sleep disturbance if continuous noise in bedrooms exceeds 30dB $L_{Aeq.8hrs}$ during the night-time, and therefore internal noise levels above this value can be considered to be above the LOAEL. This internal value can be translated to an external value by the addition of 10dB, to account for the typical reduction through an open window. Therefore, external night-time noise levels of 40dB $L_{Aeq,8hrs}$ can be defined as the LOAEL.

3.56 The WHO published their *Night Noise Guidelines for Europe* in 2009. This document sets an external 'night noise guideline' (NNG) of 40dB. This is consistent with the LOAEL value determined above. The NNG also sets an interim target of 55dB in situation where the 40dB value cannot be met. Above 55dB the NNG notes that the situation is considered increasingly dangerous for public health. On the basis of the above, a free-field external value of 55dB $L_{Aeq,8hrs}$ is considered to be the night-time SOAEL.

3.57 The WHO published their *Environmental Noise Guidelines for the European Region* in 2018. The WHO state that this document supersedes the 1999 *Guidelines for Community Noise*; however, it recommends that all indoor guideline values in the 1999 document, and any values in the 1999 document not covered by the 2018 document, such as industrial noise, remain valid. The WHO also note that the 2018 document complements the 2009 *Night Noise Guidelines*.

Noise Insulation Regulations

3.58 The *Noise Insulation Regulations 1975 (as amended 1988)* set out conditions, which if satisfied, require the promoter of a new road to offer affected residents sound insulation or a grant in respect of sound insulation.

3.59 Although legislation framed with reference to new roads is not directly relevant to the proposed development considered here, the noise levels at which sound insulation must be offered provide an indication of what constitutes a significant level of noise from these sources; these values may be used to define the level at which significant adverse effects occur, i.e. the SOAEL.

3.60 The *Noise Insulation Regulations* indicate that sound insulation should be offered when, inter alia, road traffic noise exceeds a façade noise level of 68dB $L_{A10,18hrs}$. This value can be converted to a 16 hour L_{Aeq} to match the form of the guidance recommended in BS8233 by subtracting 5dB. This correction includes a -3dB correction to remove the façade correction, a further -3dB correction to convert the 18 hour L_{A10} noise level to an 18 hour L_{Aeq} noise level, and a +1dB correction to convert the 18 hour L_{Aeq} to a 16 hour L_{Aeq}. The resulting value of 63dB $L_{Aeq,16hrs}$ is considered to be the daytime SOAEL.

3.61 Since noise levels of 63dB $L_{Aeq,16hrs}$ can be controlled through the provision of appropriate ventilation, as required by the *Noise Insulation Regulations*, it is reasonable to suggest that the point at which an unacceptable adverse effect occurs is higher than this value.

3.62 The sound insulation package specified in the *Noise Insulation Regulations* is known to give a sound reduction of approximately 35dB. At external noise levels in excess of 70dB at night the internal noise levels will exceed the reasonable criterion in BS8233 of 35dB. A noise level 1dB below this value is therefore taken to be the upper limit of acceptability for residential properties at night.

3.63 This 69dB $L_{Aeq,8hrs}$ limit has been converted to a free-field value of 66dB to be consistent with the free-field values used elsewhere in this report.

3.64 On this basis, and in the absence of any local definition, the point at which night-time noise levels result in an unacceptable adverse effect is considered to be 66dB $L_{Aeq,8hrs}$.

BRE Research Paper

3.65 A Building Research Establishment (BRE) survey titled *The effectiveness and acceptability of measures for insulating dwellings against traffic noise* (Utley W et al, Journal of Sound and Vibration (1986) Vol 109(1), pages 1-18) found that the insulation package supplied under the Noise Insulation Regulations is inadequate for road traffic noise levels of 78dB $L_{A10,18hrs}$ and above at a façade.

3.66 This figure is equivalent to a free-field level of 75dB $L_{A10,18hrs}$; which in turn is equivalent to 73dB $L_{Aeq,16hrs}$. If mitigation specified under the *Noise Insulation Regulations* becomes ineffectual at 73dB $L_{Aeq,16hrs}$, it can be concluded that 72dB $L_{Aeq,16hrs}$ is the highest noise level at which the mitigation remains effective.

3.67 On this basis, and in the absence of any local definition, the point at which daytime noise levels result in an unacceptable adverse effect is considered to be 72dB $L_{Aeq,16hrs}$.

Calculation of Road Traffic Noise

3.68 Calculations of road traffic noise have been undertaken using the *Calculation of Road Traffic Noise* (CRTN), published in 1988 by the former Department of Transport and The Welsh Office.

3.69 CRTN sets out standard procedures for calculating noise levels from road traffic. The calculation method uses a number of input variables, including traffic flow volume, average vehicle speed, percentage of heavy goods vehicles, type of road surface, site geometry and the presence of noise barriers or acoustically absorbent ground, to predict the $L_{A10,18hrs}$ or $L_{A10,1hr}$ noise level for any receptor point at a given distance from the road.

3.70 CRTN contains a *'shortened measurement procedure'* that can be used to estimate the L_{A10} noise level over an 18 hour period from a shorter, three hour measurement. It states that the average of three hourly L_{A10} noise levels, measured between 10:00 and 17:00 hours, is 1dB higher than the 18 hour L_{A10} noise level.

3.71 The 18 hour L_{A10} value can be converted to the daytime, evening and night-time L_{Aeq} noise levels using the *TRL End Correction* method described below.

TRL End Correction

3.72 The DEFRA *Method for Converting the UK Road Traffic Noise Index $L_{A10,18h}$ to the EU Noise Indices for Road Noise Mapping*, colloquially known as the *TRL End Correction*, contains equations for calculating day, evening and night-time L_{Aeq} noise levels from an 18 hour L_{A10} noise level. The equations, which are different for motorways and non-motorways, have been used in this instance to corroborate corrections made to the measured noise levels.

3.73 Although the *TRL End Correction* was formulated for the purposes of noise mapping, the formulae provide a reasonable basis for calculating L_{Aeq} noise levels from $L_{A10,18hrs}$ road traffic noise levels. The acceptability of this approach is confirmed in Section 6.2.2 of BS8233: 2014.

British Standard 4142

3.74 British Standard (BS) 4142: 2014+A1: 2019: *Methods for rating and assessing industrial and commercial sound* describes a method for rating and assessing sound of an industrial or commercial nature, which includes:

- sound from industrial and manufacturing processes;
- sound from fixed installations which comprise mechanical and electrical plant and equipment;
- sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and
- sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

3.75 In a BS4142: 2014+A1: 2019 assessment, the industrial or commercial sound is assessed outside a dwelling or premises used for residential purposes. The procedure is to quantify the *"specific sound level"*, which is the measured or predicted level of sound from the source in question over a one hour period for the daytime and a 15 minute period for the night-time. Daytime is defined in the standard as 07:00 to 23:00 hours, and night-time as 23:00 to 07:00 hours.

3.76 The preferred method for determining the specific sound level is measurement. When measuring the specific sound level, the influence of other sound sources must be accounted for, and BS4142: 2014+A1: 2019 states that this can be done by first measuring the ambient sound level, which includes contributions from both the source under consideration and other sources in the area. Measurements should then be undertaken of the residual sound, which is the sound level where the specific source is supressed to such a degree that it does not contribute to the measured sound level.

3.77 The residual sound can then be logarithmically subtracted from the ambient sound level to obtain the specific sound level. Where it is not possible to measure the residual sound level at the same location as the ambient level, for example if the source under consideration operates continuously, then an alternative location where the residual sound is comparable may be used.

3.78 Alternatively, where it is not possible to determine the specific sound by measurement alone, for example, because the difference between the ambient and residual sound level

is too small, the specific sound level may be determined by a combination of measurement and calculation. The standard states:

> *"NOTE In some cases, measurements can be supplemented by calculations. Calculations are often more reliable than a single short-term measurement when long-term averages are to be determined and in other cases where it is impossible to carry out measurements because of high residual sound levels. In case of the latter, it is sometimes convenient to carry out the measurements closer to the source and then use a calculation method to estimate the specific sound level at the assessment locations(s)."*

3.79 The specific sound level is converted to a rating level by adding penalties on a sliding scale to account for either potentially tonal or impulsive elements, using subjective judgement. The standard also sets out objective methods for determining the presence of tones or impulsive elements, but notes that these should be used where the subjective method is not sufficient.

3.80 The penalty for tonal elements is between 0dB and 6dB, and the standard notes:

> *"Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible."*

3.81 The penalty for impulsive elements is between 0dB and 9dB, and the standard notes:

> *"Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible."*

3.82 The standard also states that if a source has identifiable on/off conditions, a penalty may be applied for intermittency. The penalty for sources that have intermittent elements is stated as:

> *"If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied."*

3.83 Where the specific sound features acoustic characteristics that are distinctive against the residual acoustic climate, but are not tonal, impulsive, or intermittent in nature, a penalty of +3dB may be applied.

3.84 The standard states that the background sound level should be measured over a period of sufficient length to obtain a representative value. This should not normally be less than 15 minute intervals. The standard states that:

> *"A representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either the minimum or modal value."*

3.85 The standard notes that since the background sound level should be determined in the absence of the specific sound source that is under consideration, the background sound level can include industrial/commercial sounds that are present as separate to the specific sound being assessed.

3.86 The standard also notes that in situations where new noise sensitive receptors are being introduced and there is existing industrial and/or commercial sound, other guidance and

criteria in addition to or alternative to BS4142: 2014+A1: 2019 can also inform the appropriateness of introducing a new receptor, and also the extent of required noise mitigation.

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

> *"a) Typically, the greater this difference, the greater the magnitude of the impact.*
>
> *b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
>
> *c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.*
>
> *d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.*
>
> *NOTE 2 Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact."*

3.88 BS4142: 2014+A1: 2019 states that relevant contextual matters should be taken into account before reaching a final position on the assessment outcome. It is stated as important because:

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

3.89 BS4142: 2014+A1: 2019 lists some of the contextual matters that might influence the assessment outcome:

> *"1) The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.*
>
> *Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.*
>
> *Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.*
>
> *2) The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency*

spectrum and temporal variation of the specific sound with that of the ambient or residual sound to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/ or commercial nature is likely to be perceived and how people react to it.

NOTE 3 Consideration should be given to evidence on human response to sound and, in particular, industrial and/or commercial sound where it is available. A number of studies are listed in the "Effects on humans of industrial and commercial sound" portion of the "Further reading" list in the Bibliography.

3) The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:

i) facade insulation treatment;
ii) ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and
iii) acoustic screening."

3.90 In terms of the first of these contextual considerations, BS4142: 2014 + A1: 2019 does not indicate how the initial estimate of impact should be adjusted when background and rating levels are low. However, it is considered that in this situation, the absolute levels may suggest a more acceptable outcome than would otherwise be suggested by the difference between the values.

3.91 BS4142: 2014 + A1: 2019 does not define 'low' in the context of background sound levels nor rating levels. The note to the Scope of the 1997 version of BS4142 defined very low background sound levels as being less than about 30dB L_{A90}, and low rating levels as being less than about 35dB L_{Ar}. It is considered that these definitions provide a reasonable reference point for the definition of 'low' in the context of the current version of the standard.

3.92 It is also noted that the consideration of internal noise levels is not necessarily limited to those situations where background and rating levels are low; the contextual matters set out in BS4142: 2014 + A1: 2019 are examples, and not an exhaustive, prescriptive list.

3.93 Other contextual matters that might be relevant, include:

- character of a particular neighbourhood;
- former uses at or close to a site;
- legitimacy of the industrial use, e.g. planning permissions or environmental permits;
- implementation of best practicable means for a given process or activity; or
- local convention or perceptions.

3.94 BS4142: 2014+A1: 2019 requires uncertainties in the assessment to be considered, and where the uncertainty is likely to affect the outcome of the assessment, steps should be taken to reduce the uncertainty.

Summary

3.95 The suitability of the site has been assessed in the following ways:

- determining the external noise levels across the site, to compare with the LOAEL and SOAEL, as defined above. For clarity, the LOAEL and SOAEL adopted for this site are shown in Table 3.3;
- calculating the sound reduction performances required of the external building fabric, particularly the glazing units, so that suitable internal noise levels are achieved;
- assessing the sound levels against the criteria for external amenity areas set out in BS8233: 2014 and the WHO guidelines;
- assessing the potential impact of the commercial facilities to the west in accordance with British Standard 4142: 2014+A1: 2019.

Table 3.3: LOAEL and SOAEL for this site

Effect	Daytime $L_{Aeq,16hrs}$ (dB)	Night-Time $L_{Aeq,8hrs}$ (dB)	Comments
No Observed Effect	< 50	< 40	The parts of the site that have noise levels below these values are considered acceptable for residential development without the need for further mitigation.
LOAEL	**50**	**40**	
Observed Adverse Effect	50-55	40-45	Although the parts of the site that have noise levels between these values are above the LOAEL, BS8233 suggests that they would be acceptable.
	55-63	45-55	The parts of the site that have noise levels between these values are above the LOAEL, and are considered broadly acceptable for residential development, although mitigation may be required.
SOAEL	**63**	**55**	
Significant Observed Adverse Effect	63-72	55-66	The parts of the site that have noise levels between these values are above the SOAEL but below the point at which an unacceptable adverse effect occurs. Planning policy states that Significant Adverse Effects should be avoided and the Noise PPG states that the planning process should be used to do this by use of appropriate mitigation.
Unacceptable Adverse Effect	> 72	> 66	The noise PPG states that this situation should be prevented; however, no indication is given of how to do this.

Notes:
Stated sound levels are free-field values.

3.96 It is considered that the values in Table 3.3 can also be related to the levels of risk described in the ProPG:

- noise levels below the LOAEL, i.e. below 50dB $L_{Aeq,16hrs}$ during the daytime and below 40dB $L_{Aeq,8hrs}$ during the night-time, are considered to be a negligible risk;
- noise levels above the LOAEL but below the SOAEL, i.e. between 50dB $L_{Aeq,16hrs}$ and 63dB $L_{Aeq,16hrs}$ during the daytime and between 40dB $L_{Aeq,8hrs}$ and 55dB $L_{Aeq,8hrs}$ during the night-time, are considered to range from a low to medium risk;

- noise levels above 63dB $L_{Aeq,16hrs}$ i.e. the SOAEL, but below 72dB $L_{Aeq,16hrs}$ during the daytime, and above 55dB $L_{Aeq,8hrs}$, i.e. the SOAEL, but below 66dB $L_{Aeq,8hrs}$ during the night-time, are considered to range from a medium to high risk; and
- noise levels that result in an unacceptable adverse effect, i.e. above 72dB $L_{Aeq,16hrs}$ during the daytime and above 66dB $L_{Aeq,8hrs}$ during the night-time, are considered to be a high risk.

3.97 The lower and upper ends of these ranges, representing negligible and high risks respectively, accord with the advice set out the ProPG.

4 ENVIRONMENTAL SOUND SURVEYS

4.1 A sound survey was undertaken between Wednesday 19th and Friday 21st May 2021 to establish typical sound levels at the site.

4.2 This survey was undertaken during a period where restrictions were in place as part of the Government's response to coronavirus/Covid-19. It is possible that the effect of these restrictions would be to reduce traffic movements on roads around the site, which would in turn reduce noise levels. The effect of this on the assessment of the site is considered later in this report.

4.3 At the request of UDC, a further survey has been undertaken to capture any noise from the commercial units to the west of the site, including a taxi firm. This additional survey was undertaken at the site between Thursday 21st and Monday 25th October 2021.

4.4 The survey method and results for both surveys are set out below.

May 2021 Sound Survey Method

4.5 The measurements were undertaken between 13:00 hours on Wednesday 19th May 2021 and 13:00 hours on Friday 21st May 2021.

4.6 The equipment used during the survey is summarised in Appendix C. The sound level meters were field-calibrated immediately before and after the measurements using the listed acoustic calibrators and no significant calibration drifts were found to have occurred.

4.7 The sound level meters had been laboratory-calibrated to a traceable standard within the two years preceding the survey and the acoustic calibrators had been laboratory-calibrated to a traceable standard within the year preceding the survey.

4.8 Measurements were carried out at two positions, shown in Figure D.1 in Appendix D and described as follows:

- Position 1: on the northern edge of the site, close to Radwinter Road; and
- Position 2: on the western edge of the site, close to the newly-constructed residential area to the west.

4.9 The measurements at both positions were taken at a height of 1.5 metres above local ground level, with the microphone in free-field conditions, i.e. at least 3.5 metres away from any reflecting surfaces other than the ground.

May 2021 Sound Survey Results

4.10 The weather during the survey was mixed; for the first 24 hours of the survey it was suitable for noise measurement, it being mainly dry with wind speeds of up to 5m/s. However, from the afternoon of Thursday 20th May 2021 until the end of the survey on Friday 21st May 2021, there was rain with high wind speeds in excess of 5 m/s.

4.11 The noise measurements affected by the adverse weather are reported in this section of the report, but are not used in the assessment.

4.12 The dominant sound source at Position 1 was road traffic along Radwinter Road. Other sound sources included natural sounds such as birdsong.

4.13 The sound sources at Position 2 included distant road traffic along Radwinter Road, occasional residential noise at the development to the west, including vehicle movements and residents talking, and natural sounds such as birdsong.

4.14 The noise survey results are summarised in Table 4.1 for Position 1 and Table 4.2 for Position 2. Full survey results are included in Appendix E in graphical form. Full tabulated data is available on request.

Table 4.1: Summary of measured noise levels at Position 1, free-field dB

Date	Period	Duration, T	$L_{Aeq,T}$	$L_{A90,T}$ [1]	$L_{A10,T}$ [1]	L_{AFmax}
Wednesday 19th May 2021	Day	10 hours	64.5	39.4	67.0	71.8 to 88.9
	Night	8 hours	54.8	33.1	43.5	38.0 to 80.2
Thursday 20th May 2021	Day	16 hours	65.3	46.5	69.4	75.0 to 91.9
	Night	8 hours	58.6	48.6	61.1	64.5 to 84.5
Friday 21st May 2021	Day	6 hours	66.0	53.0	70.5	77.8 to 90.6

Note: [1] – The $L_{A90,T}$ and $L_{A10,T}$ values are the arithmetic means of the $L_{A90,15min}$ and $L_{A10,15min}$ measurements for each period.

Table 4.2: Summary of measured noise levels at Position 2, free-field dB

Date	Period	Duration, T	$L_{Aeq,T}$	$L_{A90,T}$ [1]	$L_{A10,T}$ [1]	L_{AFmax}
Wednesday 19th May 2021	Day	10 hours	41.5	32.7	41.8	42.0 to 67.7
	Night	8 hours	38.3	27.3	34.7	35.0 to 73.1
Thursday 20th May 2021	Day	16 hours	45.8	39.8	47.0	50.7 to 71.8
	Night	8 hours	48.1	41.8	50.7	55.3 to 67.9
Friday 21st May 2021	Day	6 hours	49.7	43.8	52.0	57.1 to 69.6

Note: [1] – The $L_{A90,T}$ and $L_{A10,T}$ values are the arithmetic means of the $L_{A90,15min}$ and $L_{A10,15min}$ measurements for each period.

October 2021 Sound Survey Method

4.15 The additional measurements of commercial sources to the west of the site were undertaken between 14:30 hours on Thursday 21st October 2021 and 12:45 hours on Monday 25th October 2021.

4.16 The equipment used during the survey is summarised in Appendix C. The sound level meter was field-calibrated immediately before and after the measurements using the listed acoustic calibrators and no significant calibration drifts were found to have occurred.

4.17 The sound level meter and acoustic calibrator had been calibrated by the manufacturer within the year preceding the survey.

4.18 Measurements were carried out at a single position, shown in Figure D.1 in Appendix D and described as follows:

- Position 3: on the western edge of the site, close to the adjacent commercial units.

4.19 The measurements were taken at a height of 1.5 metres above local ground level, with the microphone in free-field conditions, i.e. at least 3.5 metres away from any reflecting surfaces other than the ground.

October 2021 Sound Survey Results

4.20 The weather during the survey was mixed; until the evening of Saturday 23rd October, it was suitable for noise measurement, it being mainly dry with wind speeds of up to 5m/s. From the late evening of Saturday 23rd October there were periods of rain with high wind speeds in excess of 5 m/s.

4.21 When collecting the sound level meter at the end of the survey, the windshield was noted to be on the floor. Audio files recorded contemporaneously with the measurement data suggest the windshield came off at 01:31 hours on the morning of Sunday 24th October; there was a short noise followed by a noticeable increase in wind noise indicating the removal of the windshield.

4.22 It is not clear how the windshield came off and it is suspected that someone removed it; however, aside from the windshield, the equipment did not appear to have been interfered with, and the sound level meter calibrated with no issue at the end of the survey.

4.23 Therefore, the data gathered up until the windshield came off is considered suitable to use. The data after the windshield was removed is not valid, and is not used in the assessment, although it is reported.

4.24 The dominant source at Position 3 was distant road traffic along Radwinter Road. When Resound Acoustics' staff were on-site at the start and end of the measurements, no noise was audible from the adjacent commercial units, and no activity was observed.

4.25 Audio files recorded contemporaneously with the measurement data have been analysed, and a small number of instances of noise potentially associated with the adjacent commercial units have been identified.

4.26 The noise survey results are summarised in Table 4.3 for Position 3. Full survey results are included in Appendix E in graphical form. Full tabulated data is available on request.

Table 4.3: Summary of measured noise levels at Position 3, free-field dB

Date	Period	Duration, T	$L_{Aeq,T}$	$L_{A90,T}$ [1]	$L_{A10,T}$ [1]	L_{AFmax}
Thursday 21st October 2021	Day	8.5 hours	44.7	36.5	46.7	52.8 to 71.3
	Night	8 hours	37.4	31.3	38.4	40.4 to 65.1
Friday 22nd October 2021	Day	16 hours	47.3	38.1	47.7	49.2 to 80.1
	Night	8 hours	38.2	24.9	33.9	33.3 to 71.3
Saturday 23rd October 2021	Day	16 hours	45.5	33.1	43.5	44.7 to 82.8
	Night	8 hours	48.5	29.2	46.8	45.2 to 87.0
Sunday 24th October 2021	Day	16 hours	49.7	34.4	46.7	42.3 to 90.1
	Night	8 hours	35.4	29.4	34.5	36.4 to 63.9
Monday 25th October 2021	Day	5.75 hours	45.9	37.3	47.1	55.0 to 76.4

Note: [1] – The $L_{A90,T}$ and $L_{A10,T}$ values are the arithmetic means of the $L_{A90,15min}$ and $L_{A10,15min}$ measurements for each period.

4.27 A BS4142 assessment requires both the specific sound level, i.e. the L_{Aeq} sound level of the source being assessed, and the background sound level, i.e. the L_{A90} sound level in the absence of the source, to be determined.

4.28 As noted previously, no noise was audible from the adjacent commercial facilities when Resound Acoustics' staff were on-site at the start and end of the measurements, and no activity was observed.

4.29 Audio files recorded contemporaneously with the measurement data suggest a small number of instances where noise could potentially be associated with the adjacent commercial units.

4.30 The periods where these noises occurred were short in duration, and only occurred a small number of times throughout the survey. They are set out in Table 4.4.

Table 4.4: Potential instances of activity at commercial facilities

Date	Start Time	End Time	Activity
Friday 22nd October 2021	13:17:47	13:17:53	Car movement
	14:01:10	14:01:20	Car movement
	15:10:21	15:10:35	Car movement
	17:02:10	17:02:50	Car movement
Saturday 23rd October 2021	17:54:30	17:57:30	Multiple vehicle movements
	18:06:34	18:08:04	Motorbike revving engine
	20:03:50	20:08:10	Car revving engine

4.31 It is noted that the measurements included sound from other sources in the area as well as that potentially associated with the commercial units.

4.32 The specific sound levels, i.e. the sound levels potentially due to activities at the commercial facilities, can be determined from the ambient sound levels, i.e. the L_{Aeq} sound levels measured during the periods identified above, by logarithmically subtracting the residual sound levels, i.e. the L_{Aeq} sound levels without any activities at the commercial facilities. This effectively removes the non-commercial facility noise, leaving the specific sound level.

4.33 The residual sound levels have been taken from the periods just before and just after the ambient measurements, so that the other sound levels of the sources in the area are unlikely to have changed. To be robust in this process, the periods have been selected to avoid the influence of any occasional sources, e.g. aircraft.

4.34 The measured ambient and residual sound levels are shown in Table 4.5.

Table 4.5: Summary of measured ambient and residual sound levels, free-field dB

Activity	Measurement Type	Start Time	Duration (hh:mm:ss)	$L_{Aeq,T}$	$L_{A90,T}$	L_{AFmax}
Friday 22nd October 2021						
Car movement	Residual	13:02:45	00:15:00	45.2	41.1	67.0
	Ambient	13:17:47	00:00:06	52.4	46.9	65.1
	Residual	13:17:55	00:15:00	44.5	40.4	63.3
Car movement	Residual	13:46:05	00:15:00	48.5	41.6	66.6
	Ambient	14:01:10	00:00:10	52.7	47.5	64.6

Activity	Measurement Type	Start Time	Duration (hh:mm:ss)	$L_{Aeq,T}$	$L_{A90,T}$	L_{AFmax}
	Residual	14:01:25	00:15:00	45.1	40.6	66.0
Car movement	Residual	14:55:20	00:15:00	45.6	40.7	63.5
	Ambient	15:10:21	00:00:14	52.7	46.7	59.1
	Residual	15:10:36	00:15:00	45.7	41.0	61.5
Car movement	Residual	16:47:10	00:15:00	50.3	38.2	80.1
	Ambient	17:02:10	00:00:40	52.0	42.7	66.4
	Residual	17:02:55	00:15:00	48.4	38.4	68.5
Saturday 23rd October 2021						
Multiple vehicle movements	Residual	17:39:00	00:15:00	44.1	36.9	62.6
	Ambient	17:54:30	00:03:00	52.9	46.0	67.4
	Residual	17:57:30	00:09:00	46.2	35.7	63.9
Motorbike revving engine	Residual	17:57:30	00:09:00	46.2	35.7	63.9
	Ambient	18:06:34	00:01:30	65.6	35.4	82.8
	Residual	18:08:05	00:15:00	42.4	34.1	61.0
Car revving engine	Residual	19:48:45	00:15:00	36.6	32.7	49.9
	Ambient	20:03:50	00:04:20	61.7	32.3	80.2
	Residual	20:08:15	00:15:00	36.4	32.0	50.9

4.35 The ambient sound levels have been corrected by logarithmically subtracting the lowest out of the 15 minute residual sound levels either before or after each of the ambient measurements.

4.36 The assessment periods in BS4142: 2014+A1: 2019 are one hour for the day and 15 minutes for the night-time. BS4142: 2014+A1: 2019 does not define daytime and night-time, but suggests that they are typically 07:00 to 23:00 hours and 23:00 to 07:00 hours respectively. The measured ambient sound levels were all between 07:00 and 23:00, and therefore occurred during the daytime.

4.37 The ambient levels described above occurred for durations less than the daytime assessment period of one hour. Therefore, after correcting the ambient sound levels for the residual levels, they also need to be corrected to a one hour duration to match the daytime assessment period.

4.38 It is noted that the first two car movements identified occurred within one hour of each other. Therefore, the one hour L_{Aeq} values for each of these events have been logarithmically summed to calculate an overall one hour L_{Aeq} value. The same process has been undertaken for the 'multiple vehicle movements' and 'motorbike revving' activities, as these also occurred within one hour of each other.

4.39 The resulting values, which have been rounded to the nearest whole number to obtain specific sound levels, are shown in Table 4.6.

Table 4.6: Summary of specific sound levels, free-field dB

Date	Activity	$L_{Aeq,1hour}$
Friday 22nd October 2021	Car movements (2 no.)	28
	Car movement	28
	Car movement	30
Saturday 23rd October 2021	Multiple vehicle movements and motorbike revving	50
	Car revving	51

4.40 The method in BS4142: 2014+A1: 2019 is to compare the rating level, which is the specific sound level adjusted to account for any perceptible acoustic characteristics, against the background sound level, which is the underlying sound level in the absence of the source being assessed.

4.41 Table 4.5 set out the residual sound levels measured just before and just after the activities occurred, including the L_{A90} index which is used to quantify the background sound level. For the assessment, the lowest out of the L_{A90} values measured just before or just after each of the activities have been used; these are set out in Table 4.7.

Table 4.7: Summary of background sound levels, free-field dB

Date	Activity	L_{A90}
Friday 22nd October 2021	Car movements (2 no.)	40
	Car movement	41
	Car movement	38
Saturday 23rd October 2021	Multiple vehicle movements and motorbike revving	34
	Car revving	32

5 ASSESSMENT

Calculation Parameters

5.1 The measured sound levels set out in Section 4 have been used as input data the 3D noise modelling software package CadnaA, to calculate the noise levels across the site. The noise model implements the relevant UK calculation methods, which in this case, is as set out in CRTN for road traffic noise.

5.2 The ground heights at and around the site have been modelled according to OS mapping information and from on-site observations. The ground is modelled as 100% acoustically soft.

5.3 As noted in Section 4, the weather during the second half of the sound survey was not suitable for noise measurement, with rain and high wind speeds that may have unduly affected the measured sound levels. Data gathered during the adverse has not been used in the assessment.

5.4 For Position 1, a 16 hour daytime L_{Aeq} value of 64.9dB has been determined based on the 10 hour measurement on Wednesday 19th 2021 and a 6 hour period between 07:00 and 13:00 hours on Thursday 20th May 2021. This value has been used in the assessment with the full 8 hour night-time value of 54.8dB $L_{Aeq,8hrs}$ measured on Wednesday 19th May 2021.

5.5 For Position 2, a 16 hour daytime L_{Aeq} value of 42.2dB has been determined based on the 10 hour measurement on Wednesday 19th 2021 and a 6 hour period between 07:00 and 13:00 hours on Thursday 20th May 2021. This value has been used in the assessment with the full 8 hour night-time value of 38.3dB $L_{Aeq,8hrs}$ measured on Wednesday 19th May 2021.

5.6 The values at Position 1 have been used to calibrate a source in the model representing Radwinter Road.

5.7 As previously noted, the survey was undertaken during a period where restrictions were in place as part of the Government's response to coronavirus/Covid-19. It is possible that the effect of these restrictions would be to reduce traffic movements on roads around the site, which would in turn reduce noise levels.

5.8 To check the reliability of the measurements, they have been compared against road traffic noise levels calculated from road traffic flow data provided by the traffic consultant for the project. The data is for the year 2019, which is the most recent year prior to the start of the Covid-19 pandemic. The traffic data has been used to calculate source 16 hour daytime and 8 hour night-time L_{Aeq} values for Radwinter Road, using the formulae in CRTN and the *TRL End Correction* method. The traffic flows and calculation parameters are shown in Table F.1 in Appendix F

5.9 The resulting source levels were found to be 0.2dB lower for the daytime period, and 2dB higher for the night-time period, which is considered to be a good degree of correlation. To be robust, the higher of the measured or calculated values for each assessment period have been used, i.e. the daytime period is based on the measured data, and the night-time period is based on the calculated values from the traffic flow data.

5.10 To check the calibration of the noise model, noise levels have been calculated at a receptor location in the model representing measurement Position 2 and compared to the actual measured levels.

5.11 The calculated noise levels were found to be lower than the actual measured levels, by 2.4dB in daytime and 7.1dB in the night-time. This suggests that other sources in the area contributed to the measured noise levels. However, no other sound sources were readily identifiable at Position 2, other than occasional noise from nearby residential properties, and natural sounds such as rustling vegetation and bird song.

5.12 Consequently, this assessment is based on the calculated/modelled noise levels for the parts of the site closest to Radwinter Road, as close to this source the model is considered to be reliable, and based on the measured sound levels at Position 2 for locations away from Radwinter Road.

Site Suitability for Residential Development

5.13 The calculated daytime sound contours at the site are shown in Figure F.1 and the night-time contours are shown in Figure F.2, both in Appendix F. The contours have both been calculated on the basis of an open site with no development structures included. However, the illustrative masteplan plan has been included as an underlay to provide geographical context. The daytime sound levels have been calculated at a height of 1.5 metres above ground level, and the night-time sound levels have been calculated at a height of 4 metres above ground level.

5.14 It can be seen from Figure F.1 that during the daytime the majority of the site falls below the 50dB LOAEL (green area). A strip of land approximately 50 metres wide along the northern edge of the site is subject to noise levels between 50 and 63dB (blue and yellow areas); this is the range of values above the LOAEL but below the SOAEL. Only the very northern edge of eastern residential development zone has noise levels in the upper range of these values, between 55 and 63dB. A strip of land approximately 5 metres wide directly adjacent to Radwinter Road is subject to noise levels above 63dB but below 72dB (orange area), which is considered to be above the SOAEL, but not at the level at which an unacceptable adverse effect would occur. However, no residential development zone is proposed in this area.

5.15 It can be seen from Figure F.2 that during the night-time the majority of the site falls below the 40dB LOAEL (green area). A strip of land approximately 50 metres wide along the northern edge of the site is subject to noise levels between 40 and 55dB (blue and yellow areas); this is the range of values above the LOAEL but below the SOAEL. Only the northern third of the eastern residential development zone has noise levels in the upper range of these values, between 45 and 55dB. A strip of land approximately 8 metres wide directly adjacent to Radwinter Road is subject to noise levels above 55dB but below 66dB (orange area), which is considered to be above the SOAEL, but not at the level at which an unacceptable adverse effect would occur. However, no residential development zone is proposed in this area.

5.16 It is considered that for the southern part of the site, the reliability of the noise model is reduced, as other sources in the area aside from Radwinter Road contributed to the acoustic climate in a way that is not readily replicated by the computer model; it is unlikely that the noise levels reduce in line with the predictions due to these other sources.

5.17 As previously noted, the measurements at Position 2 are considered more representative of the acoustic climate further into the site away from Radwinter Road than the values calculated using the noise model. The measured representative noise levels at Position 2 of 42.2dB $L_{Aeq,16hrs}$ during the day and 38.3dB $L_{Aeq,8hrs}$ during the night are below the adopted LOAEL for both periods.

5.18 In terms of the level of noise risk as described in the ProPG, it is considered that the site is a low to medium risk, tending towards a low risk; the majority of the site is subject to noise levels below the LOAEL, with only the northernmost residential development zones subject to noise levels above the LOAEL but below the SOAEL.

5.19 On the basis that the site is subject to noise levels below the SOAEL, and is considered to be a low to medium risk, tending towards a low risk, the site is considered acceptable for residential use, subject to the incorporation of suitable mitigation. Mitigation is considered in Section 6 of this report.

Assessment of Adjacent Commercial Uses

5.20 No activity at the adjacent commercial uses was observed during the baseline sound survey undertaken at the site in May 2021.

5.21 However, at the request of UDC, a further baseline survey was undertaken in October 2021 to investigate potential noise from the commercial facilities. The results of this survey, which are set out in Section 4 of this report, show that a small number of activities were recorded that could have been associated with the commercial facilities.

5.22 The appropriate standard for assessing sources of an industrial or commercial nature is British Standard 4142: 2014+A1: 2019.

5.23 The method in BS4142: 2014+A1: 2019 is to compare the rating level, which is the specific sound level adjusted to account for any perceptible acoustic characteristics, against the background sound level, which is the underlying sound level in the absence of the source being assessed.

5.24 Table 4.6 in Section 4 of this report set out the specific sound levels for the activities measured, and Table 4.7 set out the background sound levels that were measured either just before or just after the activities occurred.

5.25 The perception of acoustic characteristics associated with a source should be made against the residual acoustic climate. In this instance the activities measured were vehicle sources; these are not considered to be particularly distinctive in terms of characteristics such as tonality or impulsivity, and it is noted that there is a residential development to the west of the commercial premises where there are similar vehicle movements.

5.26 However, to adopt a cautious approach, a correction of +3dB has been applied to the specific sound levels to account for general acoustic characteristics that are not necessarily tonal or impulsive in nature, but are still perceptible.

5.27 The resulting rating levels have been compared to the background sound levels, as shown in Table 5.1.

Table 5.1: BS4142 assessment, free-field dB

Date	Activity	Background Sound Level, L_{A90}	Rating Level, $L_{Ar,1hour}$	Difference
Friday 22nd October 2021	Car movements (2 no.)	40	31	-9
	Car movement	41	31	-10
	Car movement	38	33	-5
Saturday 23rd October 2021	Multiple vehicle movements and motorbike revving	34	53	+19
	Car revving	32	54	+22

5.28 It can be seen from Table 5.1 that the car movements result in rating levels below the background sound level; BS4142: 2014+A1: 2019 states that this is indicative of a low impact.

5.29 The activities on Saturday 23rd October which included revving engines result in rating levels up to +22dB above the background sound level; BS4142: 2014+A1: 2019 states that rating levels +10dB or more above the background sound level are indicative of a significant adverse impact.

5.30 BS4142 is clear that the numerical analysis only provides the initial assessment outcome and relevant contextual matters must be taken into account before reaching a conclusion on the overall potential impact.

5.31 In this instance, the following aspects are considered to provide relevant context that all suggest that the numerical outcome overstates the potential impacts:

- the activities that lead to the worst outcomes only occurred for very short durations, less than five minutes each, and they only occurred once during the survey. This suggests that there is no regular, source of high noise levels at the commercial premises that might give rise to a potential impact;
- the more regularly-occurring sources, those related to car movements, resulted in a low impact;
- the sources are related to vehicle activity, in an area where vehicles on the road network are the most prominent source of noise in the area. The vehicles associated with the commercial premises are unlikely to be a distinctive source of noise in the context of the existing noise climate;
- there are existing houses that are as close, if not closer, to the commercial premises than the proposed development and any vehicles visiting the commercial premises will pass the existing houses on Griffin Place. Since UDC's EHO did not raise a history of complaints about noise from the commercial premises, the ongoing co-existence of the existing houses and the commercial premises suggests that adverse impacts are unlikely.

5.32 On the basis of these contextual matters, it is considered that the numerical analysis overstates the likely adverse effects, and that adverse impacts are not likely.

5.33 It is possible that the commercial facilities will be visited by vehicles at other times, for example at night when it is quieter and when the shorter assessment period required by BS4142: 2014+A1: 2019 would lead to a high specific noise level, but the same contextual points set out here would be equally relevant at those other times. Any noise from the commercial premises that has the potential to affect the proposed development will affect

the existing houses to the same or a greater degree, and presumably already does so without documented complaints.

5.34 On the basis of these contextual arguments, it is considered that, overall, adverse impacts from the commercial facilities are unlikely.

6 MITIGATION

6.1 The sound levels at the site are considered broadly suitable for residential development; the majority of the site is subject to noise levels below the LOAEL, with only the northernmost residential development zones subject to noise levels above the LOAEL but below the SOAEL. Therefore, the inclusion of mitigation measures should meet the policy requirements of the NPPF and the NPSE.

6.2 There are typically three opportunities to implement mitigation to reduce noise levels at a site such as this: at source, between a source and receptor, or at a receptor.

6.3 In this instance, Rosconn Strategic Land cannot reduce noise at source, i.e. by directly affecting road traffic on Radwinter Road. Noise could be reduced between a source and receptor, for example by the use of barriers or buildings to screen Radwinter Road, or at a receptor, for example by adopting a layout that takes noise into consideration or by using appropriate building materials to control noise within the properties.

6.4 Consideration has been given to the site layout, the use of buildings and barriers to reduce noise levels, particularly in gardens, and the specification of building materials to control internal noise levels.

Site Layout

6.5 The site suitability assessment showed that the highest noise levels are at the parts of the site closest to Radwinter Road, which is the key noise source close to the site.

6.6 It is noted that the proposed illustrative masterplan does not locate residential development zones directly on the site boundary closest to this road; this is most notable at the north-western area of the site, which has large, landscaped areas between Radwinter Road and the development zones. This use of a simple distance buffer is considered good acoustic design, and it is recommended that it is incorporated into the final design of the site.

6.7 The proposed layout also includes a pedestrian/cycle link along the western boundary of the site. This acts as a small distance buffer to the commercial facilities to the west, and means that potential properties are no closer to these facilities than existing properties in the area.

Noise Barriers

6.8 Noise barriers can be effective in reducing noise levels, as they are a physical structure providing acoustic screening between a source and a receptor.

6.9 Barriers typically take the form of acoustic fences or bunds, and are most effective when located either close to a source or a receptor, which in this case would be Radwinter Road, but the site access is also from Radwinter Road, so allowing for that to pass through a barrier would reduce its effectiveness.

6.10 In this instance, the noise levels at the site are not considered to be high enough to warrant a noise barrier along the Radwinter Road boundary.

6.11 Properties can be used as noise barriers to screen their gardens behind them and where gardens are not screened from Radwinter Road by buildings, garden fences that act as noise barriers may be appropriate. Garden noise levels are considered later in this section.

Internal Noise Levels

6.12 The sound reduction performance required of the external building fabric of potential properties has been determined, so that the noise levels within the properties meet the guideline values set out in BS8233: 2014 and the World Health Organisation's *Guidelines for Community Noise*.

6.13 The same noise model described previously has been used, but this time including indicative properties based on the illustrative masterplan. Noise levels have been determined at a representative sample of these indicative properties, with the exact calculation points shown in Figure F.3 in Appendix F. These locations include the northern edge of the residential development zones, closest to Radwinter Road, which should represent the noisiest locations for properties at the site. The sound reduction performance requirements have been determined at each of these locations so that the BS8233 guideline values can be achieved.

6.14 As noted in the site suitability section, it is considered that the reliability of the noise model is reduced for the southern part of the site, as other sources in the area aside from traffic on Radwinter Road contributed to the acoustic climate in a way that is not readily included in a computer model. It is considered unlikely that the noise levels reduce in line with the predictions due to these other sources.

6.15 Therefore, the internal noise level assessment at each receptor is based on the higher of the noise levels calculated by the noise model at that location and the noise levels measured at Position 2, which was the measurement position located in the southern part of the site.

6.16 To determine suitable night-time maximum noise levels to use in the assessment, the night-time maximum sound level data at Positions 1 and 2 has been reprocessed into one minute intervals to better account for individual noise events.

6.17 As the WHO guidelines state that noise levels within bedrooms should not exceed 45dB L_{AFmax} more than 10 to 15 times per night, the tenth highest 1 minute L_{AFmax} have been identified. The values have been determined from the 8 hour night-time periods measured on Wednesday 19th May 2021; the weather was not suitable for noise measurement on the night-time of Thursday 20th May 2021.

6.18 For Position 1 a value of 78.1dB L_{AFmax} has been used. As this maximum noise level event is considered to have been due to a car pass-by on Radwinter Road, the maximum sound level has been adjusted to account for the differences in distance between Radwinter Road and the measurement position, and the road and the proposed houses, based on point source propagation.

6.19 For Position 2 a value of 60.3dB L_{AFmax} has been used. As it is not possible to determine the location of the source that caused this noise level event relative to the measurement position, no adjustment for distance has been made.

6.20 The sound reduction performance requirements apply to the whole external building fabric of the proposed buildings. However, since windows are typically the weakest link in the external building fabric, in terms of acoustic performance, the values below will particularly apply to the windows.

6.21 The higher of the calculated or measured noise levels and the sound reduction performances required of the external building fabric are shown in Table 6.1. The calculated and measured values have been rounded up to the nearest whole number so that the calculated sound reduction performance requirements are robust.

Table 6.1: Required sound reduction performances, dB

Location	Period	Target Noise Level	Calculated/ Measured Noise Level	Required Sound Reduction Performance	Overall Performance Requirement
Location1	Day	35dB $L_{Aeq,16hr}$	52	17	17
	Night	30dB $L_{Aeq,8hr}$	44	14	
	Night	45dB L_{AFmax}	62	17	
Location2	Day	35dB $L_{Aeq,16hr}$	48	13	16
	Night	30dB $L_{Aeq,8hr}$	40	10	
	Night	45dB L_{AFmax}	61	16	
Location3	Day	35dB $L_{Aeq,16hr}$	59	24	25
	Night	30dB $L_{Aeq,8hr}$	51	21	
	Night	45dB L_{AFmax}	70	25	
Location4	Day	35dB $L_{Aeq,16hr}$	53	18	19
	Night	30dB $L_{Aeq,8hr}$	45	15	
	Night	45dB L_{AFmax}	64	19	
Location5	Day	35dB $L_{Aeq,16hr}$	43	8	16
	Night	30dB $L_{Aeq,8hr}$	39	9	
	Night	45dB L_{AFmax}	61	16	
Location6	Day	35dB $L_{Aeq,16hr}$	43	8	16
	Night	30dB $L_{Aeq,8hr}$	39	9	
	Night	45dB L_{AFmax}	61	16	
Location7	Day	35dB $L_{Aeq,16hr}$	43	8	16
	Night	30dB $L_{Aeq,8hr}$	39	9	
	Night	45dB L_{AFmax}	61	16	
Location8	Day	35dB $L_{Aeq,16hr}$	43	8	16
	Night	30dB $L_{Aeq,8hr}$	39	9	
	Night	45dB L_{AFmax}	61	16	

6.22 Windows do not reduce noise equally across the entire frequency spectrum, so the frequency content of the sound will influence the overall sound reduction performance of a given window, and by extension, the resulting noise levels within the property.

6.23 However, many glazing manufacturers test their products under laboratory conditions using a typical road traffic noise frequency spectrum source. The resultant measured noise attenuation, in dB, gives a very useful guide to in-situ sound reduction performance of the

window for situations where road traffic noise dominates, known as the R_{TRA}. The sound reduction requirements set out in Table 6.1 should be interpreted as R_{TRA} values.

6.24 It can be seen from Table 6.1 that at the worst-affected location, Location 3, a sound reduction performance of 25dB R_{TRA} will be required.

6.25 Standard thermal double-glazing typically provides a sound reduction performance of 25dB $R_{TRA,}$ and therefore should be sufficient across the site.

6.26 It is noted that the sound reduction performance stated as achievable by standard thermal double-glazing is based on laboratory tests. In practice, the actual on-site performance may be lower, depending on the quality of the fitting. The sound reduction performances in Table 6.1 should be interpreted as in-situ sound reduction performances.

6.27 Glazing units other than those suggested may be suitable and it is the responsibility of the glazing manufacturer to recommend and provide appropriate systems. The above analysis demonstrates that a design solution is feasible at the site.

6.28 The detailed design of any proposed buildings may also affect the required sound reduction performance and the consequent selection of glazing units. The aspects of the detailed design that are important are the layout, room dimensions, room finishes, window dimensions, and the sound reduction performance of non-glazing elements. Further detailed consideration of the glazing components will be required once the building designs are confirmed.

6.29 Internal noise levels should be considered in the context of room ventilation and overheating requirements. As the sound reduction performance requirements are greater than 10dB, the windows will need to be closed to achieve the internal noise criteria.

6.30 Therefore, an alternative form of ventilation and/or cooling may be required so that occupants can retain access to fresh air and retain thermal comfort without compromising their noise climate. The ventilation and/or cooling system chosen should be designed so that it does not compromise the sound insulation performance of the building fabric.

6.31 Where standard thermal double glazing is sufficient to achieve an acceptable internal noise climate, standard ventilation mechanisms are considered appropriate, even if the internal noise criteria are exceeded when the windows are open. The ProPG indicates that the internal noise criteria need only be achieved when background ventilation is employed and the internal criteria are set aside under purge ventilation or thermal control conditions.

External Area Noise Levels

6.32 The noise levels at the site have been compared against the criteria for external amenity areas in BS8233: 2014 and the WHO guidelines.

6.33 The noise contours are shown in Figure F.4 in Appendix F. It can be seen from Figure F.4 that with indicative development buildings, the majority of the residential development areas are predicted to have noise levels below the lower 50dB guideline value in BS8233: 2014.

6.34 For the majority of the site, noise levels are likely to be below 50dB even without taking into account the screening provided by houses.

6.35 However, for the northern edge of the site, closest to Radwinter Road, noise levels may just exceed 55dB in garden areas that are not screened from the road.

6.36 As shown in Figure F.4, orienting properties so that they screen gardens behind is effective in reducing noise levels in the gardens to below 50dB. If this is not possible, garden fences that act as acoustic barriers would reduce noise levels to below the upper 55dB guideline value, although they may not be reduced to below the more stringent 50dB guideline value.

6.37 Any fences used as noise barriers would need to be imperforate, sealed at the base, and have a minimum superficial density of at least 13 kg/sq.m.

Summary

6.38 The illustrative masterplan includes a distance buffer to Radwinter Road, which is the key noise source at this site. It is recommended that this approach is adopted in the final site layout.

6.39 Providing the final layout adopts a similar approach, standard thermal double-glazing should be sufficient so that noise levels inside properties meet the internal guideline values in BS8233: 2014 and the WHO guidelines.

6.40 Where feasible, the final site layout should orient properties along the northern edge of the site, closest to Radwinter Road, so that they screen their gardens from the road. This should result in noise levels in these gardens meeting the more stringent 50dB guideline value for external amenity areas set out in BS8233: 2014 and the WHO guidelines.

6.41 Where gardens are not screened from Radwinter Road by buildings, garden fences that act as noise barriers may be required to reduce noise levels in garden to below the upper 55dB guideline value.

7 CONCLUSION

7.1 Rosconn Strategic Land has appointed Resound Acoustics Limited to undertake a noise assessment for a site at Radwinter Road, Saffron Walden. Rosconn Strategic Land is seeking planning permission for residential development at the site.

7.2 The assessment has shown that sound levels at the site are below the adopted Significant Observed Adverse Effect Level (SOAEL), and therefore the site is broadly acceptable for the residential development.

7.3 Providing appropriate mitigation is incorporated into the final design of the site:

- noise levels within proposed properties should meet the internal noise level guideline values set out in British Standard 8233: 2014 and the World Health Organisation's *Guidelines for Community Noise*; and
- noise levels within any external amenity areas should meet the requirements of the same two documents.

7.4 Noise from the commercial facilities to the west is unlikely to lead to an adverse impact at the site.

7.5 On the basis of the information set out in this report, it is considered that noise should not pose a constraint to the proposed development.

Appendices

Appendix A – Introduction to Noise and Glossary of Terminology

Noise is defined as unwanted sound. The human ear is able to respond to sound in the frequency range 18Hz (deep bass) to 18,000Hz (high treble) and over the audible range of 0dB (the threshold of perception) to 140dB (the onset of pain). The ear does not respond equally to different frequencies of the same magnitude, but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting (filtering) mechanism is used. This reduces the importance of lower and higher frequencies, approximating the response of the human ear.

Furthermore, the perception of noise may be determined by a number of other factors, which may not necessarily be acoustic. Noise can be perceived to be louder or more noticeable if the source of the noise is observed; e.g. roads, trains, factories, building sites etc. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time. In some cases, the time of day and other acoustic features such as tonality may be important, as may the disposition of the affected individual. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source. Various noise indices have been derived to describe the fluctuation of noise levels that vary over time. Usually, these noise indices relate to specific types of noise, and as such different noise indices are used to describe road traffic noise, background noise, construction noise, etc.

The weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement and the levels are denoted as dB(A) or L_{Aeq}, L_{A10}, etc, according to the parameter being measured.

Noise is measured on the decibel scale, which is logarithmic rather than linear. As a result of this, a 3dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3dB(A) is generally regarded as the minimum difference needed to perceive a change. Table A.1 sets out examples of noise levels typically experienced during everyday activities. Table A.2 sets out an explanation of the terminology used in this report.

Table A.1: Typical sound levels found in the environment

Sound Level	Location
0 to 10dB(A)	Threshold of hearing
10 to 20dB(A)	Broadcasting studio
20 to 30dB(A)	Quiet bedroom at night
30 to 40dB(A)	Living room during the day
40 to 50dB(A)	Typical office
50 to 60dB(A)	Inside a car
60 to 70dB(A)	Typical high street
70 to 90dB(A)	Inside a factory or noisy pub
100 to 110dB(A)	Burglar Alarm at 1m
110 to 130dB(A)	Pneumatic drill at 1m away
140dB(A)	Threshold of Pain

Table A.2: Terminology relating to noise and vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of 20μPa ($20x10^{-6}$ Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s_1 and s_2 is given by 20 $\log_{10}$ (s_1/s_2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
$L_{Aeq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level during the period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{90,T}$ or Background Noise Level	A noise level index. The noise level exceeded for 90% of the time over the period T. L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background noise.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5 metres
Façade	At a distance of 1 metre in front of a large sound reflecting object such as a building façade.
Fast Time Weighting	An averaging time used in sound level meters. Defined in BS EN 61672.

Appendix B – Site Plans

Figure B.1: Site location plan

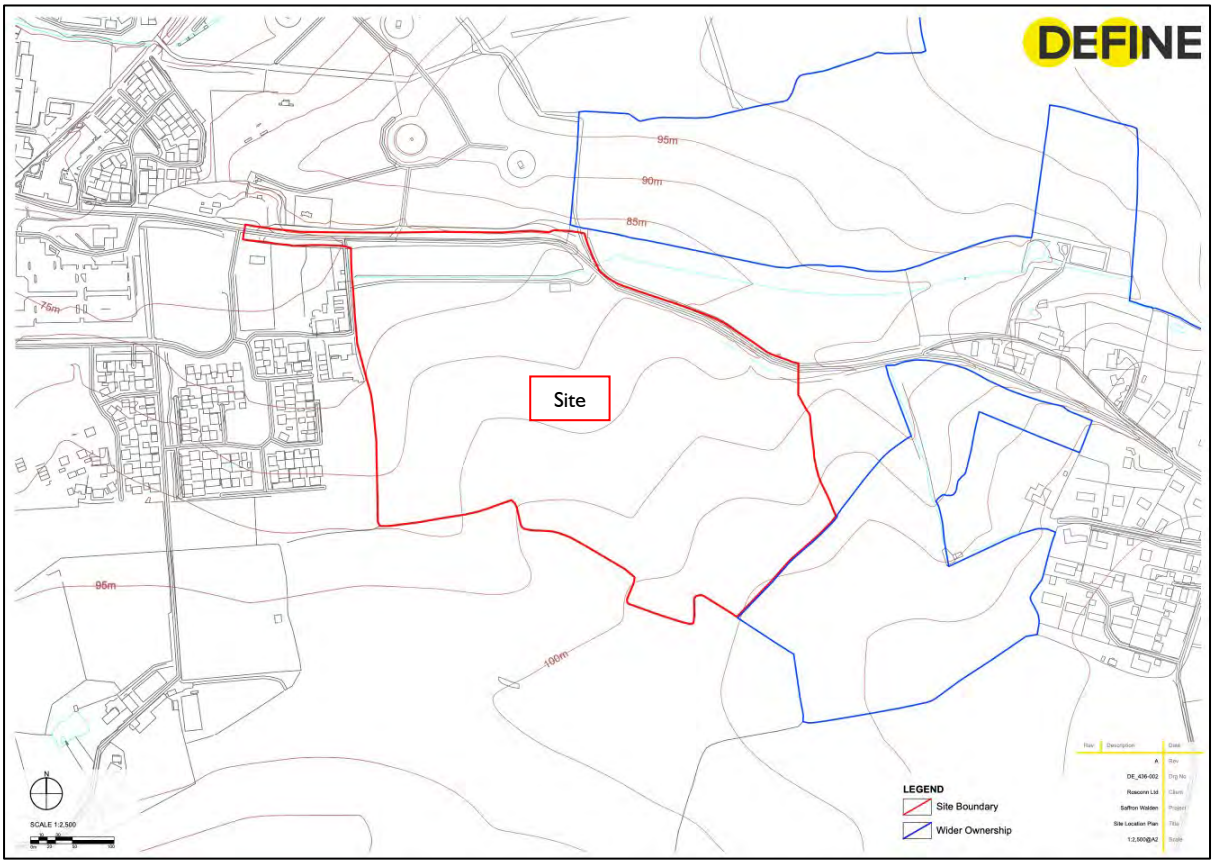


Figure B.2: Illustrative masterplan

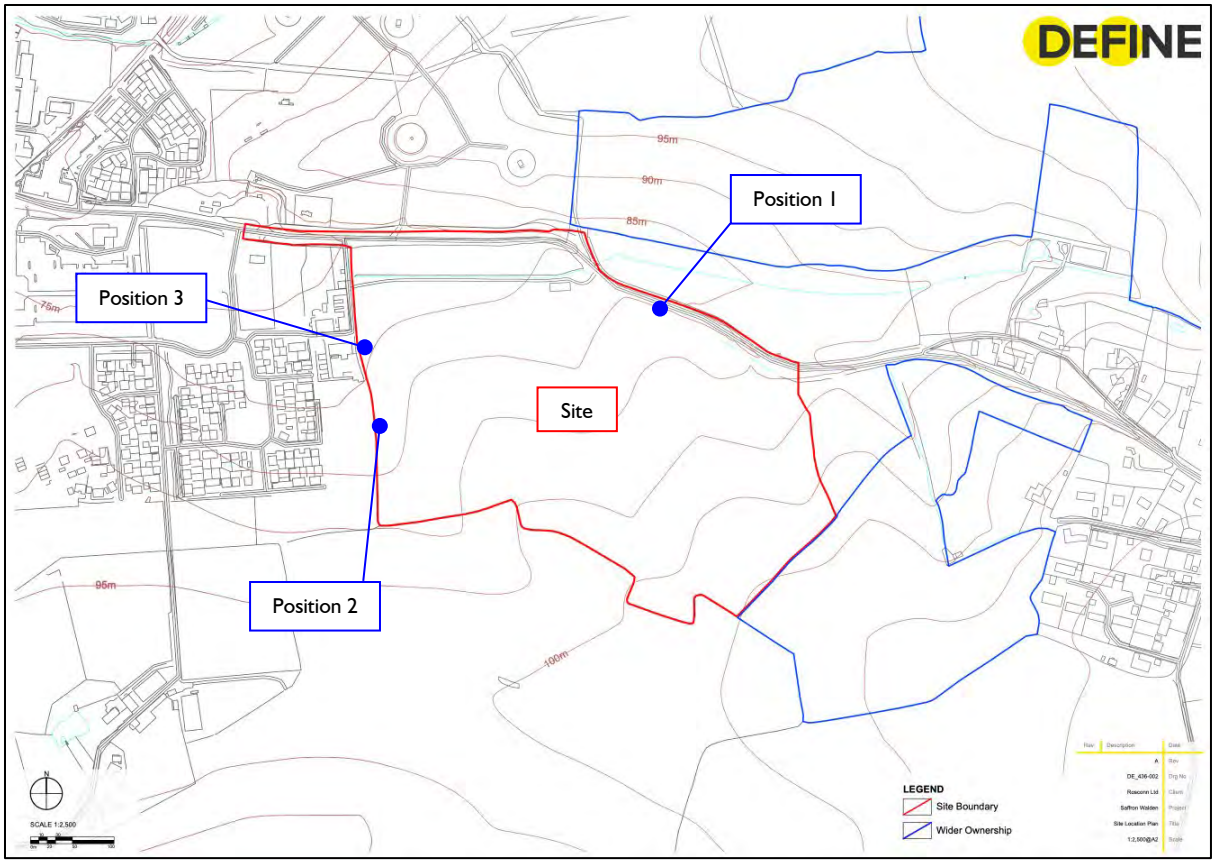
Appendix C – Monitoring Equipment

Table C.1: Noise monitoring equipment

Position(s)	Equipment	Serial Number	Calibration Date
1	01dB Black Solo class 1 sound level meter	65682	03/08/2020
	01dB PRE215 pre-amplifier	16310	
	01dB MCE212 microphone	153491	
	01dB Cal21 acoustic calibrator	34134139	31/07/2020
2	01dB Duo class 1 sound level meter	10517	07/02/2020
	PRE21S pre-amplifier	10730	
	GRAS 40CD microphone	161875	
	01dB Cal21 acoustic calibrator	34134139	31/07/2020
3	01dB Fusion type 1 sound level meter	14026	15/06/2021
	01dB PRE22N pre-amplifier	2105017	
	Gras 40CD microphone	446532	
	Cirrus CR515 acoustic calibrator	96172	28/06/2021

Appendix D – Measurement Positions

Figure D.1: Measurement positions



Appendix E – Full Survey Results

Figure E.1: Sound levels measured at Position 1, free-field dB

Figure E.2: Sound levels measured at Position 2, free-field dB

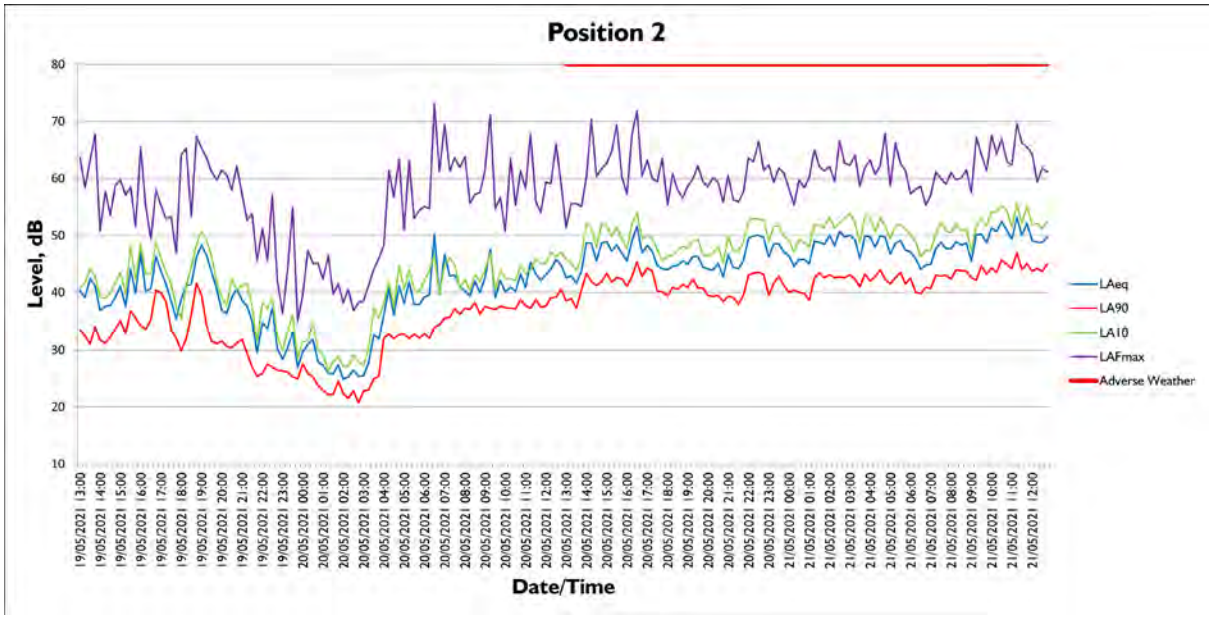
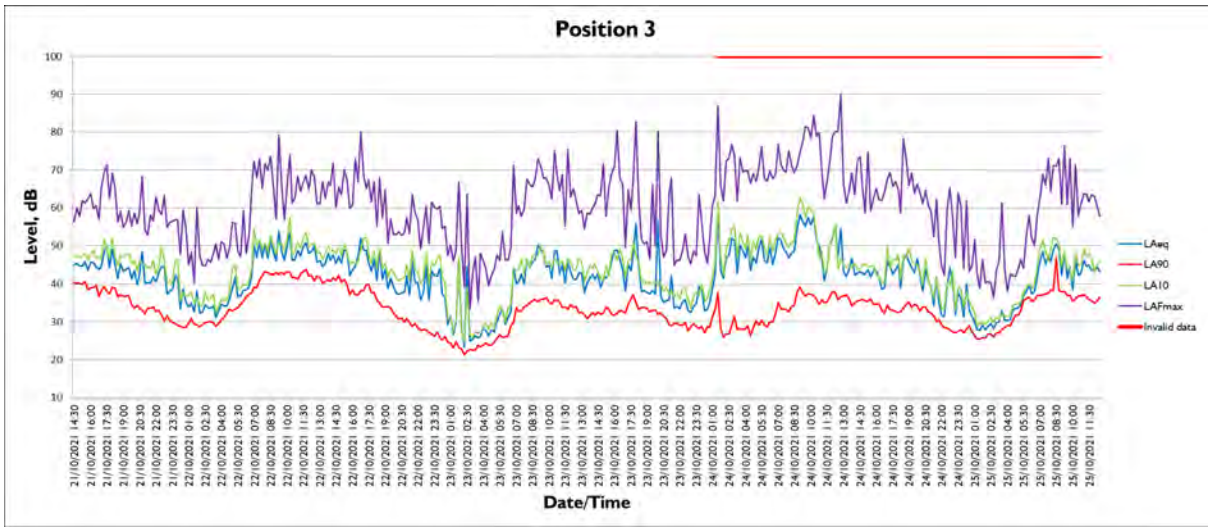


Figure E.3: Sound levels measured at Position 3, free-field dB



Appendix F – Assessment Tables and Figures

Table F.1: Road traffic data, 2019

Road	Total Vehicles, per 18 hours	HGV%	Speed (km/h)[1]	Surface	Texture Depth (mm)
Radwinter Road	4,301	0.6	81	Impervious Bituminous	2

Note: [1] Speed based on CRTN road classification.

Figure F.1: Daytime sound contours

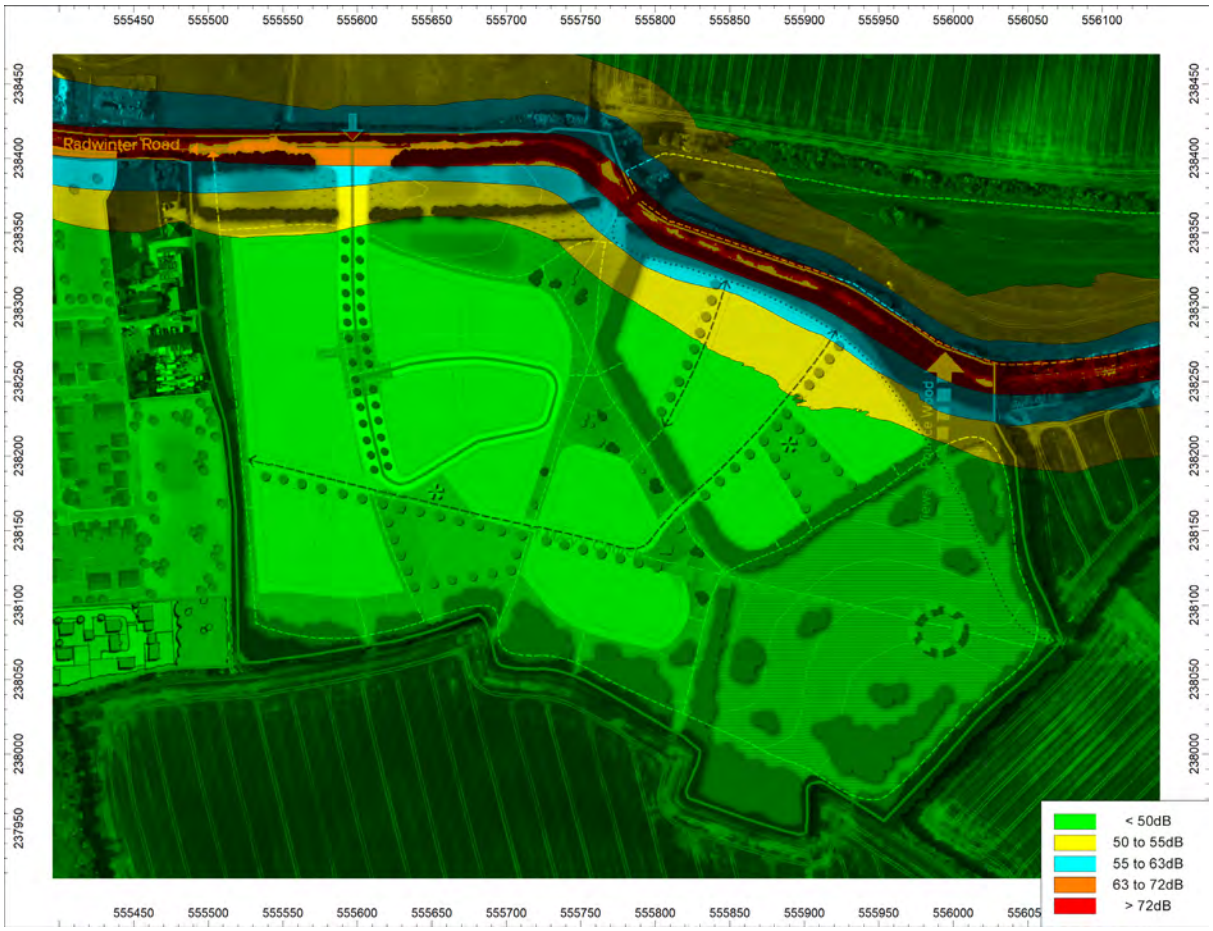


Figure F.2: Night-time sound contours

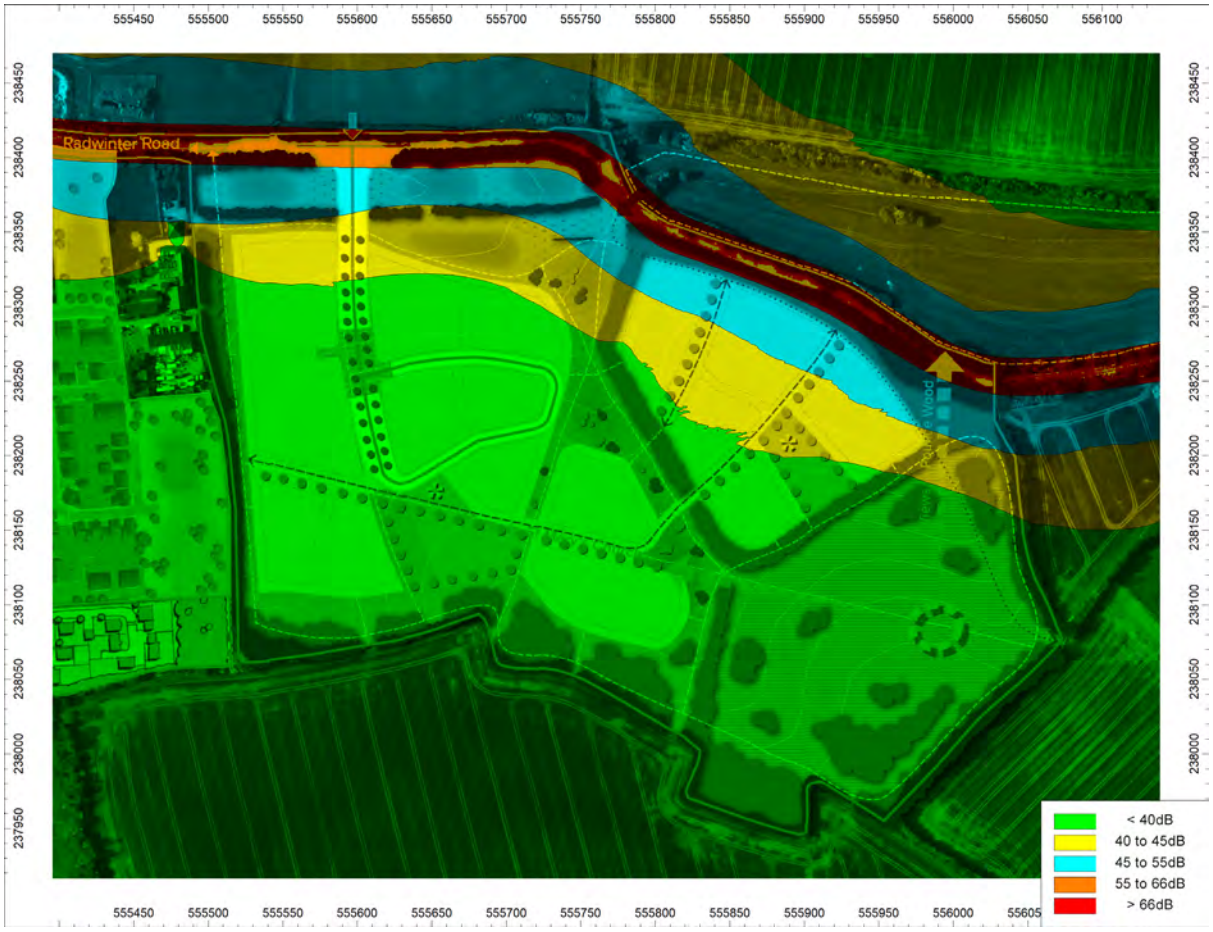
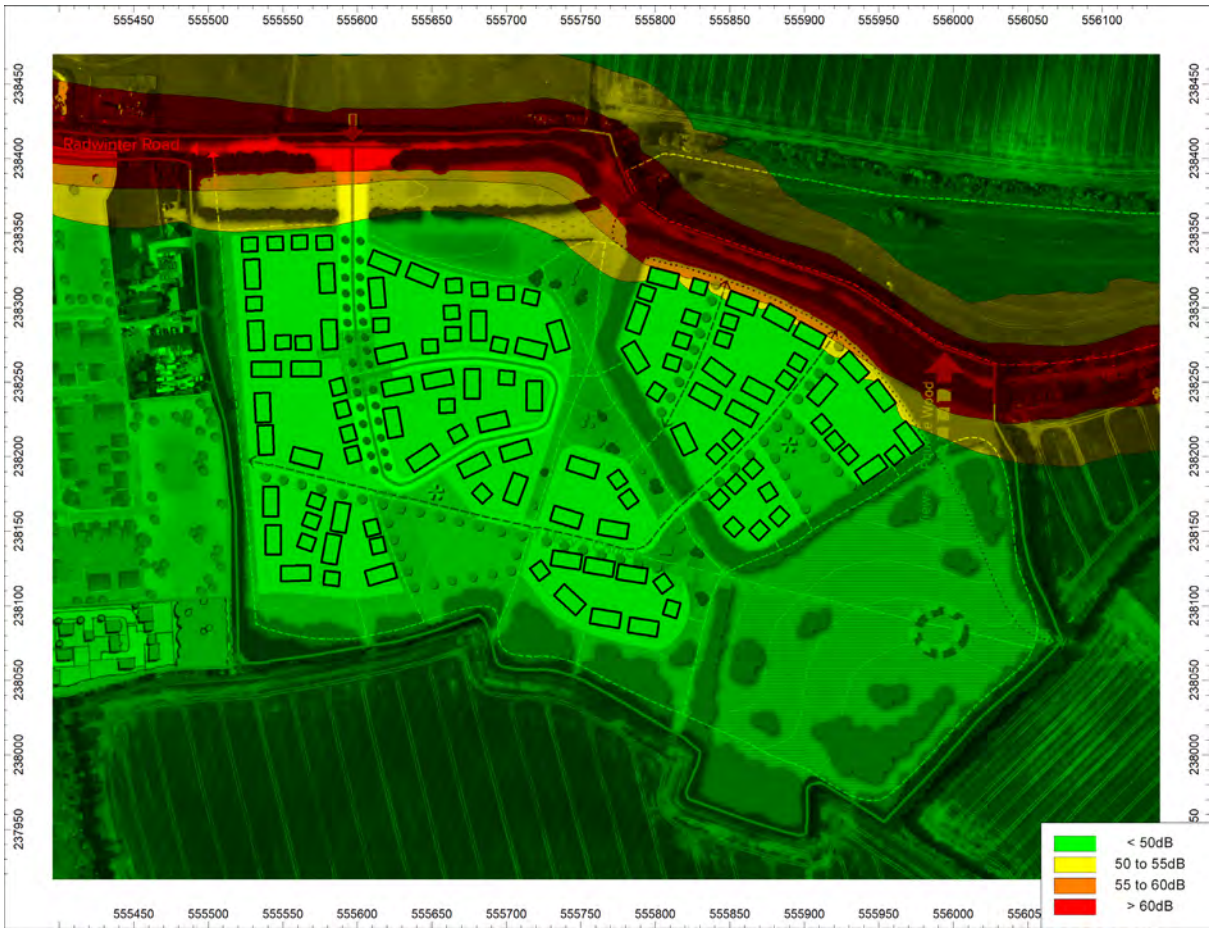


Figure F.3: Internal noise level assessment locations

Figure F.4: External amenity areas sound contours



Resound Acoustics Limited, Elizabeth Court, Church Street, Stratford-upon-Avon, Warwickshire CV37 6HB
Telephone: (01789) 387979
www.resoundacoustics.co.uk

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