A Noise Assessment for Tournament Fields, Warwick

On behalf of The Campbell Partnership

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resound acoustics

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Appendices

1 INTRODUCTION

1.1 The Campbell Partnership has appointed Resound Acoustics Limited to undertake a noise assessment for a site forming part of the Tournament Fields development area in south-west Warwick. The Campbell Partnership is promoting the site for residential development via the District Council's emerging Local Plan. The site is currently allocated for employment use.

1.2 The noise climate at the site has been established by direct measurement and the suitability of the site for residential development considered against national and local planning policy and guidelines on noise. Where required, mitigation measures are recommended to ensure that a noise climate suitable for residential development can be achieved.

1.3 Whilst every effort has been made to ensure that this report 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 on the south-western edge of the Chase Meadow development, which is itself to the south-west of Warwick town centre.

2.2 The site is bordered by the A46 Warwick Bypass along its south-western edge, by houses on Goggbridge Lane to the north-east and by open grassland to the north-west and south-east.

2.3 The A46 has four separate lanes as its passes the site; two approach the Longbridge Island roundabout which forms Junction 15 of the M40 motorway, and two pass by this junction. The closest lanes of the A46, the approach to Longbridge Island, passes the site at grade with it, rising above the site level towards the north. The lane away from Longbridge Island rises to pass over one of the bypass lanes. This elevated road has an acoustic screen along its eastern edge, approximately 2.5 metres high.

2.4 The site is allocated in the Warwick District Local Plan (2007) for employment use.

2.5 The site is currently colonised by grass, in an unmanaged way.

Proposed Site Conditions

2.6 Due to the lack of demand for commercial use, the Campbell Partnership proposes to develop the site for residential purposes. At this stage there are no proposed layouts or development plans; the findings of this assessment will inform the emerging proposals for the site.

3 GUIDANCE

Local Authority Consultation

3.1 The Environmental Health Department of Warwick District Council (WDC) has been consulted as part of this assessment, to determine their views and policies regarding noise from the site.

3.2 The council indicated that they are currently drafting a local policy on noise, that will replace the now-withdrawn Planning Policy Guidance (PPG) 24 *Planning and Noise*, and that although the policy is not yet complete, they anticipate that it will be similar in approach to the withdrawn PPG.

National Planning Policy Framework

3.3 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.

3.4 The guidance set out in PPG24 has been replaced in the NPPF by four aims, which are set out at paragraph 123 in Section 11 of the document, titled *Conserving and enhancing the natural environment*:

"Planning policies and decisions should aim to:

- *avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*
- *recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and*
- *identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."*

3.5 There are two footnotes to the above guidance. The first footnote 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"* as described in the first two bullet points.

3.6 The second footnote indicates that the third bullet point is *"subject to the provisions of the Environmental Protection Act 1990 and other relevant law"*.

3.7 Annex 1 of the NPPF, titled *Implementation* notes that:

"210 Planning law requires that applications for planning permission must be determined in accordance with the development plan unless material considerations indicate otherwise.

211 For the purposes of decision-taking, the policies in the Local Plan (and the London Plan) should not be considered out-of-date simply because they were adopted prior to the publication of this Framework.

212 However, the policies contained in this Framework are material considerations which local planning authorities should take into account from the day of its publication. The Framework must also be taken into account in the preparation of plans.

213 Plans may, therefore, need to be revised to take into account the policies in this Framework. This should be progressed as quickly as possible, either through a partial review or by preparing a new plan.

214 For 12 months from the day of publication, decision-takers may continue to give full weight to relevant policies adopted since 2004 even if there is a limited degree of conflict with this Framework."

Noise Policy Statement for England

3.8 The Department for Environment, Food and Rural Affairs published the *Noise Policy Statement for England* (NPSE) in March 2010. The explanatory note of 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."

3.9 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."

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

3.11 There are three aims in the NPSE, which match, and expand upon, the first two bullet points in paragraph 123 of the NPPF and add a third aim that relates to a wider improvement in health and quality of life (the bold text is in the NPSE):

"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."

Local Authority Policies

3.12 Warwick District Council is currently preparing its new Local Plan, which will replace its current plan, the *Warwick District Local Plan 1996 – 2011*. At present, a number of policies in the *Warwick District Local Plan 1996 – 2011* have been saved and remain valid for development control purposes.

3.13 Policy DP2 *Amenity* states:

"Development will not be permitted which has an unacceptable adverse impact on the amenity of nearby uses and residents and/or does not provide acceptable standards of amenity for future users/occupiers of the development."

3.14 The supporting text states at paragraph 4.15:

"4.15 The phrase 'amenity' is defined as the extent to which people are able to enjoy public places and their own dwellings without undue disturbance or intrusion from nearby uses. Examples of disturbance and intrusion include: loss of privacy; loss of sun/daylight; visual intrusion; noise disturbance; and light pollution. This policy is applicable to all development proposals, including extensions and changes of use."

3.15 The Local Plan does not currently define amenity in terms of specific noise levels. It is understood that WDC is writing a local noise policy, that is expected to be similar in approach to the now-withdrawn PPG24.

British Standard 8233

3.16 The scope of British Standard (BS) 8233: 1999 *Sound insulation and noise reduction for buildings – Code of practice* 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. The standard suggests suitable internal noise levels within different types of buildings, including residential dwellings, as shown in Table 3.1.

Table 3.1: Indoor ambient noise levels in spaces when they are unoccupied, dB

Criterion	Typical Situations	Design Range $L_{Aeq,T}$ dB	
		Good	Reasonable
Reasonable resting/sleeping conditions	Living rooms	30	40
	Bedrooms(1)	30	35

Note (1): For a reasonable standard in bedrooms at night, individual noise events (measured with fast time-weighting) should not normally exceed 45dB L_{Amax}

3.17 The time periods over which the above guidance applies should be appropriate for the period of use. The example given in BS8233 is for bedrooms during the night-time, where the guideline internal noise levels apply over the period 23:00 hours to 07:00 hours.

3.18 In terms of the NPSE, internal noise levels that meet the *"good"* standard can be considered as the NOEL, internal noise levels between the "good" and "reasonable" standards can be considered as being below the LOAEL. There is no value in BS8233 that could be equated to the SOAEL, i.e. an internal noise level at which significant adverse effects occur. For the purposes of this assessment, achieving the LOAEL or NOEL is considered sufficient and appropriate.

3.19 BS8233 also gives guidance on acceptable noise levels within gardens and balconies, noting:

"In gardens and balconies etc. it is desirable that the steady noise level does not exceed 50 $L_{Aeq,T}$ dB and 55 $L_{Aeq,T}$ dB should be regarded as the upper limit."

3.20 As with internal noise levels, external noise levels can be defined in terms of the NPSE; external noise levels that meet the lower desirable 50dB criterion can be considered as meeting the NOEL, levels between the lower 50dB and upper 55dB criterion can be considered as being below the LOAEL. The level at which significant adverse effects occur, the SOAEL, is considered later in this section of the report.

3.21 There is no guidance in BS8233 on what constitutes a suitable external noise level at night.

3.22 The guidance in BS8233 is of direct relevance to road traffic noise, which affects the site. This is illustrated in Section 7.3 *Limits for noise levels*, which states:

"Limits for good conditions and reasonable conditions are given. Normally, only the upper noise limit will need to be decided.

Unless otherwise stated, the noise should be assumed to be steady, such as that due to road traffic, mechanical services, or continuously running plant, and should be the noise level in the space during normal hours of occupation but excluding any noise produced by the occupants and their activities."

Noise Insulation Regulations

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

3.24 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 an unacceptable 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.

3.25 *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 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}.

3.26 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 SOAEL is higher than this value.

BRE Research Paper

3.27 A Building Research Establishment (BRE) survey titled *The effectiveness and acceptability of measures for insulating dwellings against tragic 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 $L_{A10,18h}$ and above at a façade.

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

3.29 On this basis, and in the absence of any local definition, the SOAEL is considered to be equivalent to a daytime noise level of 72dB $L_{Aeq,16hrs}$.

Calculation of Road Traffic Noise

3.30 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.

3.31 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 $L_{A10,18hour}$ or $L_{A10,1hour}$ noise level for any receptor point at a given distance from the road.

Planning Policy Guidance 24

3.32 Planning Policy Guidance (PPG) 24 Planning and Noise was withdrawn upon the adoption of the NPPF. However, WDC has indicated that its emerging local policy on noise will be similar in approach to PPG24. A summary of PPG24 has therefore been included to illustrate how WDC may appraise the site.

3.33 PPG24 was published in September 1994 and set out the Government's policies on noise-related planning issues until its withdrawal on 27th March 2012. It gave guidance to local authorities in England on the use of their planning powers to minimise the adverse impact of noise. Specifically, PPG24:

- outlined the considerations to be taken into account when determining planning applications for both noise-sensitive developments and for those activities which will generate noise;
- set out noise exposure categories for residential development, encouraged their use and recommended appropriate levels for exposure to different sources of noise; and
- advised on the use of planning conditions to minimise the impact of noise.

3.34 The four noise exposure category bands set out in PPG24 (or NECs) were designed to assist local planning authorities in evaluating applications for residential development in noisy areas. Table 3.2 summarises the noise levels that corresponded to each noise exposure category band for various sources.

Table 3.2: Recommended noise exposure categories for new dwellings near existing noise sources

Noise Source	Period	Noise Exposure Categories			
		A	B	C	D
Road Traffic Sources	07:00 to 23:00	<55	55-63	63-72	>72
	23:00 to 07:00	<45	45-57	57-66	>66

Noise Source	Period	Noise Exposure Categories			
		A	B	C	D
Rail Traffic	07:00 to 23:00	<55	55-66	66-74	>74
	23:00 to 07:00	<45	45-59	59-66	>66
Air Traffic	07:00 to 23:00	<57	57-66	66-72	>72
	23:00 to 07:00	<48	48-57	57-66	>66
Mixed Sources	07:00 to 23:00	<55	55-63	63-72	>72
	23:00 to 07:00	<45	45-57	57-66	>66

3.35 The advice to local authorities for sites falling into each of the bands is shown in Table 3.3.

Table 3.3: PPG24 planning guidance

NEC	Planning Advice
A	Noise need not be considered as a determining factor in granting planning permission, although noise at the high end of the category should not be regarded as a desirable level.
B	Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise.
C	Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.
D	Planning permission should normally be refused.

3.36 In addition to the above, PPG24 also stated that during the night, (23:00 to 07:00 hours):

"Sites where individual noise events regularly exceed 82dB L_{Amax} (S time weighting) several times in any hour should be treated as being in NEC C, regardless of the $L_{Aeq,8hr}$ (except where the LAeq,8hr already puts the site into NEC D)."

3.37 PPG24 stated that the noise levels should be measured or predicted on an open site at the position of the proposed dwellings, well away from any existing buildings, and 1.2 to 1.5 metres above ground level.

Summary

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

- Determining the external noise levels across the site, to compare with the NOEL, LOAEL and SOAEL, as defined above. Where useful, parallels are drawn to the guidance in the withdrawn PPG24 which is understood to be similar to the local noise policy WDC is writing.
- Calculating the sound reduction performance required of the external building fabric, particularly the glazing units, to ensure that suitable internal noise levels are achieved.

4 ENVIRONMENTAL NOISE MEASUREMENTS

4.1 A noise survey was undertaken on 19th and 20th June 2012 to establish the existing noise levels at the site. The survey methodology and results are set out below.

Survey Methodology

4.2 The noise survey covered a 24 hour period, starting at 15:00 hours on Tuesday 19th June 2012.

4.3 The measurements were carried out using the equipment listed in Appendix B. The sound level meter was calibrated before the measurements using the acoustic calibrator and the calibration was checked upon completion of the survey. No calibration drifts were found to have occurred.

4.4 All of the equipment had all been calibrated to a traceable standard by a UKAS-accredited laboratory within the 12 months preceding the survey.

4.5 The measurements were carried out at a single position, as shown in Appendix C and described as follows:

- Position 1: 5 metres from the fenceline along the edge of the A46.

4.6 The sound level meter was in a free-field position, i.e. at least 3.5 metres away from any reflecting surfaces other than the ground. The microphone at Position 1 was approximately 4 metres above local ground level.

Survey Results

4.7 The weather during the survey was suitable for noise measurement, it being dry with little wind.

4.8 The dominant noise source at the site was road traffic on the A46 bypass, which passes the site to the west. Other noise sources that were audible included occasional cars on the local roads within the Chase Meadow development, noise from local residents, and natural sounds such as rustling trees and birdsong.

4.9 The noise survey results are summarised in Table 4.1 and set out in full in Appendix D.

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

Position	Period(1)	$L_{Aeq,T}$	L_{A90}	L_{A10}	L_{AFmax}
Position 1	Day	66.1	53.4	69.4	76.4 to 85.8
	Night	62.3	47.2	62.9	75.5 to 77.9

Note: (1) the time periods were as follows:
Daytime period was 16 hours and night-time period was 8 hours.

5 ASSESSMENT

5.1 The suitability of the site for residential development has been determined in accordance with the standards and guidance set out in Section 3 of this report. Where it is considered helpful, parallels have been drawn with the withdrawn PPG24, which WDC has stated would be similar to their emerging local policy on noise.

5.2 The noise levels across the site have been calculated using the CADNA noise modelling package, implementing the calculation methods set out in CRTN for road traffic noise.

5.3 The noise levels measured at Position 1 have been used as input data into the model to calculate the noise levels across the rest of the site. The noise model takes account of the roads around the site. It has been assumed that traffic on the various arms of the A46 is approximately equal, and that traffic on the M40 motorway is 10dB higher than the roads that join it.

5.4 The ground is assumed to be 100% acoustically soft and all buildings are assumed to be approximately 70% reflective.

5.5 As noted in Section 3 of this report, there is no guidance in BS8233 or the WHO guidelines, for external areas at night; guidance at night relates to internal spaces to protect the occupants' sleep. Therefore, this assessment considers the external noise levels across the site for the daytime only, as shown in Figure E.1 in Appendix E. Night-time noise contours have been included in Figure E.2 for information purposes, referenced to the noise exposure categories in PPG24.

5.6 The daytime noise contours in Figure E.1 show that the entire site falls below 72dB $L_{Aeq,16hrs}$, the noise level that is considered in this assessment to be equivalent to the SOAEL. Significant adverse effects are therefore likely to be avoided. In terms of the guidance in the withdrawn PPG24, the site falls into noise exposure categories B and C.

5.7 Figure E.1 shows that the whole site, shaded yellow, is above 55dB, the LOAEL, and therefore mitigation is considered necessary to meet the objectives of the NPPF. This would also be consistent with the advice that appeared in PPG24, where it indicated that mitigation should be considered for sites in noise exposure categories B and C.

5.8 Figure E.2 also shows that the whole site falls into noise exposure categories B and C at night.

5.9 Advice on mitigation and internal noise levels are considered in the next section of this report.

6 MITIGATION MEASURES

External Noise Levels

6.1 Figure E.1 shows that the site is subject to noise above the LOAEL, and therefore mitigation is required to ensure that a suitable noise climate is achieved across the site. An indicative set of night-time noise contours, as shown in Figure E.2, suggest that the site falls into noise exposure categories B and C, as defined in the now-withdrawn PPG24.

6.2 Any houses built on the site would themselves reduce the noise across the site, as is illustrated in Figures E.3 and E.4. The housing layout shown in Figures E.3 and E.4 does not reflect a proposed layout, but is shown to illustrate the effect of putting buildings on the site.

6.3 It can be seen from Figure E.3 that the daytime noise levels across the majority of the site to the east of the properties are predicted to be below 55dB; this would be consistent with noise exposure category A, as defined in the now-withdrawn PPG24. Figure E.4 shows that the night-time noise climate would have fallen into noise exposure category B.

6.4 Parts of the site below 55dB during the daytime would be suitable for external amenity areas, such as gardens.

6.5 Erecting a noise barrier along the edge of the A46 would also reduce noise levels across the site. Figures E.5 and E.6 show the combined effect of a 3 metre high roadside noise barrier and the illustrative housing locations, as described above.

6.6 It can be seen from Figure E.5 that the daytime noise levels across the site would have fallen into noise exposure categories A and B; the majority of the site to the east of the properties falling into noise exposure category A. Figure E.6 shows that the night-time noise levels would have fallen into noise exposure B.

6.7 A solution that combines a perimeter barrier with a carefully designed layout, offers a practical way forward for the site.

6.8 Any acoustic barriers erected at the site should be imperforate, sealed at the base, and have a superficial mass of at least 13kg/m^2.

6.9 It is also noted that developing the site in the way described above would reduce noise at the existing houses on Goggbridge Lane. Although this would not be the principal reason for building houses on the site, it would be a material benefit.

Internal Noise Levels

6.10 The external building fabric of the proposed properties should be specified to ensure that external noise is reduced to appropriate levels within.

6.11 To determine the sound reduction performance likely to be required of the external building fabric, the noisiest part of the site has been considered; the highest noise levels at the site are likely to be at properties proposed close to the A46 bypass.

6.12 The sound reduction performance required of the external building fabric for these properties has been calculated and is shown in Table 6.1. For the purposes of this assessment, it is assumed that the closest properties are approximately 10 metres from the fenceline adjacent to the A46.

6.13 The sound reduction performance requirements set out below apply to the whole external building fabric of the proposed property, however, since windows are typically the weakest link in the external building fabric, in terms of acoustic performance, the values below will apply to the windows particularly. The noise levels predicted at the worst-case property have been rounded up to the nearest decibel.

Table 6.1: Required sound reduction performance, dB

Location	Period	Calculated Noise Level	Target Noise Level	Required Sound Reduction Performance
Properties adjacent to A46 Bypass	Daytime L_{Aeq}	64	30-40	24-34
	Night-time L_{Aeq}	62	30-35	27-32
	Night-time L_{Amax}	75	45	30

6.14 It can be seen from Table 6.1 that a reduction of 34dB would be sufficient to achieve an internal noise climate that would be considered *"good"* within a property located as close as 10 metres from the site boundary adjacent to the A46, when assessed against the guidance in BS8233. This outcome is considered to meet the aspirations of the NPPF and NPSE as the internal noise levels are predicted to be below the LOAEL.

6.15 Properties further from the A46, or properties screened by other buildings on the site, will have lower sound reduction performance requirements. These requirements should be determined once the layout is finalised as the proposed buildings themselves will affect how noise propagates across the site.

6.16 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 receiving room.

6.17 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}.

6.18 The sound reduction requirements set out in Table 6.1 should be interpreted as R_{TRA} values.

6.19 Glazing units capable of achieving a 34dB R_{TRA} performance include Pilkington's 10.8/16/6 double glazing system. This unit comprises two panes of glass, one 10.8mm thick and one 6mm thick, separated by a 16mm airgap.

6.20 Glazing units other than that suggested above may be suitable and it is the responsibility of the glazing manufacturer to recommend and provide appropriate systems. The above analysis is provided to demonstrate that a design solution is feasible at the site for the purposes of a planning application and not for the purposes of detailed design or glazing procurement.

6.21 The detailed design of the proposed properties will affect both the required sound reduction performance and the appropriate selection of glazing units. The aspects of the detailed design that are important are the 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 detailed design is confirmed.

6.22 Internal noise levels should be considered in the context of room ventilation requirements as the target internal noise levels will only be achieved when windows are closed. An alternative means of ventilation may therefore be required to comply with the requirements of the Building Regulations Approved Document F.

6.23 The Building Research Establishment (BRE) has published an Information Paper on the acoustic performance of such passive ventilation systems. IP4/99: *Ventilators: Ventilation and Acoustic Effectiveness* (October 1999) details a study into the sound reduction performance of fourteen different window mounted trickle ventilators and seven different through-wall passive ventilators. The measured sound reduction performance, after taking into account flanking sound paths (i.e. sound paths that do not travel directly through the vent) and the effective area of the ventilator, ranged from 14 to 46dB.

6.24 Passive vents are available that meet or exceed the sound reduction required by the glazing elements. If considered appropriate, whole house ventilation systems would allow the occupants to keep their windows closed and retain access to rapid ventilation. Such systems often offer environmental benefits such as heat recovery systems.

7 CONCLUSION

7.1 The Campbell Partnership has appointed Resound Acoustics Limited to undertake a noise assessment for a site known as Tournament Fields, Warwick. The Campbell Partnership is promoting the site through the council's emerging Local Plan for residential development.

7.2 This assessment has shown that the noise climate at the site would be suitable for residential development and would achieve the policy aims of the National Planning Policy Framework providing that:

- external building fabric materials are used, particularly glazing, that meet the sound reduction performance requirements set out in Table 6.1 for the properties closest to the A46;
- the site layout is designed to ensure that the development proposals maximise the opportunities for providing acoustic screening, including where appropriate, an acoustic barrier along the A46 frontage.

7.3 Where mitigation is provided, the site would fall into noise exposure categories A and B, as defined in the now-withdrawn Planning Policy Guidance 24; sites in noise exposure categories A and B were generally considered suitable for residential development under the guidance in PPG24.

7.4 Warwick District Council has indicated that their new local policy on noise would be similar in approach to PPG24, hence its use in this assessment.

7.5 Although not the principal reason for building houses on the site, the existing houses on Goggbridge Lane would benefit from a reduced noise climate as a result of developing the site.

7.6 On the basis of this assessment, and providing the recommended mitigation measures are implemented, it is considered that noise should not pose a constraint to 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

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_w	The L_w, or sound power level, is a measure of the total noise energy of a source.
$L_{Aeq,T}$	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.
SEL	A noise level which, if maintained for a period of 1 second, would cause the same A-weighted sound energy to be received as is actually received from a given noise event.
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 BS5969.

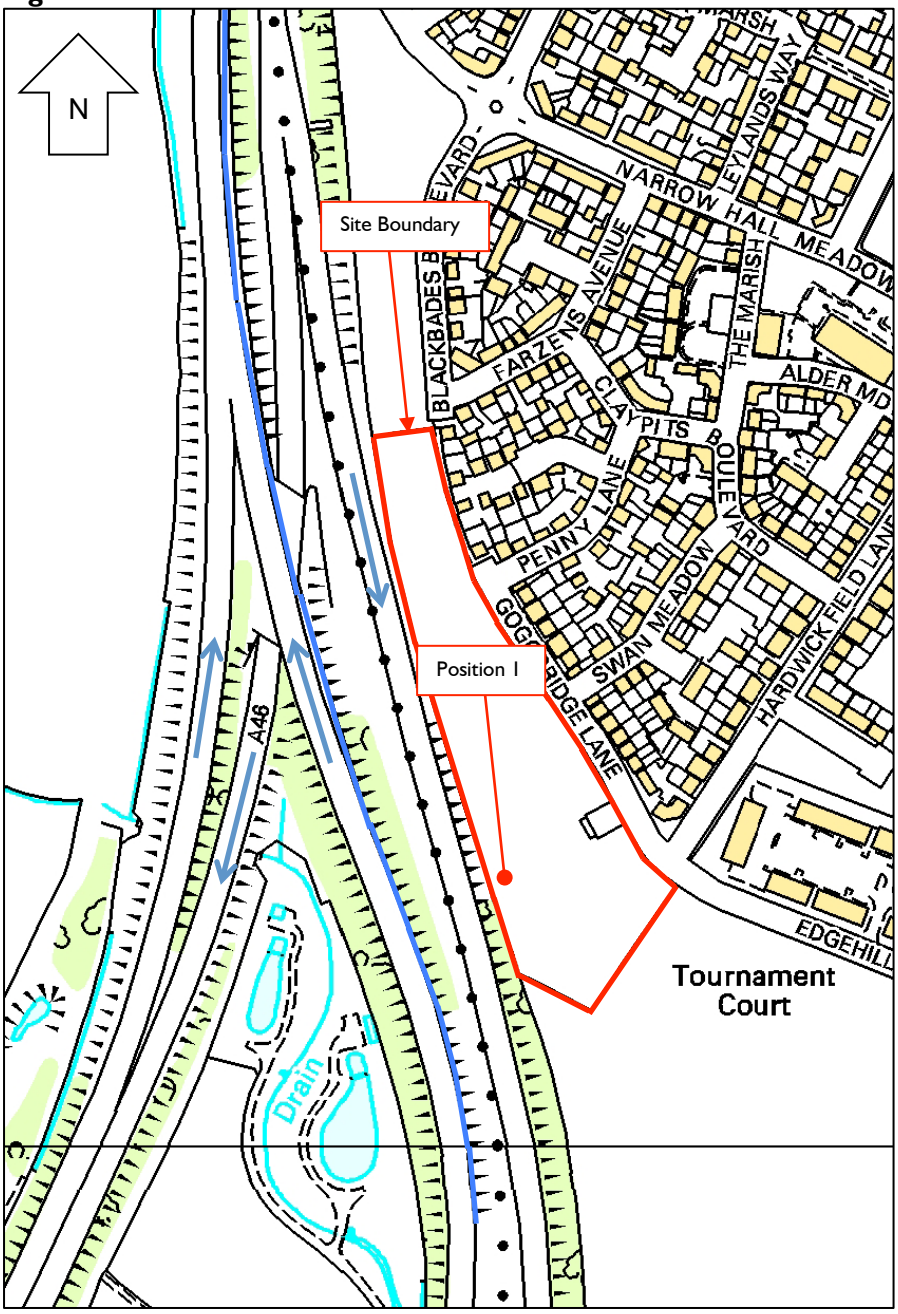
Appendix B – Noise Monitoring Equipment

Table B.1: Noise monitoring equipment

Position	Equipment	Serial Number
Position 1	01dB Solo type 1 sound level meter	60582
	01dB PRE21S pre-amplifier	13510
	01dB MCE212 microphone	90416
	01dB CAL01 acoustic calibrator	980058

Appendix C – Noise Measurement Location

Figure C.1: Measurement Location



Key:

Direction of travel on roads

Existing roadside barrier

Appendix D – Full Survey Results

Table D.1: Noise levels measured at Position 1, June 2012, free-field dB

Date	Time	$L_{Aeq,T}$	L_{A90}	L_{A10}	L_{AFMax}
19/06/2012	15:00	66.4	55.6	70.1	77.0
19/06/2012	16:00	67.7	57.6	71.1	82.8
19/06/2012	17:00	68.0	57.9	71.2	79.1
19/06/2012	18:00	66.6	54.2	70.2	84.5
19/06/2012	19:00	65.0	51.3	69.4	78.9
19/06/2012	20:00	62.2	45.6	67.0	76.7
19/06/2012	21:00	61.6	45.9	66.5	85.8
19/06/2012	22:00	60.5	45.6	65.4	76.4
19/06/2012	23:00	59.6	44.6	63.8	77.9
20/06/2012	00:00	58.0	44.8	60.6	76.3
20/06/2012	01:00	57.6	45.7	58.3	76.2
20/06/2012	02:00	56.2	42.8	53.8	75.9
20/06/2012	03:00	59.5	43.5	61.5	75.5
20/06/2012	04:00	61.0	47.1	64.4	77.7
20/06/2012	05:00	65.1	52.9	69.6	77.3
20/06/2012	06:00	67.6	56.0	71.5	77.6
20/06/2012	07:00	68.9	59.7	72.1	78.6
20/06/2012	08:00	68.5	59.3	71.8	82.4
20/06/2012	09:00	66.6	54.1	70.1	77.3
20/06/2012	10:00	65.4	52.9	69.0	79.0
20/06/2012	11:00	65.1	52.3	69.0	77.6
20/06/2012	12:00	65.4	53.4	69.1	77.0
20/06/2012	13:00	65.5	53.7	69.2	84.2
20/06/2012	14:00	65.6	54.8	69.3	78.9

Note: All measurements were 1 hour in duration

Appendix E – Noise Contour Plots

Figure E.1: External daytime noise contours

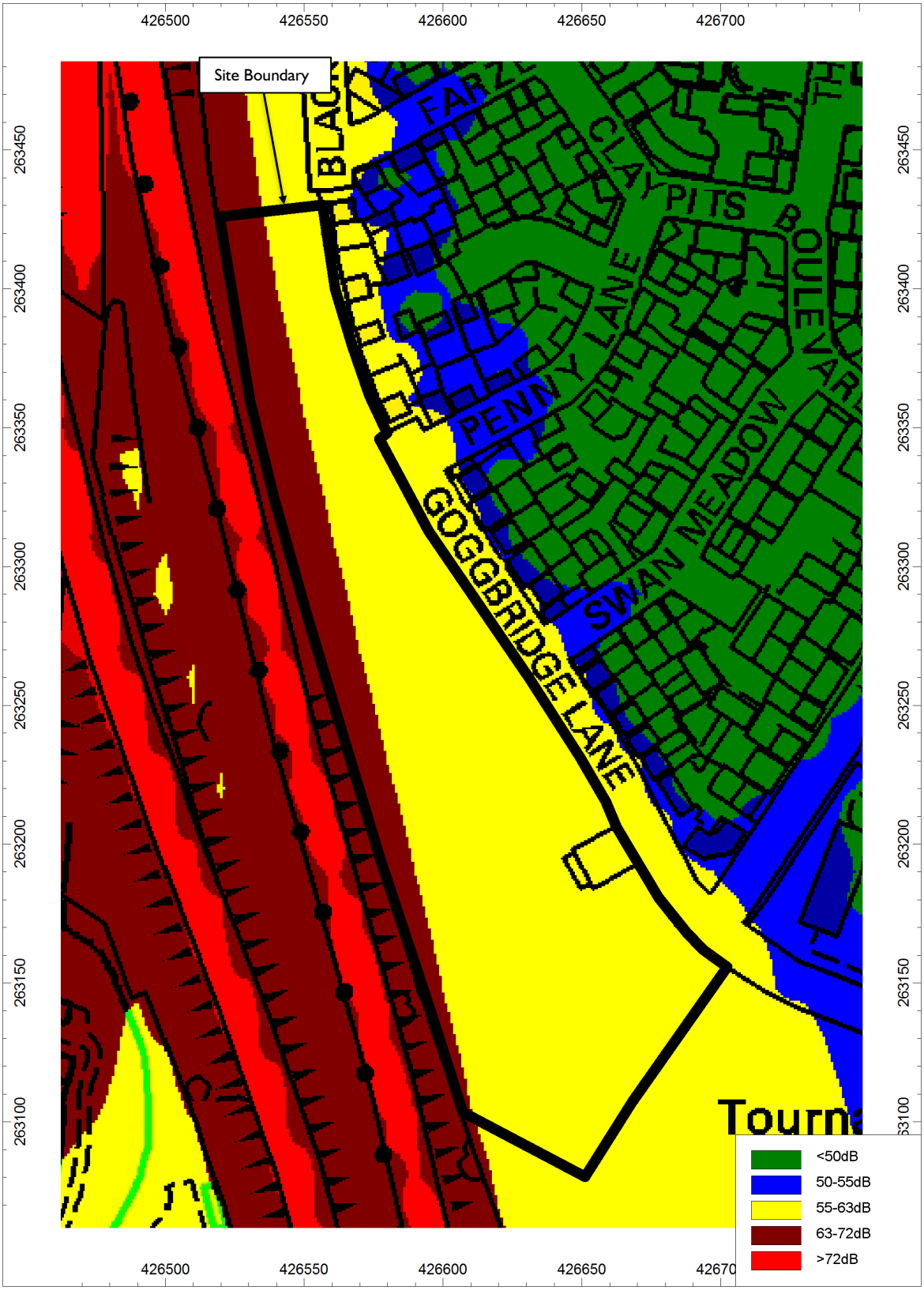


Figure E.2: Indicative PPG24 night-time contours

Figure E.3: External daytime noise contours with illustrative layout

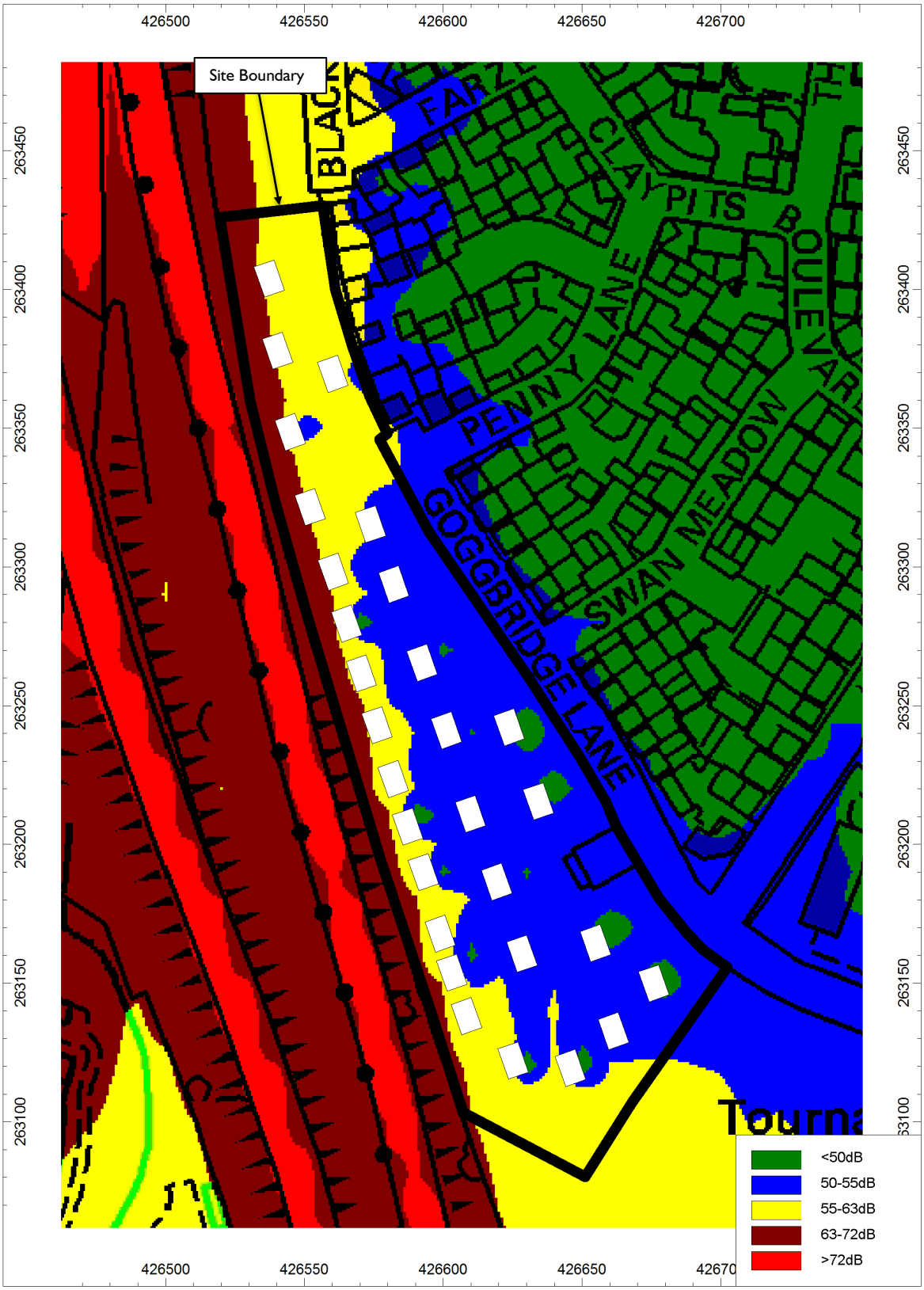


Figure E.4: External night-time noise contours with illustrative layout

Figure E.5: External daytime noise contours with 3 metre high barrier and illustrative layout

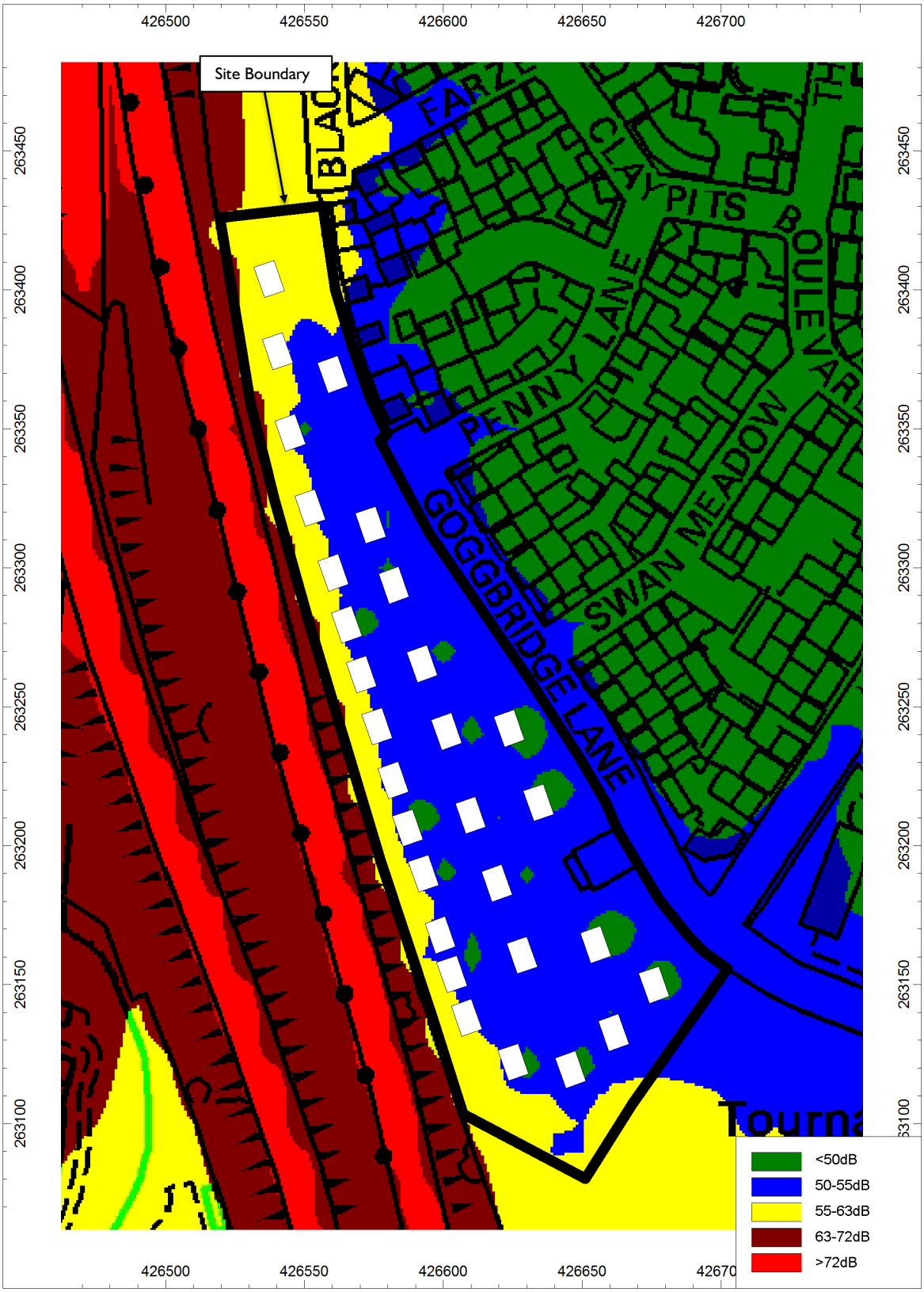


Figure E.6: External night-time noise contours with 3 metre high barrier and illustrative layout

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