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Acoustic Assessment in support of Outline Planning Permission for Residential Development at:

Land to the south of the A617, Rainworth

FOR: Aspbury Planning

ON BEHALF OF: Romo Holdings Ltd

Report Reference: B5338 2021-03-16 R

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B5338.1	Updated site boundary	KT	16 March 2021
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Contents

1.0 Synopsis

1.1 In preparation for an application for outline planning permission to develop a site south of the A617 in Rainworth for residential purposes, an acoustic assessment has been undertaken to assess the viability of the site for residential development. This assessment has been conducted in line with ProPG Planning and Noise, informed by other relevant guidance.

1.2 An attended site survey was conducted to gather qualitative and quantitative data to inform the assessment. Part of this was a CRTN measurement to determine the impact of road traffic travelling along A617 Rainworth Bypass on any potential residential development on the site.

1.3 Using Good Acoustic Design in line with ProPG, the site can be developed for residential purposes. The dwellings should be located to maximise screening attenuation and distance from the road, orientated to protect noise sensitive indoor rooms and outdoor amenity areas from road noise, and constructed using suitable attenuation measures including specific glazing and ventilation strategies where appropriate to achieve suitable sound levels indoors.

1.4 With appropriate design, consistent with the Good Acoustic Design principles of ProPG, this site can comply with the ProPG Recommendation – 'No objection on noise grounds', specifically '*Planning consent may be granted subject to the inclusion of suitable noise conditions*'.

2.0 Introduction

2.1 A site to the south of A617, Rainworth has been identified as an area for possible residential development. It is understood that the site is currently the subject of an allocation in the Newark and Sherwood Local Plan for employment development (Policy Ra/E/1 Rainworth – Employment Site 1 of the Newark and Sherwood Allocations and Development Management Development Plan Document, July 2013). However, this site does not lend itself well to such a development due to the site's constraints, including difficult topography (which poses a significant constraint to the design of suitable access from the A617), ecology, drainage, and proximity to residential neighbourhoods. As such, residential development of the site is proposed, to include up to 95 dwellings.

2.2 ACC has been appointed by Aspbury Planning on behalf of Romo Holdings Ltd to undertake an acoustic assessment of the site to determine the viability of the site for residential use.

2.3 This report has been drafted in accordance with Stage 2 of ProPG Planning & Noise, and includes recommendations of good acoustic design to assess whether the site is suitable for residential development.

2.4 ACC is an independent acoustic consultancy company. All our acoustic consultants are qualified and experienced practitioners and are either Associate or Corporate members of the Institute of Acoustics. Acoustical Control Engineers Limited is our associated company specialising in engineered solutions to acoustic problems.

3.0 Scope

3.1 To establish the level and character of the existing acoustic environment in the vicinity of the site.

3.2 Identify appropriate acoustic criteria for internal and external sound levels within the potential development to properly protect the amenity of occupiers of the new development.

3.3 Analyse the sound level data to assess the suitability of the site for housing development and identify mitigation measures, where appropriate, consistent with Good Acoustic Design.

3.4 Provide an acoustic assessment report setting out the information outlined above.

4.0 Survey

4.1 A site visit and attended sound survey was undertaken on Tuesday 12th January 2021 by Kristoffer Tsinontas BSc (Hons), MIOA.

4.2 Sound pressure level measurements were taken to inform the assessment and to assist with characterising the acoustic environment. All measurements were taken at a height of 1.2 m to 1.5 m above the ground and at least 3.5 m away from reflective surfaces apart from the ground.

4.3 Figure 4.1 below shows the site location, overlaid with the proposed site plan. Measurement positions are labelled with numbered markers.

Figure 4.1 – Site Location and Proposed Plan

Instrumentation

Cirrus Optimus Sound Level Analyser Type CR 171B, Serial No. G301578
Cirrus Calibrator Type CR 515, Serial No. 70553
Cirrus Windshield

Tripod
Skywatch Meteos Anemometer

4.4 On site calibration was undertaken before and after the measurements using a calibrator. Negligible drift in calibration was observed. Valid calibration certificates are available upon request.

4.5 Weather conditions were logged throughout the survey. At the measurement location there was a slight westerly breeze, temperatures of around 5°C, ground surfaces were dry, and skies were clear.

Measurements

4.6 Graphs 1, 2 & 3 of Appendix 1 display the results of the measurements undertaken during the survey.

4.7 Graph 1 shows the sound levels measured 10 m from the site's north eastern nearside edge for the purposes of a CRTN assessment. This location was chosen for its proximity to the traffic light controlled T-junction intersection with Rufford Colliery Lane which would be adapted in to a 4 way intersection to provide access to the development. The sound level at this location was characterised primarily by sound from road traffic passing, with traffic occasionally ceasing on the A617 to allow traffic from Rufford Colliery Lane to join the A617. Occasional aircraft were also present during the measurement period but did not contribute substantially to the acoustic environment.

4.8 Between passing cars and HGVs the sound level varied between 50 to 60 dB L_A. Passing light vehicles increased the level to around 75 to 80 dB L_A, rising further to up to 85 dB L_A due to passing HGVs on occasion. Three representative 15-minute measurements were taken over the three-hour period between 13:30 and 16:30 in accordance with the shortened CRTN calculation method. The L_{A10} sound level for each of the representative 15-minute periods are used in subsequent analysis to determine the average sound level of road traffic noise from the A617 carriageway near the site. These L_{A10} sound levels are summarised in Table 4.2 below:

Measurement Time Period	L_{A10} dBA
13:36 – 13:51	77
14:41 – 14:56	76
15:41 – 15:56	77
Arithmetic average	**77**

Table 4.2 – L_{A10} statistical sound levels taken from CRTN measurement at north east of site.

4.9 Graph 2 shows the sound levels measured 10 m from the A617 at the north western edge of the site for the purposes of a CRTN assessment. This position was chosen as the traffic would be more likely to be moving at full speed at this position rather than being controlled by traffic lights to the north east of the site. The sound level at this position was characterised primarily by sound from road traffic passing the measurement position. Occasional aircraft were also present during the measurement period.

4.10 Between passing cars and HGVs the sound level varied between 50 to 60 dB L_A. Passing light vehicles increased the level to around 75 to 80 dB L_A, rising further to up to 85 dB L_A due to passing HGVs on occasion. Three representative 15-minute measurement were taken over the three-hour period between around 14:00 and 17:00 in accordance with the shortened CRTN calculation method. The L_{A10} sound level for reach of the representative 15-minute periods are used in subsequent analysis to determine the average sound level of road traffic noise from the A617 carriageway near the site. These L_{A10} sound levels are summarised in Table 4.3 below:

Measurement Time Period	L_{A10} dBA
13:54 – 14:09	77
14:58 – 15:13	78
15:58 – 16:13	79
Arithmetic average	**78**

Table 4.3 – L_{A10} statistical sound levels taken from CRTN measurement at north west of site.

4.11 Graph 3 shows the sound levels measured in the grassland area off Churchfield Drive to the south west of the site in the vicinity of Rainworth Garage. The purpose of this measurement was to determine the residual environment due to sources other than road traffic on the A617, and to quantify the contribution from Rainworth Garage.

4.12 The sound level here varied between 45 to 50 dB L_A depending on the contribution from distant road traffic sources. The road provides access to a care home and a series of caravan houses, whose resident vehicles passed the measurement position a number of times raising the sound level to 60 dB L_A. Occasional impulsive events were generated by work at Rainworth Garage (such as hammering and other handheld tools) which produced instantaneous events of up to 70 dB L_A at the measurement position.

5.0 Relevant Guidance & Criteria

5.1 Annex B provides a detailed review of relevant guidance that may be applicable to this assessment. The key points of relevant documents are summarised below:

National Planning Policy Framework (NPPF), Noise Policy Statement for England (NPSE) and National Planning Practice Guidance (NPPG)

5.2 There is a presumption in favour of sustainable development throughout both plan-making and decision-taking. Assessments should be proportionate to the proposed development. Local planning authorities should consider whether otherwise unacceptable development could be made acceptable through the use of conditions or planning obligations.

5.3 Below the No Observed Effect Level (NOEL) sound is unnoticeable and of no significance. Below the Lowest Observed Adverse Effect Level (LOAEL) sound can be heard but does not cause any changes in behaviour or attitude, although the acoustic character of the area may be slightly changed. Below the Significant Observed Adverse Effect Level (SOAEL) sound may cause slight changes in behaviour or attitude e.g. turning up volume of a television or closing windows. There is potential for some sleep disturbance and a perceived change in the acoustic character of the area and quality of life.

5.4 Areas of Tranquillity should be protected, but in general cases it may be inappropriate to achieve a level below the LOAEL as this provides no benefit but may require additional resources such energy, materials, space, time, and money. Adversely affecting the sustainability of doing so. Noise above the LOAEL should be mitigated and reduced to a minimum, although it may be appropriate to exceed the LOAEL and create an adverse acoustic impact, if this provides other sustainability benefits that are of greater significance. Noise above the SOAEL should be avoided.

ProPG: Planning and Noise Professional Practice Guidance

5.5 This guidance specifically relates to new residential developments subjected primarily to noise from transportation sources, rather than new noise producing developments. However, it sets out the principles of Good Acoustic Design and provides useful guidance regarding acoustic design criteria to protect the residents of dwellings against disturbance due to noise.

5.6 The guidance relies on BS 8233: 2014 which itself draws on WHO guidance. An external night time sound level of 40 dBA or lower is considered to pose 'negligible risk' for new residential development, on the basis that this will correspond to internal sound levels of 30 dBA or lower within bedrooms with windows partly open for ventilation.

5.7 This also clarifies that individual noise events (from all sources) should not normally exceed 45 dB L_{AFmax} more than 10 times a night as this represents a threshold below which the effects of individual noise events on sleep can be regarded as negligible. Appendix A of ProPG includes further discussion on the relationship between sleep and the maximum level of, and the number of, individual noise events. It is difficult, based on currently available evidence, to reach a clear conclusion on when the impact of individual noise events should be regarded as "unreasonable" or "unacceptable".

BS8233:2014 Guidance on sound insulation and noise reduction for buildings

5.8 For dwellings the main considerations are to protect sleep in bedrooms and to protect resting, listening and communicating in other rooms. For noise without a specific character it is desirable that the overall average levels during the 8 hour night or 16 hour day time periods do not exceed 30 dB L_{Aeq} or 35 dB L_{Aeq} respectively.

5.9 For amenity spaces, such as gardens and patios, it is desirable that the average level does not exceed 50 dB L_{Aeq}, with an upper guideline value of 55 dB L_{Aeq} which would be acceptable in noisier environments. For dwellings with conventional windows, an internal target of 35 dB L_{Aeq} during the day equates to around 50 dB L_{Aeq} (possibly slightly lower) outside noise sensitive rooms with openable windows.

World Health Organization: Guidelines for Community Noise & Night Noise Guidelines for Europe

5.10 These establish that a steady level of 30 dB L_A within bedrooms is suitable to protect vulnerable people from sleep disturbance and that occasional maximum levels of up to around 42 dB L_A to 45 dB L_A are also consistent with this. The difference between a sound level outdoors and the resultant level indoors with open windows varies through Europe due to differing building characteristics and particularly window type. An average difference of around 15 dB L_A is often used, although this is also dependent upon other factors such as the frequency spectrum of the incident sound.

World Health Organization

5.11 The WHO publication 'Guidelines for Community Noise' provides guidance regarding suitable levels of noise that will protect vulnerable groups against sleep disturbance. A steady level of 30 dB L_A in bedrooms are identified as being suitable to achieve this, which in terms of this assessment is considered to be the LOAEL threshold, with maximum internal event levels of 45 dB L_A according to section 5.7 of the guidelines to avoid sleep disturbance.

5.12 The difference between a sound level outdoors and the resultant level indoors with open windows varies due to differing building characteristics and particularly window type. An average difference of around 15 dB L_A is often used, although this is also dependent upon other factors such as the frequency spectrum of the incident sound.

5.13 This means that the corresponding criteria for the night-time noise level outdoors are steady levels of up to about 45 dB L_A and maxima of up to around 60 dB L_A.

Chartered Institution of Building Services Engineers: CIBSE Guide A: Environmental Design

5.14 The environmental design guidance provides details of Noise Rating (NR) curves which are commonly used within Europe for specifying mechanical plant in order to control the character of the noise. The relationship between NR and dB L_A is not constant because it depends upon the spectral characteristics of the noise. However, for ordinary intrusive noise found in buildings, dB L_A is usually between 4 and 8 greater than the corresponding NR value. BS 8233 gives a single conversion value of 6.

5.15 Table 1.15 of the design guidance provides a suggested maximum noise level generated within urban dwellings of NR25 for bedrooms and NR30 for living rooms. Guidance is also provided for offices and public buildings.

Calculation of Road Traffic Noise (CRTN)

5.16 CRTN provides an assessment method for the calculation of noise from road traffic schemes based upon the changes flow rate, speed and vehicle type. Using TRL Method 3 it is possible to extrapolate measurements taken for the purpose of CRTN calculations to their equivalent assessment periods for day time and night time.

Discussion

5.17 National Planning Policy recognises that development may affect amenity but clarifies that any such impact must be within acceptable limits to protect amenity and that noise must not be considered in isolation but as part of the overall sustainability impact and that an adverse acoustic impact may be acceptable if this provides other sustainable benefits of greater overall significance.

5.18 Current guidance indicates there may be no benefit in achieving conditions below the LOAEL because this is unlikely to provide any additional benefit but have other adverse effects on the sustainability of the development.

5.19 During the night residents will hear various sources of sound from within and external to their dwelling. The fact that any particular source of noise is audible does not mean that it will disturb someone who is trying to sleep if it does not exceed the LOAEL threshold. The likelihood of disturbance depends instead upon other factors such as the actual level of sound and the character of the soundscape within the bedroom.

5.20 Taking all of the above factors into account, the LOAEL for internal levels would be 35 dB $L_{Aeq,16hour}$ for resting areas during the day, and 30 dB $L_{Aeq,8hour}$ internally for bedrooms during the night. The L_{Amax} sound levels should not exceed 45 dB internally more than 10 times per night, equating to 60 dB LAmax externally with windows slightly open for ventilation. The average level of external amenity areas should not exceed the upper guideline value of 55 dB L_{Aeq} as the site is currently a noisier environment.

6.0 Analysis

6.1 The results of the predicted L_{Aday} and L_{Anight} have been determined from both the NE and NW measurement locations using a combination of the CRTN shortened noise monitoring procedure and TRL Method 3 to calculate values from the 3-hour CRTN measurement. The results of these calculations are shown in Table 6.1 below:

Line	NE Survey	L_{A10}, dB	NW survey	L_{A10}, dB	Notes
1	13:36 – 13:51	77	13:54 – 14:09	77	
2	14:41 – 14:56	76	14:58 – 15:13	78	
3	15:41 – 15:56	77	15:58 – 16:13	79	
4	Average	77	Average	78	
5	L_{A10} (18-hour)	76	L_{A10} (18-hour)	77	Line 4 – 1 dB
6	**L_{day}**	**74**	**L_{day}**	**75**	0.95 x Line 5 + 1.44
7	**L_{night}**	**65**	**L_{night}**	**66**	0.9 x Line 5 - 3.77

Table 6.1 - Lday and Lnight at measurement positions to the NE and NW of proposed site.

6.2 In order to assist with acoustic impact assessment a 3D model was generated using DataKustic's CadnaA 2019. The model includes the topography of the site, and the contribution to the acoustic environment from the A617 carriageway. The predicted sound level emitted by vehicles traversing the road was calibrated to match the L_{day} and $L_{night\ t}$ values of the two measurement positions in Table 6.1.

6.3 It should be noted that these levels are calculated from the $L_{10,18\ hour}$ level for road traffic, which is itself calculated from the sound levels measured during the representative 15 minute snapshots over a 3 hour day time period. Therefore uncertainty is in these calculated levels due to the method used, but this is appropriate for the purposes of this assessment.

6.4 At 10 m from the edge of A617 Rainworth Bypass, the predicted average sound levels during the day (07:00 to 23:00 hours) and night (23:00 to 07:00 hours) are 75 and 66 dB L_A respectively.

6.5 Figure 1a/b and Figure 2a/b in Appendix 2 show how these sound levels decrease from the front (north) towards the rear (south) of the site currently. Figure 1a and Figure 1b show the predicted sound level on the site prior to any development during the day and night respectively (this naming convention continues for further Figures in Appendix 2). The predicted average sound levels towards the rear of the site are around 51 and 42 dB L_A during the day and night respectively at areas earmarked for dwelling locations.

6.6 Figure 2a/b shows the same topographical model with buildings located on the proposed block locations to simulate the screening characteristics which are likely to be present between the road and dwellings further to the rear of the site. This will allow for mitigation strategies to be recommended which are more in line which would be required on a finished site.

6.7 As the type of housing is unknown at this point (detached, town houses etc.), the model uses an uninterrupted block building to simulate the presence of dwellings on each side of each proposed road. This may slightly overstate the screening provided as there may be gaps if the dwellings are detached. This is especially relevant when modelling maximum sound levels for the purposes of assessing potential sleep disturbance during the night.

6.8 The presence of buildings decrease the sound level to the rear of the site by between 3 and 15 dB L_A depending on the field of view to the road.

6.9 Figures 3a/b and 4a/b show the model results with a 3 m acoustic barrier positioned parallel next to the bicycle/footpath on the A617, and parallel to the road at the boundary of the site respectively. Locating a barrier closer to the sound source (the road) would have a greater acoustic screening effect compared to locating the barrier within the site boundary, however, the latter may be necessary due to developmental constraints.

6.10 The 3 m acoustic barrier located parallel next to the bicycle/footpath would have the greatest screening effect on the ground floor windows of dwellings closest to the road. The reduction in sound levels to windows on the ground floor of dwellings facing the road, and those facing perpendicular to the road near the front of the site, would be approximately 7 to 8 dB L_A during the day. The sound level to the first floor windows of these same dwellings would be reduced by 5 to 6 dB L_A. Dwellings further in to the site would receive less benefit from the screen due to the localised screening provided by the other dwellings.

6.11 The screening effects on specific dwellings can be modelled with more certainty at the detailed design stage of the development when the actual layout is known. This would allow for more bespoke selection of mitigation strategies.

6.12 If such an acoustic barrier was located along the 'red line' of the site boundary, parallel to the road, it would provide a similar amount of acoustic screening to the ground floor windows of dwellings closest to the road but would have a somewhat diminished effect on first floor windows. It is predicted that the ground floor windows of dwellings closest to the road, and perpendicular to the road to the front of the site, would have a reduction of 5 to 6 dB L_A on the average sound levels during the day, with average sound levels during the night reduced by 2 to 3 dB L_A at the first floor windows.

6.13 At this stage of the design general advice can be given regarding the types of ventilation required for bands of areas on the proposed site. More specific advice can be determined during the detailed design stage of the development. In order to achieve suitable average sound levels during the day and night, suitable glazing and mechanical ventilation may be required for dwellings within the purple band on Figures 2, 3 and 4 whereas those between bands red and yellow would achieve suitable levels internally with suitable glazing and specified trickle ventilation. Dwellings within the yellow band would achieve suitable internal sound levels with windows slightly open. As seen from Figure 3 and somewhat in Figure 4, screening from an acoustic barrier can allow for more dynamic and bespoke ventilation strategies per household in order to protect the amenity of future residents.

6.14 Dwellings on the proposed plan are laid out with the houses on the outside of a block with gardens/outdoor amenity areas within. These outdoor areas would benefit from substantial screening from the road by the houses themselves. The expected sound level during the day time is modelled at a height of 2 m in the centre of the outdoor areas to give a worst case scenario of the sound level expected at what would be the rear of residents' gardens. The average sound level ranges from 46 dB L_A to 53 dB L_A in the gardens depending on the distance from the road, and the local topography. It would be expected that residents using their gardens would typically congregate closer to the house which would increase the acoustic screening benefit compared to the level assessed to the rear of the gardens.

6.15 HGVs passing the measurement location produced sound levels of up to 85 dB L_A on several occasions. According to ProPG, 10 events above 45 dB L_{Amax} internally should be avoided which, with partly open conventional windows, equates to 60 dB L_{Amax} externally. With no mitigation measures in place, such as suitable layout, screening from other dwellings, or a barrier closer to the road, it would only be possible for dwellings more than 170 m from the road to achieve suitable maximum levels with windows slightly open.

6.16 For proposed dwellings closest to the road, HGV on the A617 would produce maximum sound levels of up to 78 dB L_A at the first floor windows. Installing a suitable acoustic barrier can reduce this by up to 8 dB L_A. It would be necessary to utilise suitable glazing and ventilation to reduce these maximum sound levels by up to 35 dB L_A to achieve suitable internal sound levels with windows closed. Depending on the final positioning of houses, some dwellings further back from the road may have a direct line of sight to the road, which would necessitate suitable glazing and ventilation at those properties to achieve suitable internal maximum sound levels to avoid sleep disturbance.

6.17 The sound level between transient events measured off Churchfield Drive, which were influenced primarily by distant road traffic on the A617, varied between 50 and 55 dB L_A during the measurement period. The acoustic model predicted a sound level at this location during the day of 53 dB L_A, which is in line with what was measured during the survey.

6.18 Activity could be heard at Rainworth Garage to the east of measurement location 3. Impulsive sounds including hammering could be heard at the measurement location, producing levels of up to 70 dB L_A on occasion. The measurement location was around 35 m with a direct line of sight to garage, whereas the fronts of houses will be around 25 m from the garage. It is not known at this point whether screening will be in place between the garage and the closest houses. Proposed outdoor amenity space, which would be sensitive to sound from the garage during its operational hours, would be significantly screened from the garage by intervening houses, resulting in maximum sound levels of approximately 60 dB L_A. These events did not occur constantly during the measurement period, and there could be an element of self-selection for residents of dwellings that are located close to the garage.

7.0 ProPG Acoustic Design Statement

Element 1 – Good Acoustic Design

7.1 Good Acoustic Design should be applied to ensure the suitability of the site for residential development purposes. This includes consideration and use of methods to achieve suitable acoustic conditions, which will not have other adverse effects, rather than simply implementing acoustic control measures which may adversely affect residents of the proposed dwellings in other ways e.g. sealed, mechanically ventilated buildings.

7.2 The orientation of dwellings can be utilised such that noise sensitive facades or areas face away from or are perpendicular to the A617. Openable windows can be oriented so that they do not reflect sound indoors, e.g. by hinging windows to the side so that they open in the direction to deflect sound from the road away.

7.3 The internal layout of dwellings can be configured to minimise the number of noise sensitive rooms that are directly exposed to noise from road traffic on the A617, by positioning less acoustically sensitive uses such as hallways, stairs, bathrooms, and kitchens to this façade.

7.4 Dwellings can be strategically positioned to provide screening to other dwellings further in to the site in an efficient manner.

7.5 Good Acoustic Design also includes consideration of mitigation measures such acoustic barriers e.g. earth bund, fencing, or combination of the two, which in this case could be utilised at the north eastern site boundary if a barrier along the bicycle/footpath is not possible.

7.6 More dwellings could be located towards the south western end of the site to maximise the benefits of distance attenuation from the A617. With communal outdoor amenity space and facilities located more towards the north eastern end of the site. Amenity areas can provide additional distance and possibly screening attenuation to dwellings to the rear of the site (from the A617).

7.7 It is important to consider the cumulative effects of location, orientation, screening, and other factors that may affect the sound levels at assessment locations (indoors and outdoors).

Element 2 – Internal Noise Level Guidelines

7.8 BS8233 recommends internal sound levels less than 35 dB L_A during the day to ensure suitable conditions for rest, and 30 dB L_A during the night to protect residents sleeping in bedrooms. In order to achieve these recommendations , depending upon the layout of the site and location of dwellings, it may be necessary to utilise some form of a mechanical ventilation strategy for windows facing directly towards, or somewhat perpendicular to the road. For example, it appears likely that dwellings on facades facing directly towards, and near the A617 should make use of a glazing and mechanical ventilation system to reduce the sound level external to internally by approximately 40 dB L_A or greater. Lower performance trickle systems, or possibly openable windows will be appropriate elsewhere on the site, depending upon the orientation, internal, and external layout of the dwellings. It would be prudent to ensure that each dwelling's ventilation strategy is considered in the context of its location and orientation within the site as a whole.

7.9 ProPG recommends that events resulting in internal levels exceeding 45 dB L_A should not occur more than ten times per night to protect residents from sleep disturbance. Allowing for a 15 dB L_A reduction in sound level due to windows being slightly open for ventilation this equates to 60 dB L_A externally. These sound levels can be approximately achieved 170 m from the road towards the rear of the site due to distance attenuation, without accounting for potential screening from intervening buildings.

7.10 Typically the external maximum sound levels from passing HGVs, at dwellings further than around 50 m from the A617 which benefit from screening by intervening buildings, would be around 60 dB L_{Amax} or below, which equates to suitable maximum levels indoors with windows slightly open; however this would depend on each dwelling's specific location in relation to other dwellings located on site, and the amount of acoustic screening afforded to each noise sensitive window which will be explored further in the detailed design stage of the development.

7.11 For dwellings that directly face the road, a combination of mitigation measures should be considered to achieve suitable maximum sound levels indoors with windows slightly open for ventilation, such as orientating dwellings so that sensitive facades facing away, or side on to the road, in conjunction with local acoustic barriers where applicable.

7.12 To control average sound levels resulting from road traffic, it is recommended that a suitable acoustic barrier is erected as close to the road as is practicable to provide screening between the road and the dwellings closest to the road. The exact construction, height, and location of the barrier would depend upon localised elevations, the location of dwellings and their orientation, but it may provide up to 8 dB L_A screening to noise sensitive windows depending on the proximity to the road. The amount of screening provided to ground floors will be more than first floor windows, and this should be considered during the specification of the barrier. The dwellings closest to the road would provide some screening to dwellings further to the rear of the site.

Element 3 – External Amenity Area Noise Assessment

7.13 It is recommended in authoritative guidance, such as WHO Guidelines, that external sound levels in outdoor amenity areas should be lower than 50 dB L_{Aeq}, with a potential relaxation of an additional 5 dB.

7.14 As road traffic noise is the primary influence on the acoustic environment, it is recommended that outdoor amenity areas closest to the A617, such as gardens, are positioned such that they benefit from the acoustic screening provided by the dwellings. Due to the topography of the site, some areas of proposed gardens are likely to be subject to average sound levels between 50 and 55 dB L_{Aeq} which would be at the upper end of suitability.

Element 4 – Assessment of Other Relevant Issues

7.15 Occasional aircraft could be heard during the measurement period, although the maximum sound levels from these never exceeded that from the road traffic noise.

7.16 Sound was measured from activity at the Rainworth Garage off Churchfield Drive. The sound levels at the location of the closest proposed dwellings would be slightly higher than that at the existing dwellings on Churchfield Drive. The sound level from most of these activities would likely be masked by road traffic noise, but the louder impulsive events could be audible in the outdoor amenity areas such as gardens.

Summary

7.17 Utilising the principles of Good Acoustic Design through the outline and detailed stages of planning, it is possible to develop the site for residential purposes in a way that will properly protect the amenity of future residents of the dwellings.

7.18 These design aspects include, but are not limited to, locating dwellings to maximise distance attenuation and screening to sensitive areas; orientating dwellings and designing the internal layout to ensure that less noise sensitive facades face the road; and screening more sensitive dwellings using acoustic barriers such as bunds and/ or appropriate fences.

7.19 Existing dwellings are located around 500 m east of the site at the end of Top Street and at The Hay Fields. These dwellings are a similar distance from the A617 Rainworth Bypass to the proposed dwellings. These areas appear to utilise earth bunding close to the road and the buildings also appear to have been oriented such that less sensitive facades face the road, as is recommended in this statement to achieve good acoustic conditions for the proposed development.

7.20 Sound from Rainworth Garage located to the south west of the site consisted of short duration impulsive events, some of which would be masked by road traffic noise. The extent of the Rainworth Garage's influence and impact on proposed dwellings would require further assessment in the later stages of planning once exact locations of dwellings are known, and whether localised screening can be implemented to mitigate sound from the garage.

8.0 Conclusions

8.1 ACC was appointed by Aspbury Planning on behalf of Romo Holdings Ltd to undertake an acoustic assessment of a site south of the A617 in Rainworth, Nottinghamshire to determine the viability of the site for residential use for approximately 100 dwellings.

8.2 The existing acoustic environment has been measured and assessed to determine the suitability of the site for residential development. This has informed the Acoustic Design Statement which incorporates Good Acoustic Design principles to assist in making the site suitable for residential purposes.

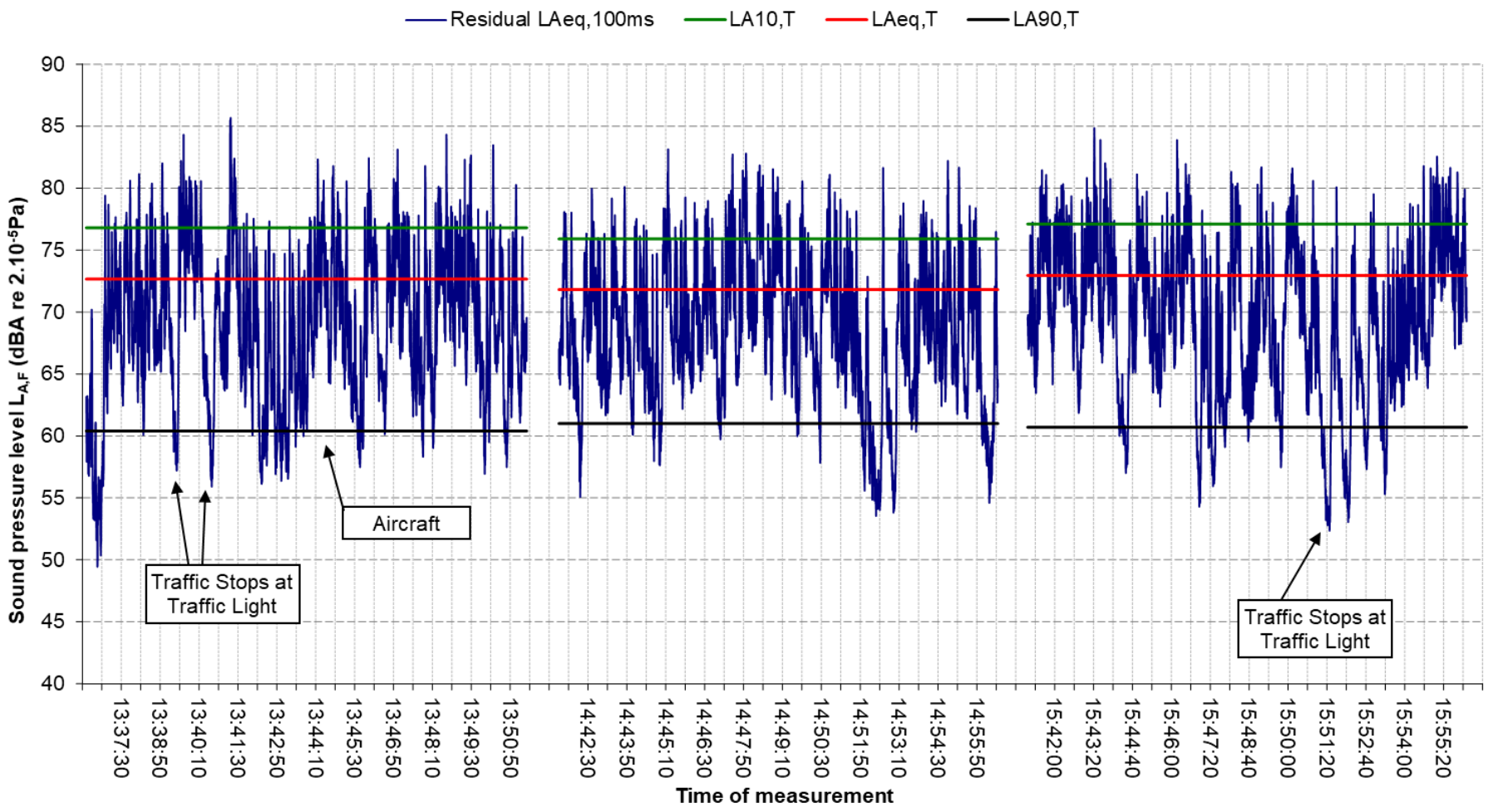
8.3 By locating dwellings, and orientating them to protect amenity areas, rooms will have suitable internal sound levels to provide suitable acoustic conditions for residents within the dwellings during the day and night.

8.4 External amenity areas such as gardens can be made suitable by locating them generally to the south of the series of dwellings, which will provide acoustic screening from road traffic noise. Additionally, if appropriate, locating communal amenity areas to the northern end of the site would allow dwellings further away from the road to benefit from increased distance attenuation.

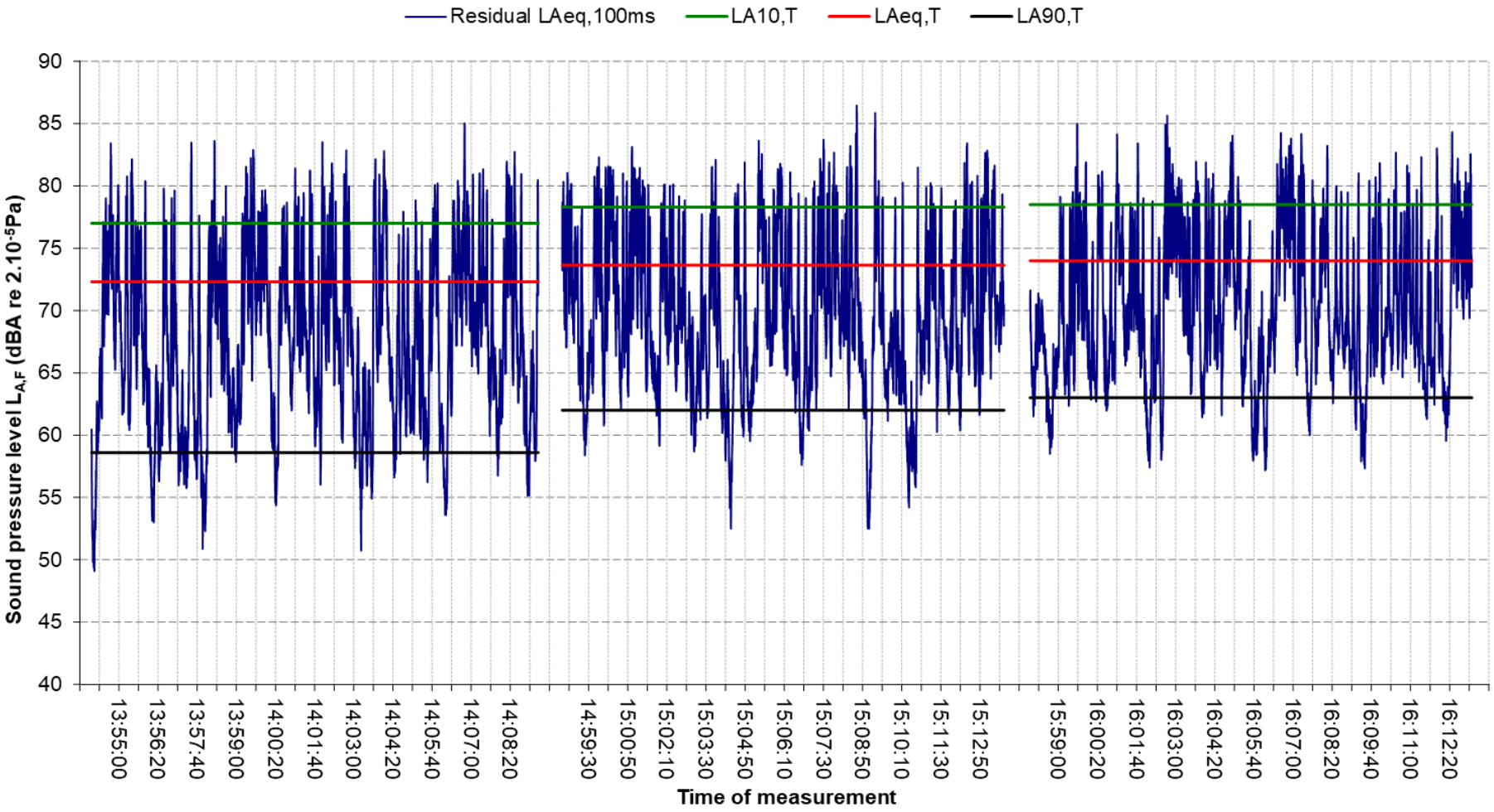
8.5 By applying Good Acoustic Design principles and incorporating appropriate mitigation measures, suitable acoustic conditions can be provided for the residents of dwellings that may be constructed on this site.

Appendix 1 Measurement Graphs

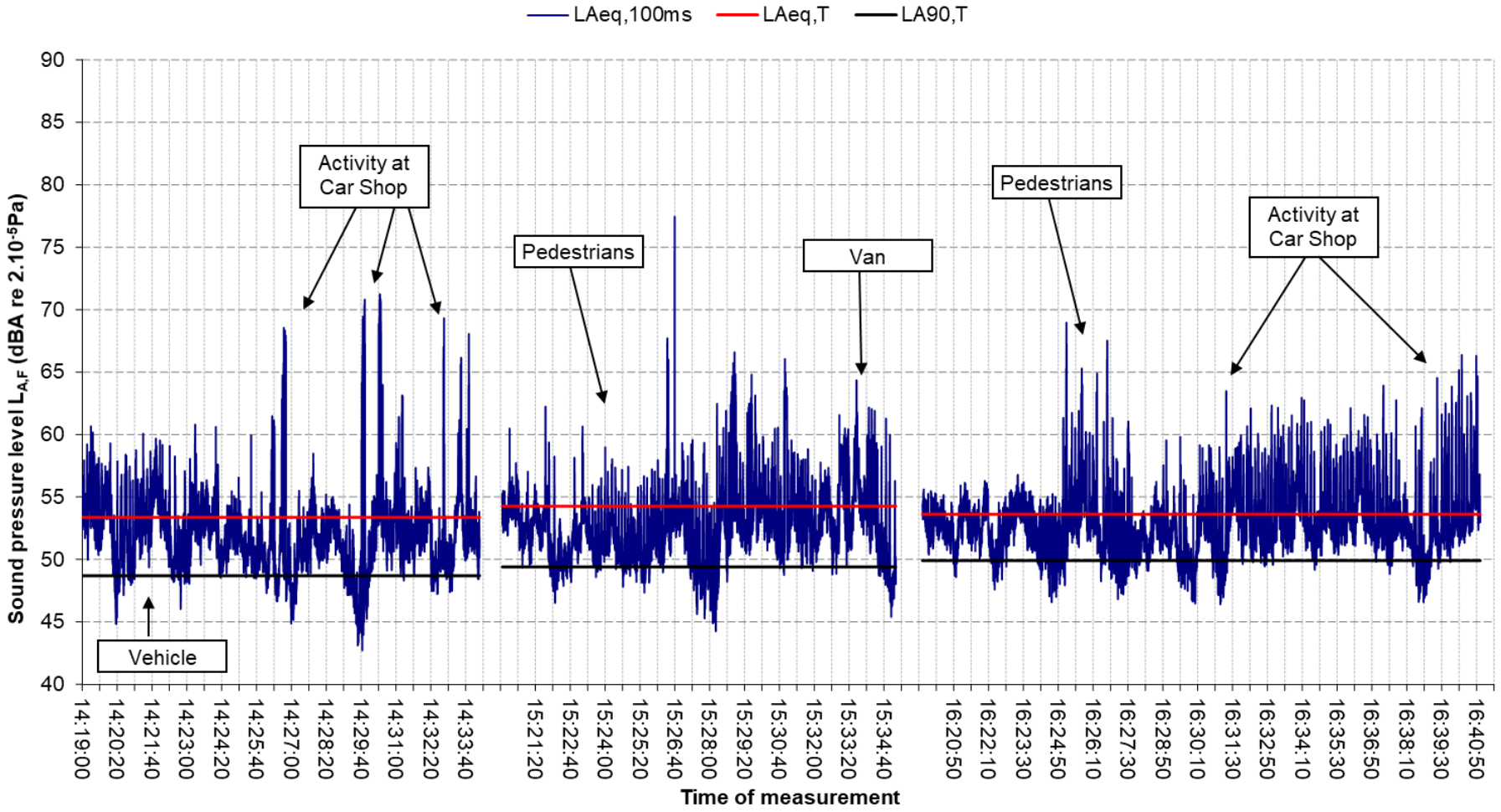
Graph 1 - Existing residual sound level on corner of A617 and Rufford Colliery Lane (NE of Site)
Measured 12th January 2021



Graph 2 - Existing residual sound level on A617 Rainworth Bypass (NW of Site) Measured 12th January 2021



Graph 3 - Existing residual sound level on Churchfield Drive (SW of Site)
Measured 12th January 2021



Appendix 2 Acoustic Model and Sound Contours

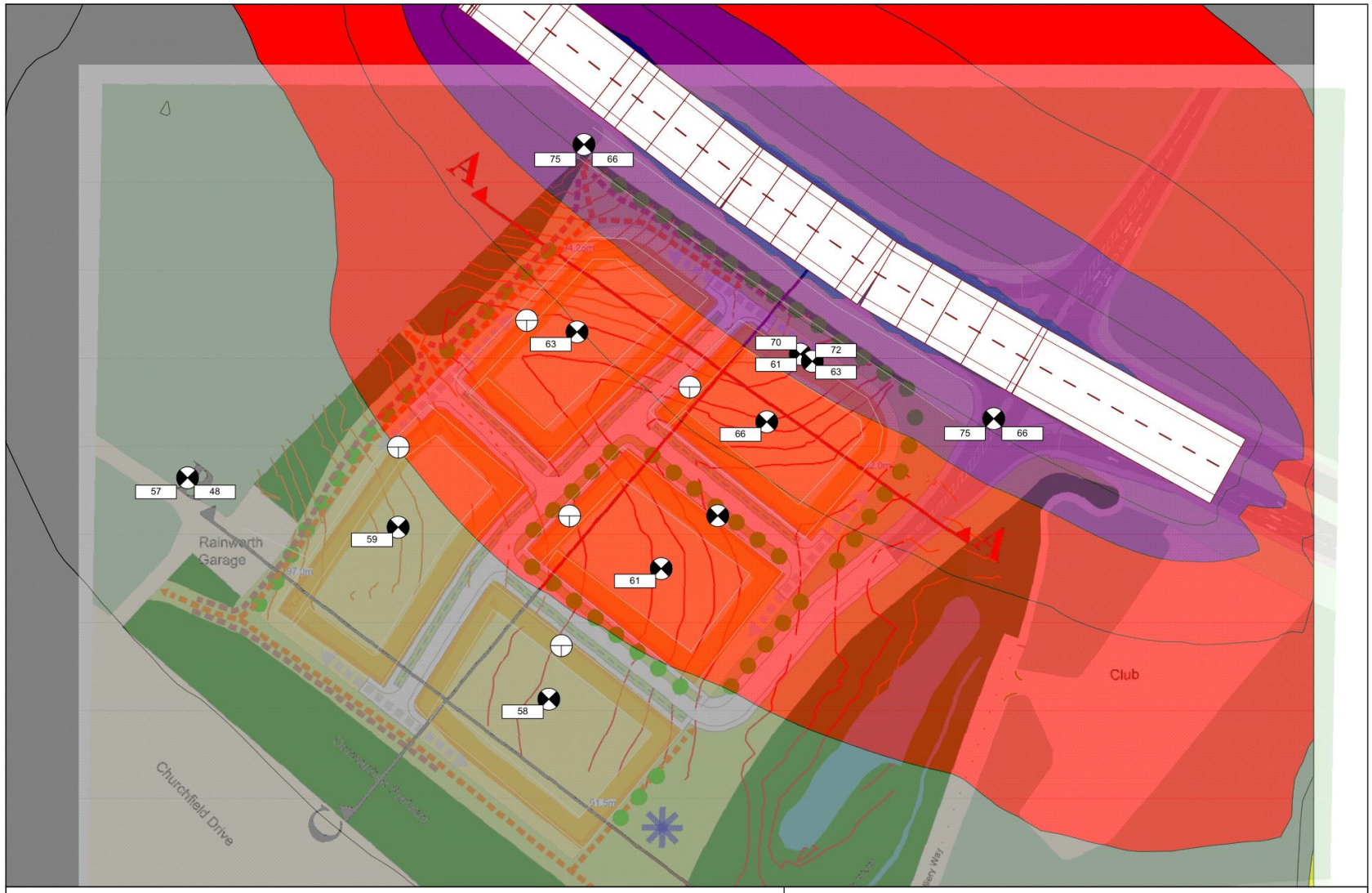


Figure 1a - Daytime Sound Levels
Land South of A617
Proposed Development Site

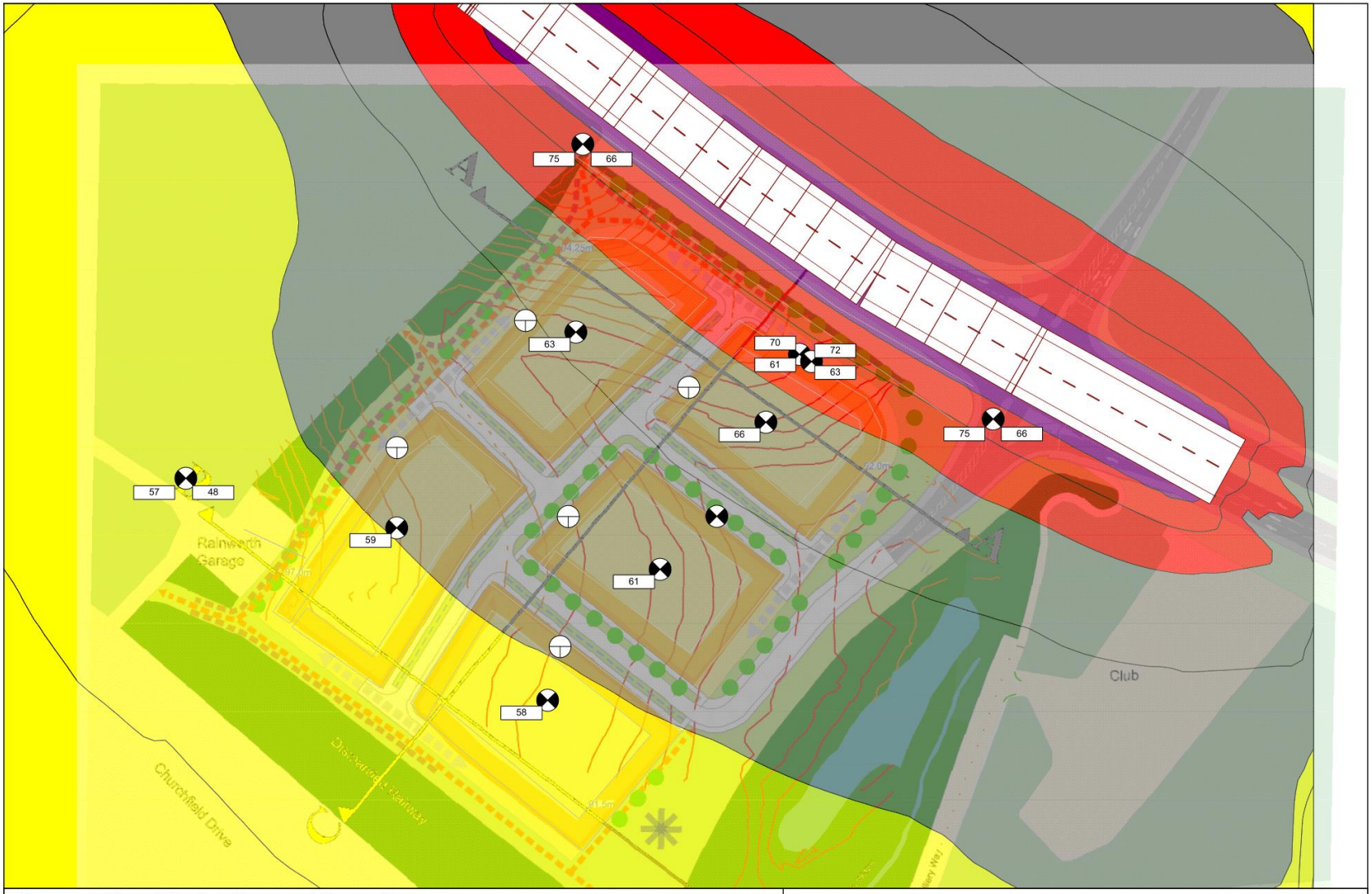


Figure 1b - Night-Sound Levels
Land South of A617
Proposed Development Site

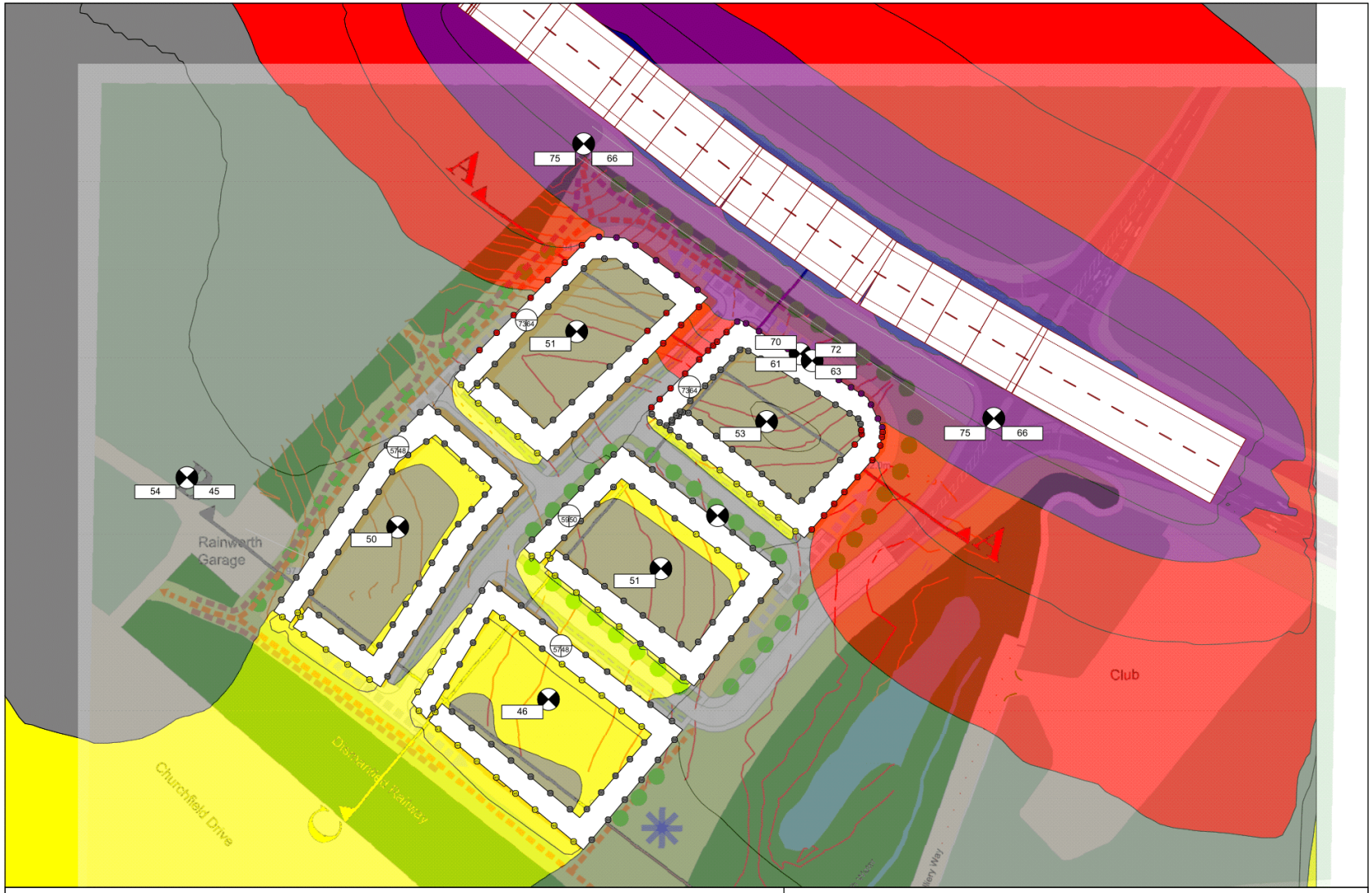


Figure 2a - Daytime Sound Levels
Land South of A617
Proposed Dwelling Blocks

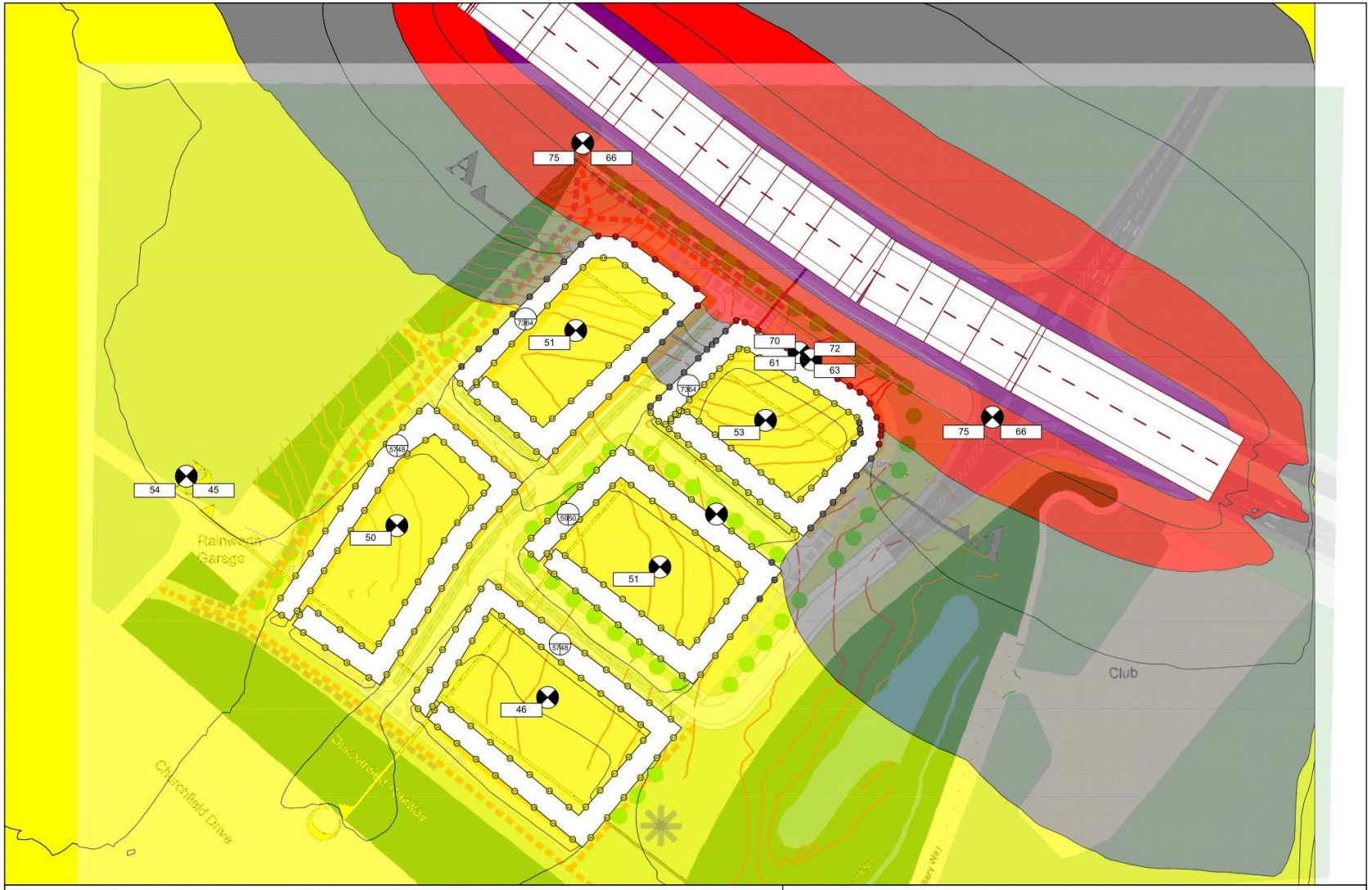


Figure 2b - Night-time Sound Levels
Land South of A617
Proposed Dwelling Blocks

... < 50.0
50.0 <= ... < 60.0
60.0 <= ... < 70.0
70.0 <= ... < 80.0
80.0 <= ...

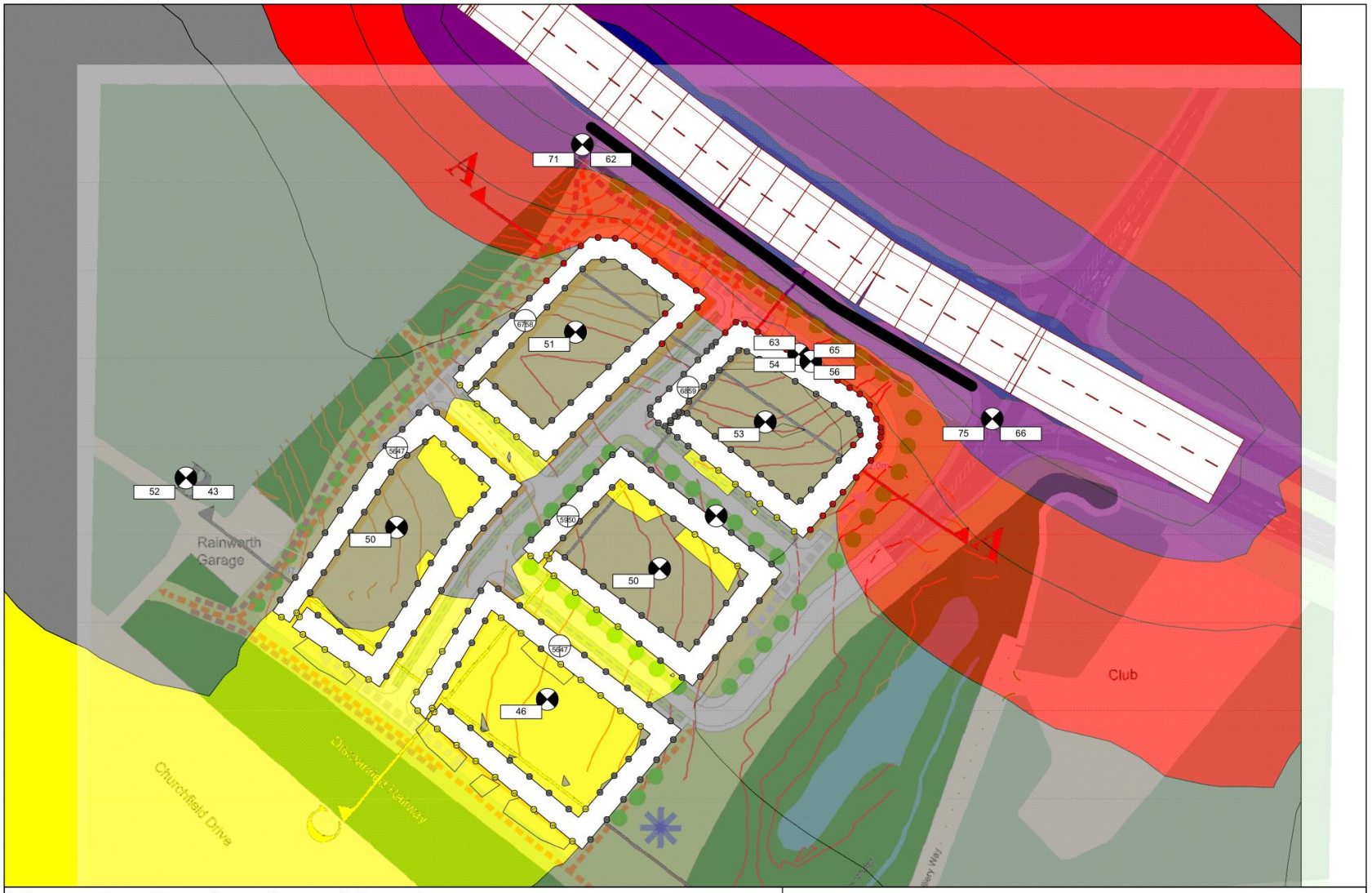


Figure 3a - Daytime Sound Levels
Land South of A617
Proposed Dwelling Blocks, Bicycle Barrier

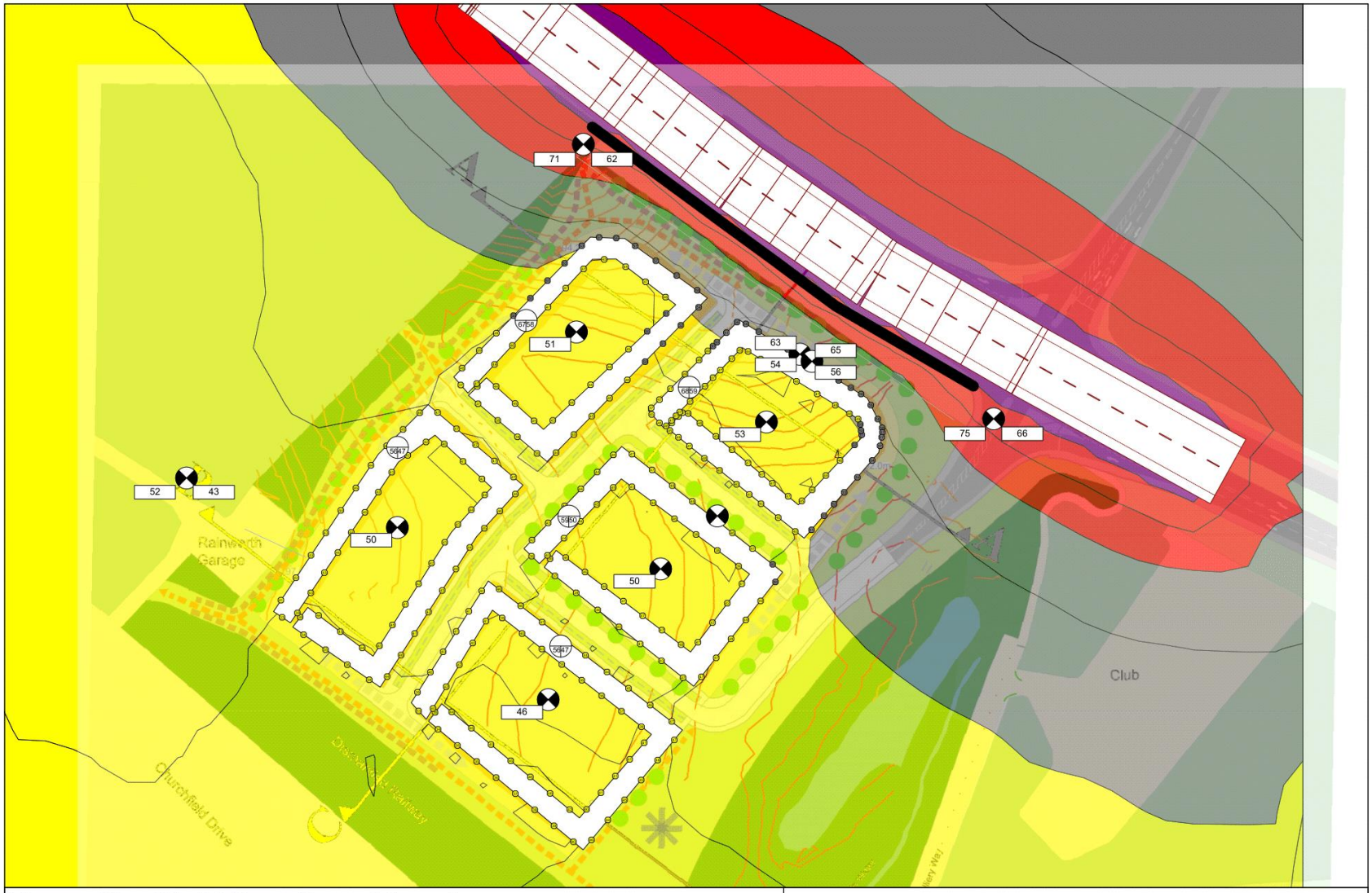


Figure 3b - Night-time Sound Levels
Land South of A617
Proposed Dwelling Blocks, Bicycle Barrier

... < 50.0
50.0 <= ... < 60.0
60.0 <= ... < 70.0
70.0 <= ... < 80.0
80.0 <= ...

Figure 4a - Daytime Sound Levels
Land South of A617
Proposed Dwelling Blocks, Site Barrier

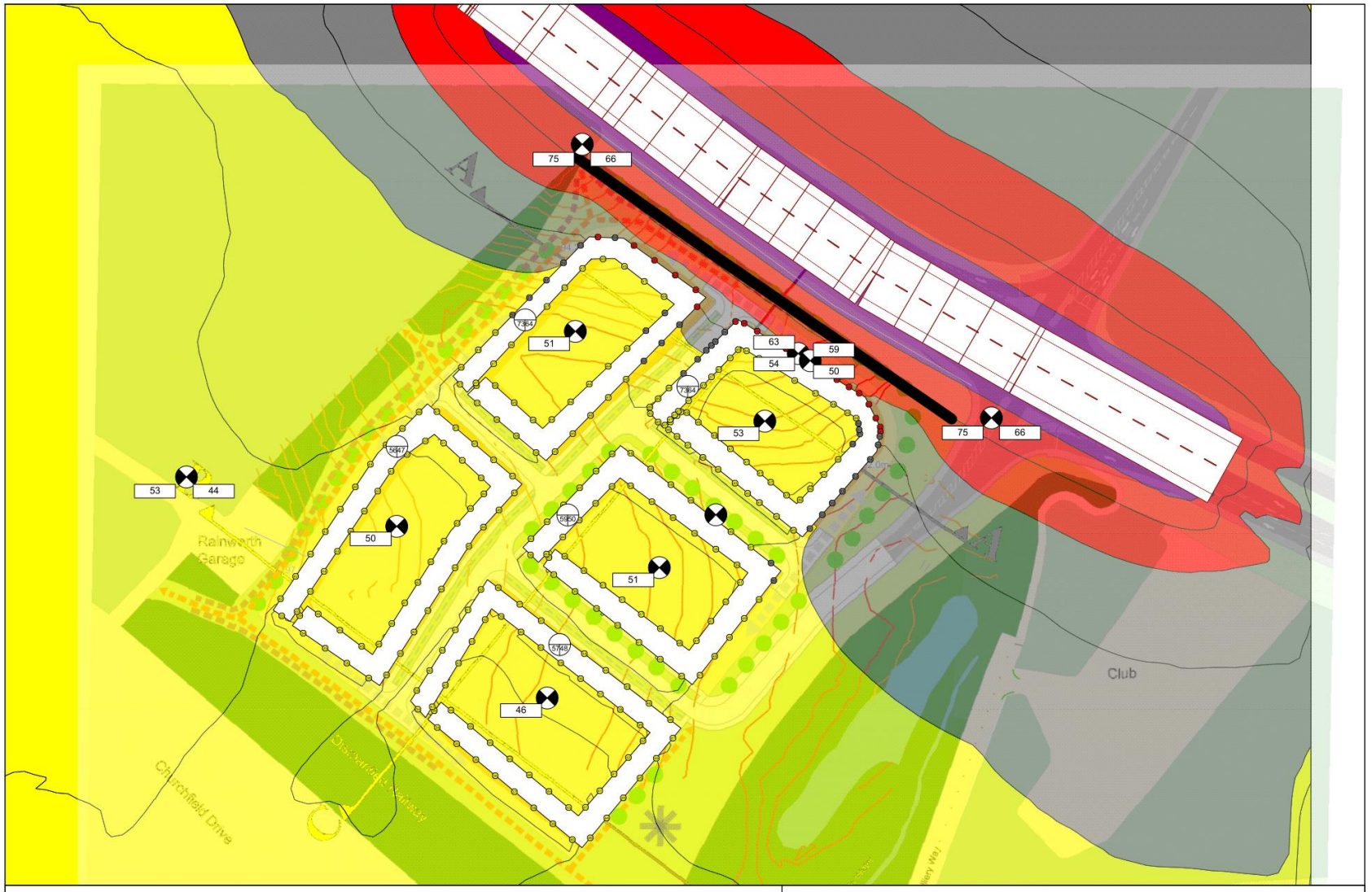


Figure 4b - Night-time Sound Levels
Land South of A617
Proposed Dwelling Blocks, Site Barrier

... < 50.0
50.0 <= ... < 60.0
60.0 <= ... < 70.0
70.0 <= ... < 80.0
80.0 <= ...