GUILD LIVING, UXBRIDGE

Acoustic Planning Report

Reference: 10276.RP01.APR.4
Prepared: 14 January 2021
Revision Number: 4

Cast
Black Bull Yard
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London
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Revision	Comment	Date	Prepared By	Approved By
0	First issue of report	12 August 2020	James Stokes	Torben Andersen
1	Incorporating feedback from planners	28 August	James Stokes	Torben Andersen
2	Amendment of formatting	4 September 2020	James Stokes	Torben Andersen
3	Incorporating Planners Comments	21 September 2020	James Stokes	Torben Andersen
4	Updated to incorporate comments and suggestions from Anderson Acoustics review	14 January 2021	James Stokes	Torben Andersen

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The recommendations within this report relate to acoustics performance only and will need to be integrated within the overall design by the lead designer to incorporate all other design disciplines such as fire, structural integrity, setting-out, etc. Similarly, any sketches appended to this report illustrate acoustic principles only and again will need to be developed in to full working drawings by the lead designer to incorporate all other design disciplines.

In line with our Environmental Policy, up to two hard copies of the report will be provided upon request. Additional copies of the report, or further hard copies of revised reports, would be subject to an administrative cost of £20.00 (+VAT) per copy.

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1.0 INTRODUCTION

RBA Acoustics have been appointed to input into the full planning permission for comprehensive redevelopment of the site at Land off Harefield Road (Units 1 and 2), Uxbridge, UB8 1JS. The redevelopment will comprise demolition of existing buildings to provide residential care accommodation (C2), restaurant and nursery (E) in buildings up to 8 storeys, car parking, landscaping and associated works.

In line with the anticipated requirements of London Borough of Hillingdon (LBH), the following acoustic report provides assessments of acoustic elements of the project relating to:

- Baseline Noise Surveys
- External Noise Ingress (Façade Glazing & Ventilation Strategy)
- Acoustic Ventilation & Overheating (AVO) Level 1 Assessment
- Plant Noise Assessment

Section 2.0 of this report details the relevant acoustic criteria to our assessments. The following sections provide the required assessments and conclusions to demonstrate to LBH that a robust analysis of acoustic elements has been undertaken and, where required, mitigated in the design.

2.0 ACOUSTIC CRITERIA

The London Borough of Hillingdon Supplementary Planning Document (SPD) for Noise (dated April 2006) has been reviewed and the following criteria and guidance are deemed to be in line with the requirements of the SPD and commensurate with good acoustic design.

2.1 Approved Document E (2003) of Building Regulations

Building Regulations Approved Document E (2003) provides guidance for levels of sound insulation within residential developments. These criteria are applicable to separating walls and floors between individual demises and also between demises and common parts but does not apply to walls containing doors or to walls separating bedrooms from their associated en-suite bathrooms. Therefore, the sound insulation criteria to be achieved are as follows:

Separating Floors
Minimum airborne sound insulation of 45dB $D_{nT,w+}C_{tr}$. This is an on-site performance rating.
Maximum impact sound pressure level of 62dB $L'_{nT,w}$. This is an on-site performance rating.

Separating Walls
Minimum airborne sound insulation of 45dB $D_{nT,w+Ctr}$. This is an on-site performance rating.

2.2 BS8233:2014

BS 8233:2014 "Guidance on *Sound insulation and noise reduction for buildings*" draws on the results of research and experience to provide information on achieving internal acoustic environments appropriate to their functions.

The standard advises the following internal ambient noise levels for achieving suitable resting and sleeping conditions within residential properties. The noise level values given are in terms of an average (L_{Aeq}) level. A brief explanation of the acoustic terminology used in this report is shown in Appendix A attached.

Table 1 – BS 8233:2014 Residential Criteria

Room	07:00 to 23:00	23:00 to 07:00
Living Rooms	35 dB $L_{Aeq,16hour}$	--
Dining Room/area	40 dB $L_{Aeq,16hour}$	--
Bedrooms	35dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

Furthermore, the standard also advises on design criteria for external amenity spaces in urban areas:

> *"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. However, it is also recognised 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.*

The following relates specifically to balconies and terraces:

> *"Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation. In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space."*

2.3 World Health Organisation: Guidelines for Community Noise

The document describes guideline levels that are *"essentially values for the onset of health effects from noise exposure".*

A table of guideline values is included, relating to adverse health effects, referred to as any temporary or long term deterioration in physical, psychological, or social functioning that is associated with noise exposure.

The following is an extract from *Table 4.1: Guideline values for community noise in specific environments*, as stated in the document.

Table 2 – Guideline Values for Community Noise

Specific Environment	Critical Health Effect(s)	L_{Aeq} (dB)	Time Base (hours)	$L_{Amax,f}$ (dB)
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, night-times	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

With reference to maximum noise levels the following further guidance is provided within WHO:

> *"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45dB L_{Amax} more than 10-15 times per night (Vallet & Vernet 1991) and most studies show an increase in the percentage of awakenings at SEL values of 55-60 dBA (Passchier-Vermeer 1993; Finegold et al. 1994; Pearsons et al. 1995). For intermittent events that approximate aircraft noise, with an effective duration of 10-30s, SEL values of 55-60 corresponds to a L_{Amax} value of 45dB. Ten to 15 of these events during an 8 hour night-time implies a $L_{Aeq, 8h}$ of 20-25dB. This is 10-15dB below the $L_{Aeq, 8h}$ or 30dB for continuous night-time noise exposure, and shows that intermittent character of noise must be taken into account when setting night-time noise limits for noise exposure. For example, this can be achieved by considering the number of noise events and the difference between the maximum sound pressure level and the background of these events."*

Therefore the frequency of occurrence of maximum noise events should not typically exceed 45dB L_{Amax} more than 10-15 times in any night.

3.0 BASELINE NOISE SURVEYS

3.1 Historic Survey Dates & Times

Our analysis of the site has been based on noise data measured during the following site surveys undertaken by Philip Dunbavin Acoustics (PDA) and RBA Acoustics:

- **PDA – March 2018**
  13th -14th March 2018
  Positions PDA1 & PDA2
  Measurements were conducted over a continuous period between 22:30 on the 13th March 2018 and 12:00 on the 14th March 2018.

- **PDA – September 2018**
  29th August to 5th September 2018
  Position PDA3

- **RBA – June 2020**
  25th June 2020
  Positions RBA1 – RBA4
  Attended daytime measurements were taken between the periods of 10:30-13:30.
  As this survey was undertaken during the Covid-19 pandemic, when evening activity and reduced traffic flows were anticipated to be less representative of 'typical' noise levels than previous PDA long-term noise survey data, a daytime noise survey was undertaken around site to compare with the previously measured PDA noise data as well as to identify any additional nearby noise sources.

Note that in the following sections, information relating to PDA surveys is taken from previous acoustic report (ref. J001807/3048/ECE/03 Issue 3, dated September 2018).

In each survey, measurements were made of the L_{A90}, L_{Amax} and L_{Aeq} noise levels over sample periods of up to 15 minutes duration.

3.2 Weather Conditions

Weather conditions noted during the surveys were as follows.:

- **PDA – March 2018**
  Temp: 7 - 14 °C
  Wind Speeds: 0 – 5m/s
  Wind direction: West
  Precipitation: None

- **PDA – September 2018**
  Temp: 8 - 26 °C
  Wind Speeds: 0 – 2m/s
  Wind direction: Variable, though south was dominant
  Precipitation: None

- **RBA – June 2020**
  Temp: 29 - 32 °C
  Wind Speeds: 4 – 7m/s
  Wind direction: West
  Precipitation: None

3.3 Measurement Locations

To determine the existing noise climate around the site, measurements were undertaken at the following locations during the RBA survey:

Position RBA1

Attended noise levels were measured at the north-west edge of the parking area of the Halfords development at a distance of 3m from the nearest edge of Harefield Road and at a height of 1.5m from ground level. The dominant noise source was road traffic on Harefield Road and some distant parking traffic associated with the Halfords/Wickes.

Position RBA2

Attended noise levels were measured at the north-east corner of the parking area of the Halfords development at a distance of 75m from the nearest edge of Harefield road and at a height of 1.5m from ground level. The dominant noise source was road traffic on Harefield Road and parking traffic associated with the Halfords/Wickes. The variation in measured levels between the RBA and PDA surveys is likely due to variation in parking traffic in the immediate vicinity.

Position RBA3

Attended noise levels were measured at the south-west corner of the parking area of the Halfords development at a distance of 50m from the nearest edge of Harefield road and at a height of 1.5m from ground level. The dominant noise source was road traffic on Harefield Road and distant parking traffic associated with the Halfords/Wickes.

Position RBA4

Attended noise levels were measured on the Penfield industrial estate to the south-east of site. Measurements were taken at a height of 1.5m from ground level and at a distance of 8m to the nearest industrial unit which served as a mechanics (J R Autos Ltd). Additionally, a nearby car body shop was located at a distance of 40m from the measurement position. Measured noise levels in this location were generally low, and although some noise from J R Autos was noted, it was not deemed to cause disturbance to proposed units to the rear of the development.

Positions Used During the PDA Surveys were as follows:

Position PDA1

This was in the same location as RBA1

Position PDA2

This was in the same location as RBA2

Position PDA3

Noise levels were measured at the south-east corner of the site down a side access alley adjacent to the Halfords/Wickes building, at a height of 1.5m from ground level. This position was located at a distance of 92m from Harefield Road and received a significant level of line-of-sight screening to the road. Despite this screening, the dominant noise source was still road traffic on Harefield Road and distant parking traffic associated with the Halfords/Wickes.

The measurement positions are shown on the site plan attached in Figure 1 in Appendix E.

3.4 Instrumentation

For information regarding the equipment used during the surveys please refer to Appendix B.

3.5 Results

In order to ensure a worst-case assessment the lowest background L_{A90} noise levels measured have been used in our analyses. The lowest L_{A90} and the period averaged L_{Aeq} noise levels measured are summarised in Table 1, along with typical L_{AFmax} levels measured during the night-time. Note that in our assessment detailed below, the higher measured L_{Aeq} noise levels were used to represent a worst-case assessment. Furthermore, the daytime measured levels will have included some noise due to parking and activity relating to the existing Halford/Wickes shops on the premises. As such, these noise levels represent an absolute worst-case for noise.

Table 3 – Measured Levels

Position	Lowest L_{A90} (dB)		L_{Aeq} (dB)		Typical L_{AFmax} (dB Fast)
	Day * 07:00 - 23:00	Night 23:00 - 07:00	Day * 07:00 - 23:00	Night 23:00 - 07:00	Night 23:00 - 07:00
RBA1	50	-	63	-	-
RBA2	44	-	57	-	-
RBA3	46	-	53	-	-
RBA4	39	-	50	-	-
PDA1	48	46	65	58	78
PDA2	45	39	50	47	65
PDA3	38	37	47	44	66

Note: * RBA daytime noise levels were measured during the daytime periods of 10:30-13:30 and are only indicative of the full 16-hour period – However there is generally a high degree of correlation between the measured levels in equivalent locations. It should be noted, however that due to the Covid-19 pandemic, traffic rates were not anticipated to be fully representative of 'normal activity' and as such, previous PDA noise survey levels formed the basis of the acoustic modelling, which were measured during a period representative of a typical weekday during 'normal activity'.

3.6 Police Station Noise

Having spoken directly with a member of personnel at Uxbridge Police Station, we understand that although the Police Station is used mainly for administrative purposes, active police cars do occasionally come/go from the site with their sirens on, however we were informed that when this does occasionally occur, this is typically no more than 2-3 times per night. We were also informed by the Police Station staff that the usage of sirens during night-time periods is reduced whenever possible.

Given that the sirens may be activated before the cars leave the police station parking, we have predicted noise transfer from the exit gate of the parking from the nearest facades of Block A facing the station.

Based on a worst-case siren noise of 100dB, L_{Afmax} @ 3m, we have predicted that internal maximum noise levels would be 38dB, L_{Afmax} with sirens activated at the gates of the police station, providing the 'Zone 1' specification of glazing & ventilation is used, as specified below. Typically, an allowance of between 10-15no. occurrences of noise levels exceeding 45dB L_{Afmax} are permitted, therefore the siren noise is well within this range, both in terms of noise level and frequency of occurrence. This comfortably meets the criterion of 45dB L_{Afmax} and occurs sufficiently infrequently that this is deemed to be no worse than a window overlooking a main road in a town/city centre, which typically experience several siren pass-bys per night.

4.0 EXTERNAL BUILDING FABRIC ASSESSMENT

4.1 Background

Analyses of the external building fabric have been undertaken in order to ascertain the required acoustic performance of the glazing and other external fabric elements to achieve the project criteria.

4.2 Assumptions

Our external building fabric analyses have assumed the following:

(a) Drawings

The assessment has been based on the latest GA drawings provided by Marchese Architects at the time of writing this revision of the report.

(b) Noise Levels

The assessment has been based on the measured noise levels as detailed in Section 3.0. Using these noise levels, a 3D Acoustic Model has been built using acoustic modelling software, Cadna. The model was calibrated using the existing survey data.

(c) Room Absorption

The bedrooms are assumed to be acoustically "soft" with carpets, curtains and other soft furnishings. For the purposes of our analyses we have assumed the absorption coefficients detailed in Tables 4 and 5.

Table 4 – Bedroom Absorption Coefficients

Absorption Coefficient (α) at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
0.15	0.18	0.25	0.27	0.31	0.32	0.32	0.32

The living rooms are assumed to be less acoustically absorptive (with a hard floor finish, although with furnishings). For the purposes of our analyses we have assumed the following absorption coefficients.

Table 5– Living Room Absorption Coefficients

Absorption Coefficient (α) at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
0.15	0.18	0.20	0.22	0.22	0.22	0.23	0.27

(d) External Wall

The majority of the external non-glazed areas are to comprise the following:

- Brickwork
- Thermal insulation and cavity
- 10mm Calcium Silicate Board
- Metsec type frame with mineral wool in void
- 2 layers 15mm dense plasterboard (min 12.5kg/m^2 per board)

For the facades of the top floor apartments of Blocks A & B, the non-glazed façade is proposed to consist of a curtain wall system utilising an external spandrel panel.

As such, we have assumed the following sound reduction indices for these non-glazed façade areas comprising the above constructions:

Table 6– Non-Glazed SRIs

Non-glazed façade Type	Assumed Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)								Rw
	63	125	250	500	1k	2k	4k	8k	
Brickwork Façade	35	42	48	53	63	70	74	74	58
Spandrel Panel Facade	18	30	40	50	55	55	55	55	51

Should the proposals for non-glazed areas change, it is critical we are informed at the earliest opportunity as this could have a significant impact on the sound insulation performance requirements of the glazing systems.

(e) Ventilation

It is understood that natural ventilation via trickle ventilators is the preferred primary method of ventilation. Ventilator selections have also been assessed and the acoustic performance specification for such trickle ventilators is detailed below.

It should be noted the trickle ventilators provide background trickle ventilation only and that windows are to generally be openable to provide rapid ventilation. During those periods where windows are opened for purge/rapid ventilation, noise levels will naturally be increased internally.

4.3 Specification & Guidance Constructions

The sound reduction performance specification for the ventilators and glazed elements of the external building fabric will need to be determined at a later design stage once the design has further progressed. However, for guidance purposes we would typically expect the following glazing configurations detailed below to prove commensurate with achieving the required level of sound insulation:

Table 7– Glazing Guidance Constructions

Glazing Type	Glazing Configuration
G1	High specification double glazing comprising 10mm glass / 12mm cavity / 6mm glass
G2	Standard thermal double glazing with differing pane thicknesses, e.g. 4mm glass/12mm cavity/6mm glass

It should be noted that due to the necessity for security laminated glass on the ground (lower / accessible) floors, the specifications may exceed those stated above in some locations.

For guidance purposes we would typically expect the following trickle ventilator types to prove commensurate with achieving the required level of sound insulation:

Table 8– Guidance Trickle Ventilator Types

Ventilator Type	Example Ventilator Type
V1	High spec acoustically-rated "through-the-frame" trickle ventilator, e.g. Renson Invisivent EVO AK High
V2	Any standard "through-the-frame" type trickle ventilator with indirect air path

4.4 Applicable Zoning

Due to the differences in the prevailing noise climate around the site and the types of rooms at each floor level, three primary glazing zones have been defined, as indicated on the façade zoning plan provided in Figures 2-7 in Appendix E.

(i) Zone 1 – Glazing Type: G1
Ventilator Type: V1

(ii) Zone 2 – Glazing Type: G2
Ventilator Type: V2

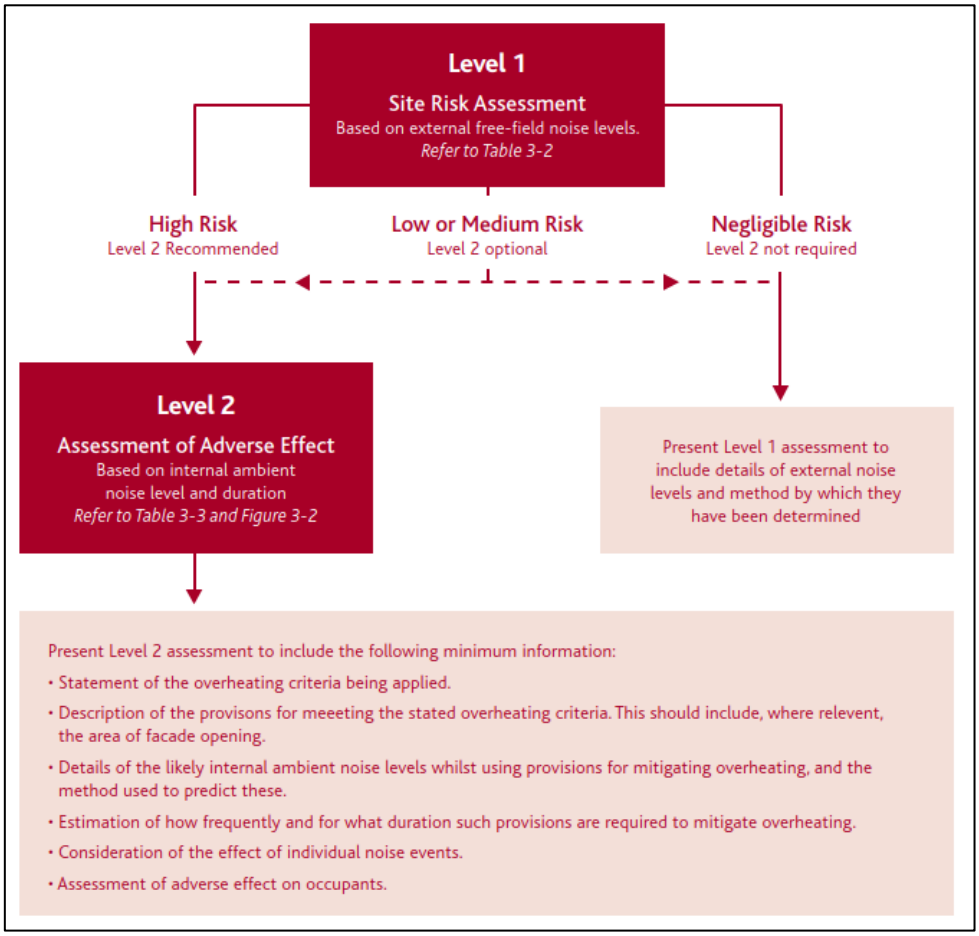
5.0 ACOUSTIC VENTILATION AND OVERHEATING (AVO)

As part of our acoustic assessment of the proposed development RBA Acoustics have been commissioned to undertake an assessment regarding noise implications if windows are required to be opened to reduce the risk of overheating.

Many buildings require closed windows to provide good internal acoustic conditions, however, opening a window is the normal way to keep a building cool during the warmer summer months. These opposing requirements have become a major issue in the design of buildings, in particular for housing, especially given the general desire to avoid the widespread use of mechanical cooling.

The recently released Acoustics Ventilation & Overheating (AVO) guide by the Association of Noise Consultants (ANC) attempts to address this increasingly urgent need for an integrated approach to consider noise, ventilation, and overheating. The guide involves a two-level approach to addressing issues of overheating with respect to noise:

AVO Assessment Process



The following section presents our Level 1 assessment in order to determine risk of overheating at this site due to noise issues.

5.1 AVO Level 1 Assessment

Criteria

In order to assess the possibility of overheating within the development it is necessary to predict internal ambient noise levels and compare these with the criteria set by BS 8233:2014 *Guidance on Sound insulation and noise reduction for buildings* as shown in Table 2. In line with the guidance provided by BS8233:2014 it is appropriate to increase these values by 5dB to account for the natural increase in internal ambient noise levels from opening a window.

Additionally, it is reasonable to assume that a partially open windows provides a reduction in sound of approximately 13 dBA. Therefore, in order to achieve internal noise levels in line with BS8233:2014 external noise levels incident on the facade should fall within the levels presented in 11.

Table 11 – Maximum External Noise Levels to Allow Openable Windows

Room	07:00 to 23:00	23:00 to 07:00
Living Rooms	53 dB $L_{Aeq,16hour}$	--
Dining Room/area	58 dB $L_{Aeq,16hour}$	--
Bedrooms	53dB $L_{Aeq,16hour}$	48 dB $L_{Aeq,8hour}$

Based on the external levels detailed above the AVO guide seeks to determine the level of risk associated with overheating within a new development based on the developments surrounding noise climate. The AVO risk categories and their associated noise levels are detailed below:

Table 12 – AVO Level 1 Risk Assessment Guide

Daytime Noise Levels ($L_{Aeq, 07:00-23:00}$)	Night-time Noise Levels ($L_{Aeq, 23:00-07:00}$)	Risk Category	Mitigation
⩽ 53 dBA	⩽ 48 dBA	Negligible Risk	None required – openable windows suitable for ventilation
54 – 62 dBA	49 – 54 dBA	Low/Medium Risk	Level 2 assessment optional in order to give more confidence regarding the suitability of internal noise conditions
⩾ 63 dBA	⩾ 55 dBA	High Risk	Level 2 assessment recommended. Windows which are unopenable on grounds of noise will inevitably create issues for the overheating strategy.

The AVO risk category associated with the different facades of the developments have been shown in the attached Figures 2-7. In each case, the worst-case rating out of day- and night-time has been shown.

AVO Level 1 Assessment Results and Discussion

From analysis of the AVO risk categories marked in Figures 2-7, it is clear that the majority of the site falls into the Negligible Risk category. However, facades nearer to Harefield Road are subject to higher noise levels and as such, much of these facades fall into the High Risk category.

Based on the above, and for those dwellings falling into the High Risk category, it is necessary to understand in more detail what the overheating risks are based on the site location, orientations/heights of the buildings and façade arrangements. This requires detailed modelling studies to be undertaken by an energy & sustainability consultant, in accordance with TM59 *'Design methodology for the assessment of overheating risk in homes'*, before further advice may be provided on the likelihood of more robust ventilation and acoustic attenuation measures being required.

Given that areas of the development have been identified as High Risk with regards to ventilation and overheating, a Level 2 AVO assessment in accordance with TM59 will need to be undertaken at a later design stage – This could be appropriately controlled by LBH by way of Planning Condition.

6.0 PLANT NOISE ASSESSMENT

6.1 Local Authority Criteria

It is our understanding that LBH require plant noise emissions from new developments to be controlled such that the resulting cumulative plant noise emissions do not exceed a noise level 5dB below the existing background noise level as a measured at 1m outside the nearest noise sensitive receptors.

6.2 Baseline Noise Level Summary

Based on the previous noise surveys detailed in Section 3 above, the typical-lowest background L_{A90} noise levels measured are summarised below and were used in our analyses:

Table 13 – Existing Baseline Background Noise Levels

Measurement Position	Existing Baseline Background Noise Levels, $L_{A90, 5mins}$ (dB)	
	Daytime (07:00 – 23:00 hours)	Night-time (23:00 – 07:00 hours)
Facing Harefield Road (PDA1)	48	46
Further (>50m) from Harefield Road/significantly screened (RBA3)	46	43

6.3 Plant Noise Emission Criteria

In accordance with the anticipated requirements of LBH, detailed above, it is proposed that items of mechanical services are designed, such that cumulative noise emissions from the plant do not exceed the following levels when assessed at the nearest external noise sensitive location:

Table 14 – Plant Noise Emission Limits to Noise-sensitive Receptors

Receptor Description	Plant Noise Emission Limits, L_{Aeq} (dB)	
	Daytime (07:00 – 23:00 hours)	Night-time (23:00 – 07:00 hours)
Residential Units Facing Harefield Road or within 50m (unscreened) from Harefield Road (PDA1)	43	41
Residential Units Further than 50m from Harefield Road or significantly screened from Harefield Road (RBA3)	41	38

In line with BS 4142, should the proposed plant be identified as having intermittent or tonal characteristics, a further penalty should be subtracted from any of the above proposed noise emission limits in Table 2.

It should be noted that the above requirements are applied at the nearest residential adjacencies and alternative (relaxed) criteria should be incorporated if there are also commercial properties affected by the proposed plant installations.

6.4 Proposed Items of Plant & Nearest Receptors

Note that where a specific unit has not yet been selected, only the plant type has been stated:

Level 4 – Block B Rooftop

- Kitchen Supply Fan
- Kitchen Extract Fan

Level 7 – Block A Rooftop

- 2no. ASHPs (Daikin EWYT135B-XSA1)
- 9no. VRF Condensers - Daikin (2no. REYQ 12U, 1no. REYQ 14U, 2no. RETQ 16U and 4no. REYQ 18U)

Level 8 – Block B Rooftop

- 2no. ASHPs (Daikin EWYT135B-XSA1)

In each of the above cases, the worst-affected units are located directly beneath the nearest roof edge within the proposed development, given that all of the assessment plant is at rooftop level at Level 4 or above, so will experience significant roof edge screening to any of the surrounding residential houses. Furthermore, because the worst-case receptor units will all be significantly screened from Harefield Road, the noise limits of 41dB, L_{Aeq} (daytime) and 38dB, L_{Aeq} (night-time) would apply.

6.5 Operating Hours

It is currently understood that all items of plant may operate during daytime or night-time periods. Although there will inevitably be a variation in the required duty throughout a typical day, our assessment assumes normal duty at all times of the day and night, which represents a worst-case scenario.

6.6 Noise Levels

Information regarding the noise levels of the proposed plant has been provided by the M&E consultant responsible for the specific plant units. Where manufacturer's information on certain items of plant has not been provided, noise levels have been assumed based on data available for similar plant type and duty from RBA's own noise data library. Details of which can be found in the Plant Noise Schedule attached within Appendix C.

Review of the octave band data provides no indication of any tonal characteristics associated with any of the proposed plant.

6.7 Calculation of Noise Levels at Nearest Residential Window

Our calculation method for predicting noise levels from ducted mechanical services at the nearest noise sensitive windows is summarised below.

- Source Term SPL / SWL
- Duct losses
- Grille end reflection
- Directivity Correction
- Screening Losses
- Reflections
- 20LogR Distance Attenuation

Our calculation method for predicting noise levels from the roof plant at the nearest noise sensitive windows is summarised below.

- Source Term SPL / SWL
- 20LogR Distance Attenuation
- Directivity
- Reflections
- Screening Losses

6.8 Results of Assessment

Using the above calculation methods, the following was predicted:

Level 4 – Block B Rooftop

In order to meet the proposed plant noise criteria, noise emissions as measured at 1m from the kitchen extract ducts (intake & discharge) should be controlled to not exceed 76dB, L_{Aeq} @ 1m.

Note that the assumed fan noise levels used in our calculation met this limit by 11dB, however this should be checked once final KEF units have been selected.

Rooftops - Block A (Level 7) & Block B (Level 8)

We have predicted that resulting noise levels will meet the target plant noise criteria, based on the layout proposals with the units located centrally on the rooftop of each block. Our assessment assumes the presence of a visual acoustic screen that surrounds the ASHP with a height at least equivalent to the top of the units. The VRF units would not require any additional acoustic treatment.

7.0 VIBRATION CONTROL

In addition to the control of airborne noise transfer, it is also important to consider the transfer of noise as vibration to adjacent properties (as well as to any sensitive areas of the same building).

We would typically advise that condensing units (VRFs), AHUs and ASHPs be isolated from the supporting structure by means of either steel spring isolators or rubber footings. For particularly sensitive locations, or when on lightweight structures the mounts should ideally be caged and be of the restrained type.

It is important the isolation is not "short-circuited" by associated pipework or conduits. To this end, any conduits should be looped and flexible connectors should be introduced between the condenser and any associated pipework. Pipework should be supported by brackets containing neoprene inserts.

8.0 FUTURE NOISE CONDITIONS

Future predictions of the increase in road traffic due to the development have been undertaken by Pell Frischman which indicate an increase of approximately 182no. additional vehicles passing in front of the development on Harefield Road. It should be noted that a doubling (or 100% increase) of traffic levels would result in a 3dB increase in noise levels, so even in a very extreme case, the increase in noise levels due to increased future traffic flows is typically marginal. As such, on the basis that 182no. vehicles is likely to represent less than a 10% increase for a typical town/city centre road, this would represent a change in noise levels of less than 1dB, and as such, is not deemed to cause any future concerns with regards to road traffic noise increase. Furthermore, due to the existing usage of the site being 2no. retail units with a large parking area, there will also be an associated reduction in traffic movement due to the removal of these units, which further indicates that future traffic noise is not likely to cause any issues.

As part of the development, there are also several units proposed for ground floor usage, including a restaurant and a nursery, however their expected contribution to the overall external noise environment will be minimal.

9.0 CONCLUSION

RBA Acoustics have undertaken noise monitoring at the proposed development site at the Land off Harefield Road (Units 1 and 2), Uxbridge, UB8 1JS. The measured noise levels are presented within this report alongside previous noise survey data obtained during more normal activity (unaffected by the Covid-19 lockdown).

Based on the data from the noise surveys, noise levels have been predicted at the facades of the proposed building and these predictions have been used in the assessment of the glazing & ventilation scheme requirements to ensure suitable internal noise levels are achieved at the proposed development with reference to BS 8233 and WHO. Additionally an AVO Level 1 assessment has been undertaken to indicate risk zones relating to external noise & overheating around the development. Given that areas of the development have been identified as High Risk with regards to ventilation and overheating, a Level 2 AVO assessment in accordance with TM59 will need to be undertaken at a later design stage.

A plant noise assessment has been undertaken to establish plant noise criteria in line with the anticipated LBH requirements, as well as assessment of proposed items of plant. Where specific units have not yet been proposed, we have provided plant noise limits to be met, which would result in compliant cumulative plant noise levels capable of achieving the target criteria at the nearest noise sensitive receptors.

This report has demonstrated that a suitable noise environment can be achieved for the proposed development where the proposed acoustic specification and mitigations measures are adhered to. Such measures can be secured by way of planning condition.

Appendix A - Acoustic Terminology

dB	Decibel - Used as a measurement of sound pressure level. It is the logarithmic ratio of the noise being assessed to a standard reference level.
dB(A)	The human ear is more susceptible to mid-frequency noise than the high and low frequencies. To take account of this when measuring noise, the 'A' weighting scale is used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average human. It is also possible to calculate the 'A' weighted noise level by applying certain corrections to an un-weighted spectrum. The measured or calculated 'A' weighted noise level is known as the dB(A) level. Because of being a logarithmic scale noise levels in dB(A) do not have a linear relationship to each other. For similar noises, a change in noise level of 10dB(A) represents a doubling or halving of subjective loudness. A change of 3dB(A) is just perceptible.
L_{eq}	L_{eq} is defined as a notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (1 hour).
L_{Aeq}	The level of notional steady sound which, over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measured over that period.
L_{An} (e.g L_{A10}, L_{A90})	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time, hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the average minimum level and is often used to describe the background noise.
$L_{max,T}$	The instantaneous maximum sound pressure level which occurred during the measurement period, T. It is commonly used to measure the effect of very short duration bursts of noise, such as for example sudden bangs, shouts, car horns, emergency sirens etc. which audibly stand out from the general level of, say, traffic noise, but because of their very short duration, maybe only a very small fraction of a second, may not have any effect on the L_{eq} value.

Appendix B - Instrumentation

The following equipment was used for the measurements

PDA – March 2018

Measurements were undertaken with NTi XL2 and Rion NL52 sound level meters. The measurement equipment are Class 1 accuracy in accordance with BS EN 61672-1. The meters were calibrated directly before any measurement took place and immediately afterwards and no significant drift was observed. The meters were set to log automatically every 5 minutes.

PDA – September 2018

Measurements were undertaken with NTi XL2 and Rion NL52 sound level meters. The measurement equipment are Class 1 accuracy in accordance with BS EN 61672-1. The meters were calibrated directly before any measurement took place and immediately afterwards and no significant drift was observed. The meters were set to log automatically every 15 minutes with an additional 1-second LAeq logging. The meter was also set up with audio recording so that the results could be further analysed

RBA – June 2020

Manufacturer	Model Type	Serial No.	Calibration	
			Certificate No.	Valid Until
Norsonic Type 1 Sound Level Meter	Nor140	1406970	U32886	20 September 2021
Norsonic Pre Amplifier	1209	21205		
Norsonic ½" Microphone	1225	271055	32885	20 September 2021
Norsonic Sound Calibrator	1251	35020	U32884	20 September 2021

The meter was calibrated before and after use and no calibration drift was observed.

Appendix C – Plant Noise Levels

Unit	Parameter	Sound Level (dB) at Octave Band Centre Frequency (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
ASHP - Daikin EWYT135B-XSA1	Lp @1m	66	68	63	63	62	64	57	48	68
VRF - Daikin REYQ12	Lp @1m	64	66	61	57	54	51	54	44	61
VRF - Daikin REYQ14	Lp @1m	62	63	60	60	53	49	48	47	60
VRF - Daikin RETQ16	Lp @1m	67	69	64	62	55	52	52	48	63
VRF - Daikin REYQ18	Lp @1m	68	64	60	60	55	53	53	46	62
KEF - Typical In-duct inlet/outlet spectrum	Lw In-duct	81	79	78	68	67	64	55	49	74

Note that the above levels are based on indicative plant selections at this stage. Further analysis will be required at later design stages to ensure plant noise criteria are achieved.

Appendix D – CDM Considerations

The likelihood the harm will occur can be assessed by applying an indicative score (from 1 to 5) as follows:

1 – Remote (almost never)
2 – Unlikely (occurs rarely)
3 – Possible (could occur, but uncommon)
4 – Likely (recurrent but not frequent)
5 – Very likely (occurs frequently)

The severity of harm can be assessed by applying an indicative score (from 1 to 5) as follows:

1 – Trivial (e.g. discomfort, slight bruising, self-help recovery)
2 – Minor (e.g. small cut, abrasion, basic first aid need)
3 – Moderate (e.g. strain, sprain, incapacitation > 3 days)
4 – Serious (e.g. fracture, hospitalisation > 24 hrs, incapacitation > 4 weeks)
5 – Fatal (single or multiple)

The rating value is obtained by multiply the two scores and is then used to determine the course of action.

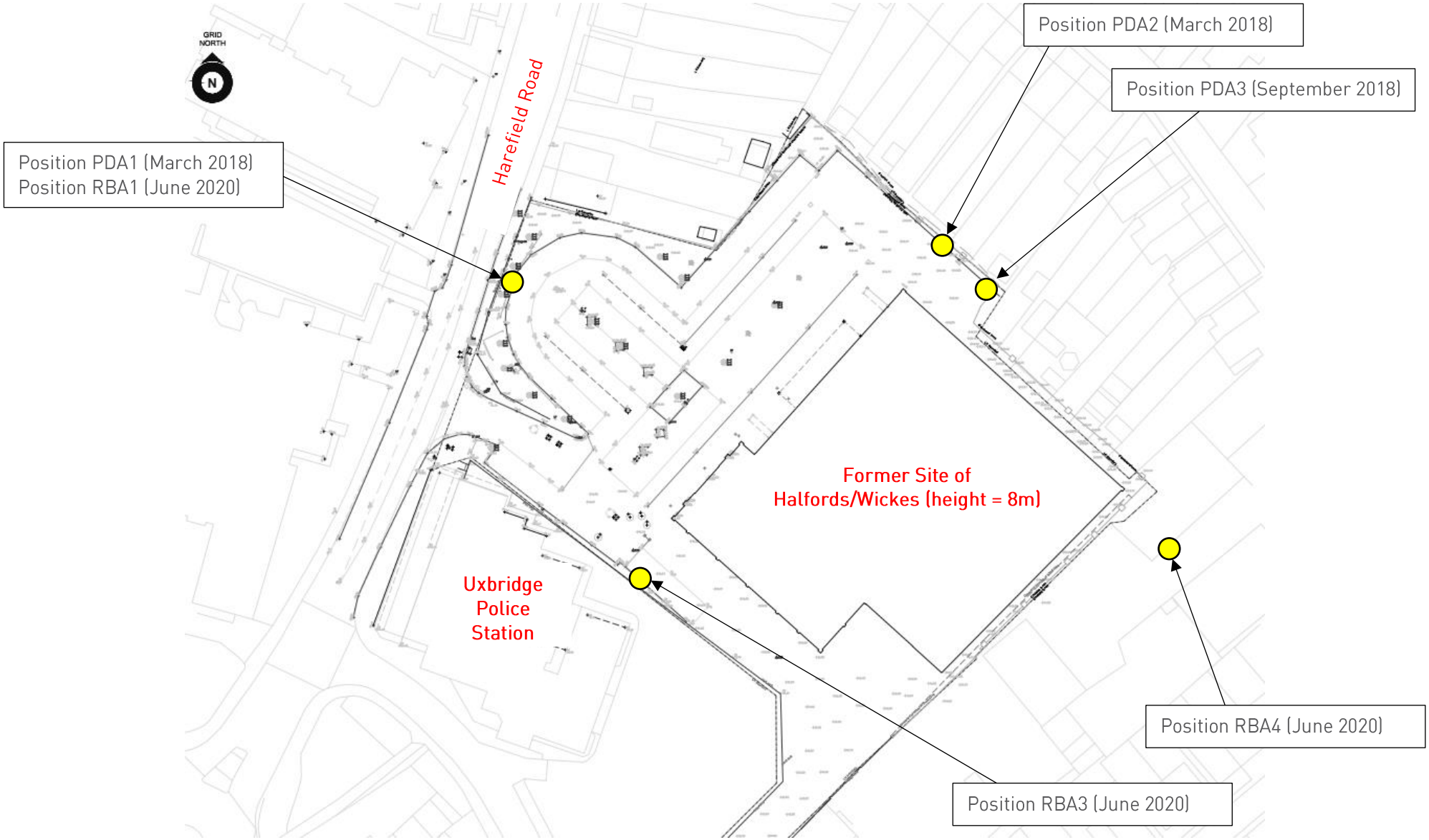
Rating Bands (Severity x Likelihood)		
Low Risk (1 – 8)	Medium Risk (9 -12)	High Risk (15 – 25)
May be ignored but ensure controls remain effective	Continue, but implement additional reasonable practicable controls where possible	Avoidance action is required; therefore alternative design solutions must be examined. Activity must not proceed until risks are reduced to a low or medium level

The following hazards pertinent to our design input have been identified and control measures suggested:

Hazard	Risk Of	At Risk	Rating			Control Measures	Controlled		
			L	S	R		L	S	R
Mineral wool within drywalls and linings	Skin and respiratory irritation	Contractors	4	3	12	Wear gloves and mask	1	3	3
Vibration Isolators	Injury to hands	Contractors	3	3	9	Care needs to be taken during adjustment. Follow manufacturers guidance	1	3	3
Acoustic glazing - weight	Strain of neck, limbs or back. Fall from height.	Contractors	3	5	15	Provide sufficient manpower, lifting gear and structural support	1	5	5

L: Likelihood S: Severity R: Rating

Appendix E – Graphs and Site Plans



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Existing Site Plan showing Measurement Positions

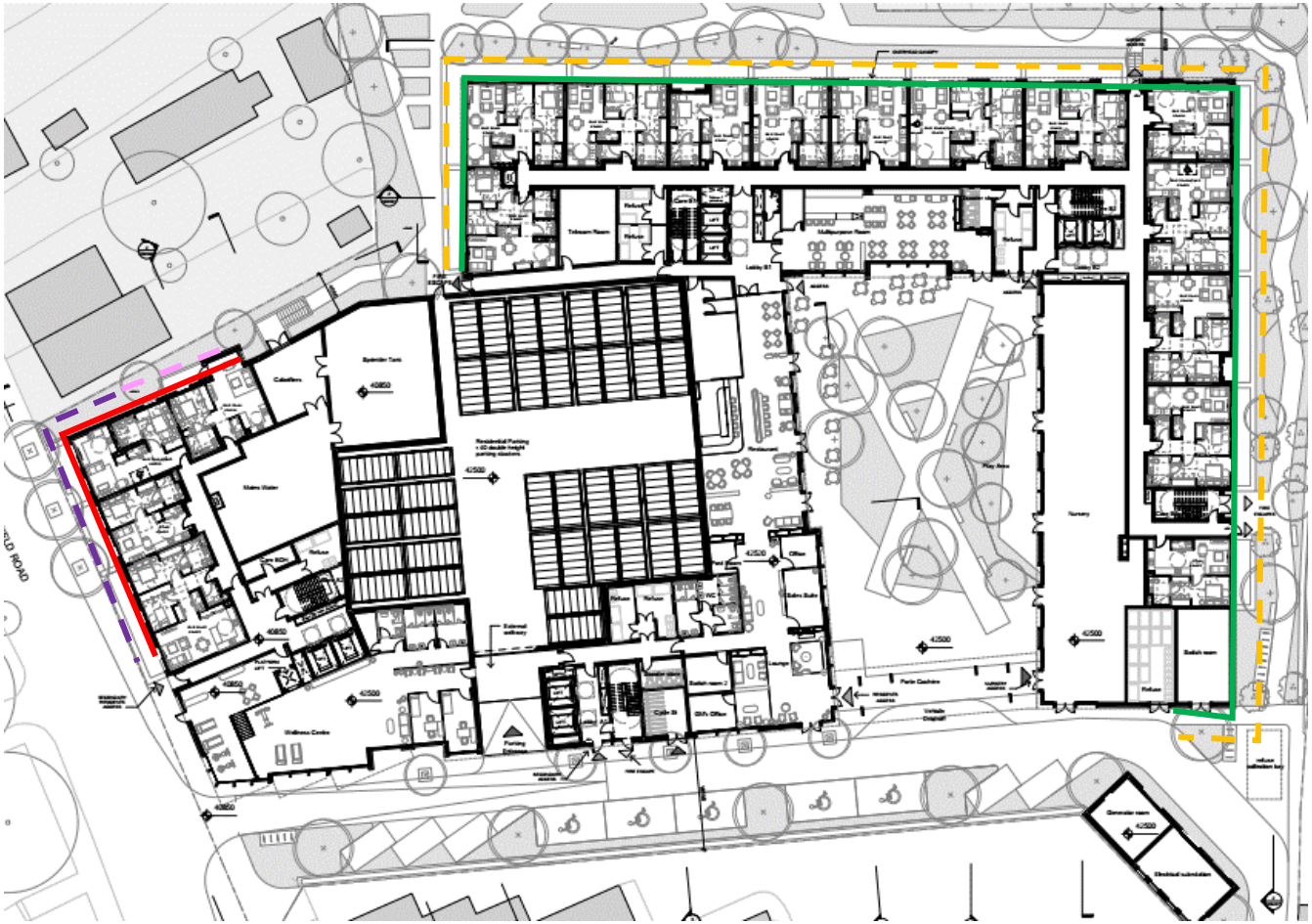
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Figure 1

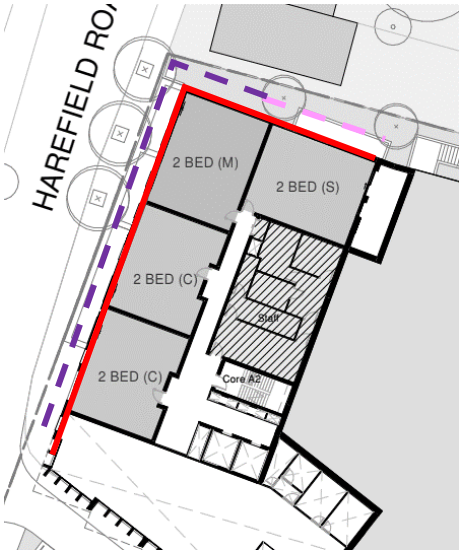
14 January 2021

Not to Scale

RBA ACOUSTICS



Glazing & Ventilation Zones:	
Zone 1	
Zone 2	
AVO L1 Assessment Zones	
Negligible Risk	
Low/Medium Risk	
High Risk	



Guild Living, Uxbridge

Glazing & Ventilation Zoning Plan – L0 + Mezzanine Level

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Figure 2

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Not to Scale

RBA ACOUSTICS



Glazing & Ventilation Zones:	
Zone 1	
Zone 2	
AVO L1 Assessment Zones	
Negligible Risk	
Low/Medium Risk	
High Risk	

Guild Living, Uxbridge

Glazing & Ventilation Zoning Plan – L1

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Figure 3

14 January 2021

Not to Scale

RBA ACOUSTICS



Glazing & Ventilation Zones:	
Zone 1	
Zone 2	
AVO L1 Assessment Zones	
Negligible Risk	
Low/Medium Risk	
High Risk	

Guild Living, Uxbridge

Glazing & Ventilation Zoning Plan – L2

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Figure 4

14 January 2021

Not to Scale

RBA ACOUSTICS



Glazing & Ventilation Zones:	
Zone 1	
Zone 2	
AVO L1 Assessment Zones	
Negligible Risk	
Low/Medium Risk	
High Risk	

Guild Living, Uxbridge

Glazing & Ventilation Zoning Plan – L3

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Figure 5

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Not to Scale

RBA ACOUSTICS



Glazing & Ventilation Zones:	
Zone 1	
Zone 2	
AVO L1 Assessment Zones	
Negligible Risk	
Low/Medium Risk	
High Risk	

Guild Living, Uxbridge

Glazing & Ventilation Zoning Plan – L4

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Figure 6

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Guild Living, Uxbridge

Glazing & Ventilation Zoning Plan – L5 and L6 (indicative of facades)

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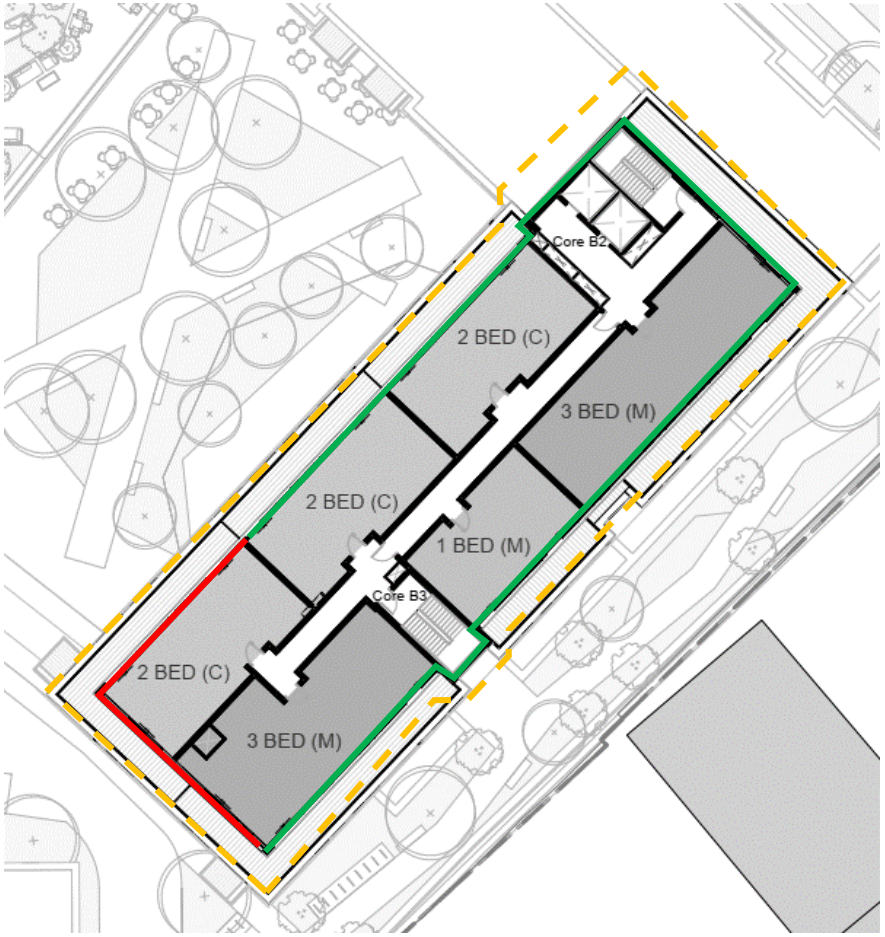
Figure 7

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Not to Scale

RBA ACOUSTICS

Glazing & Ventilation Zones:	
Zone 1	
Zone 2	
AVO L1 Assessment Zones	
Negligible Risk	
Low/Medium Risk	
High Risk	



Guild Living, Uxbridge

Glazing & Ventilation Zoning Plan – L7

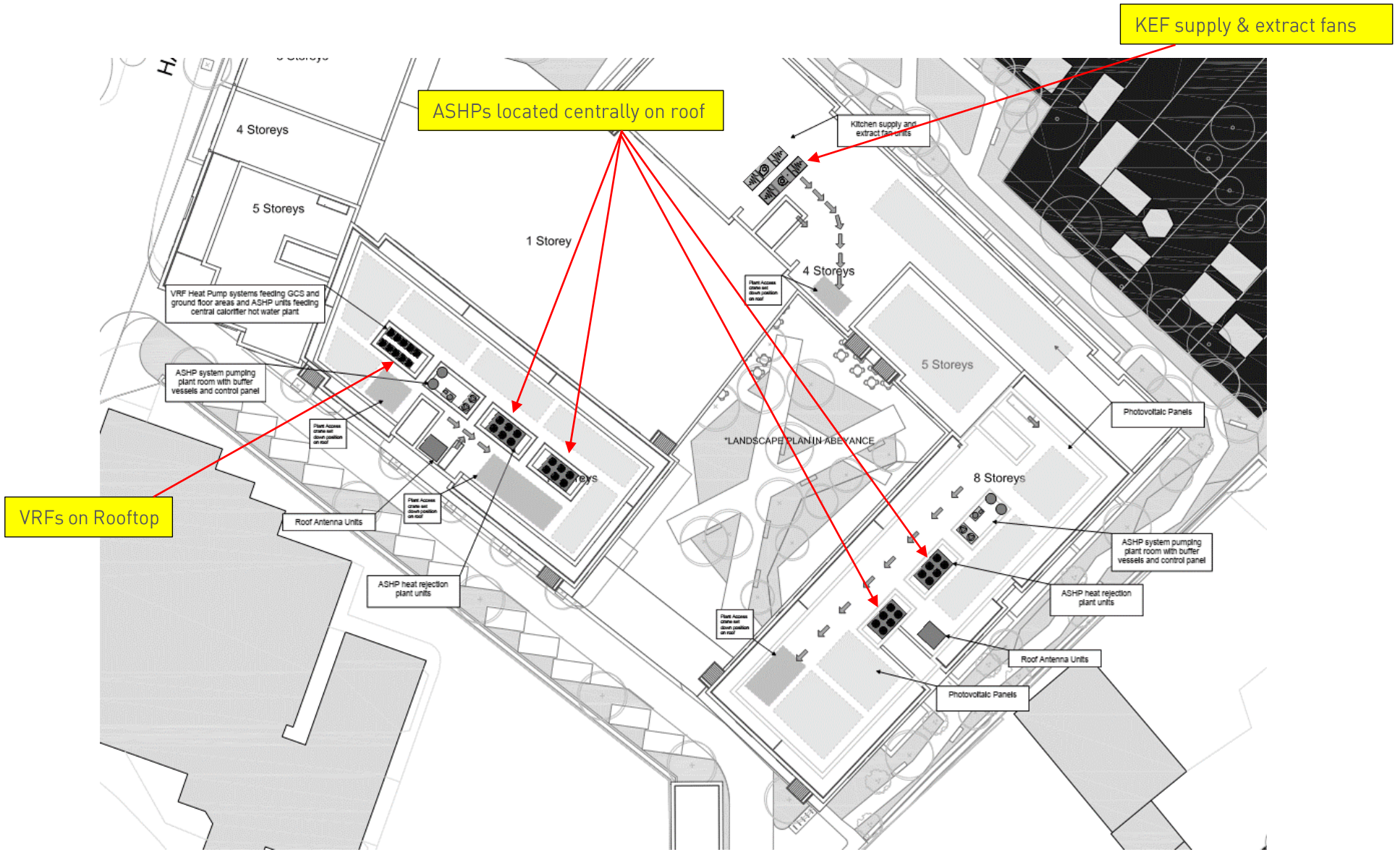
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Figure 7

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Proposed Rooftop Plant Locations (indicative)

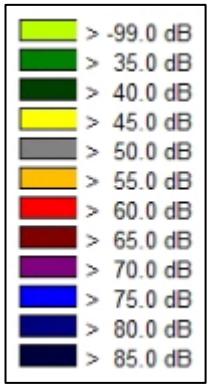
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Figure 8

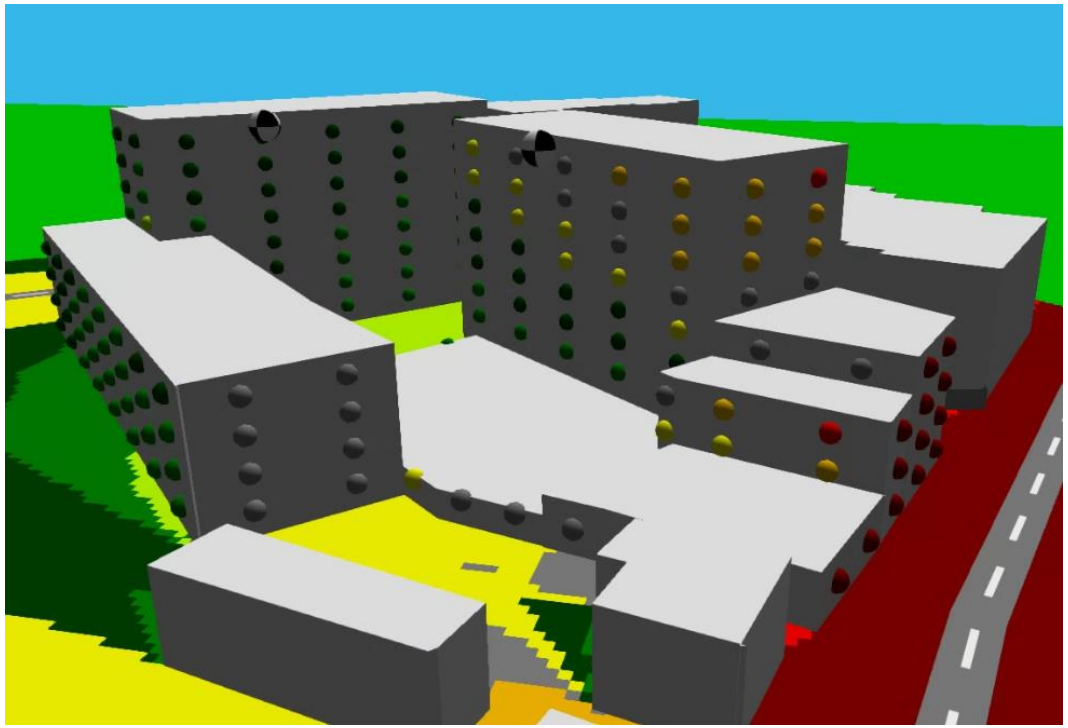
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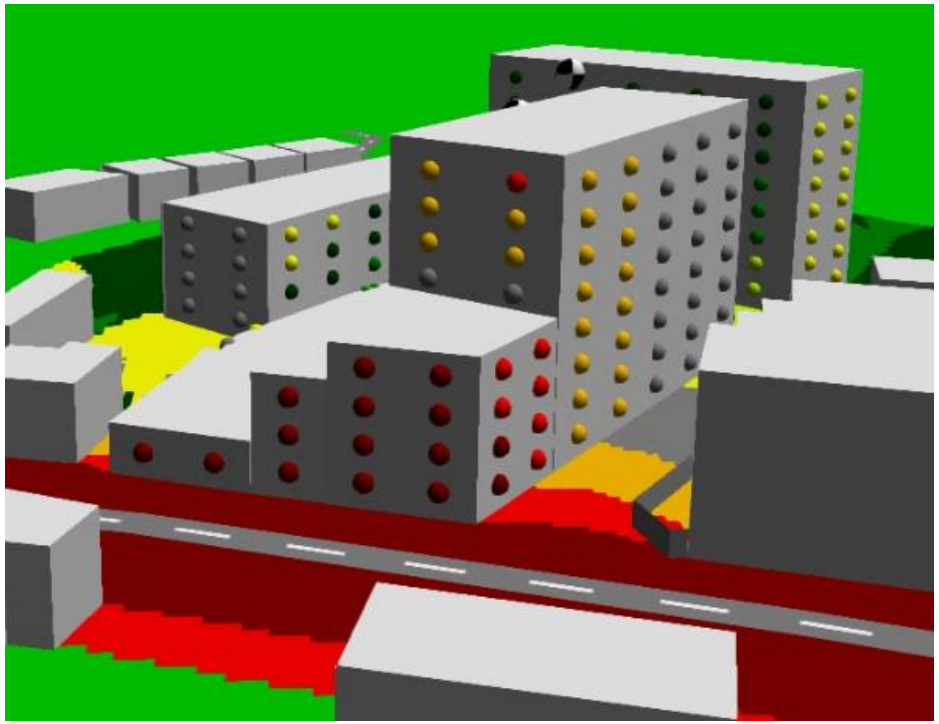
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As Viewed from North





As Viewed from West

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Screenshots of 3D Acoustic Model in Cadna showing Daytime Façade Noise Levels

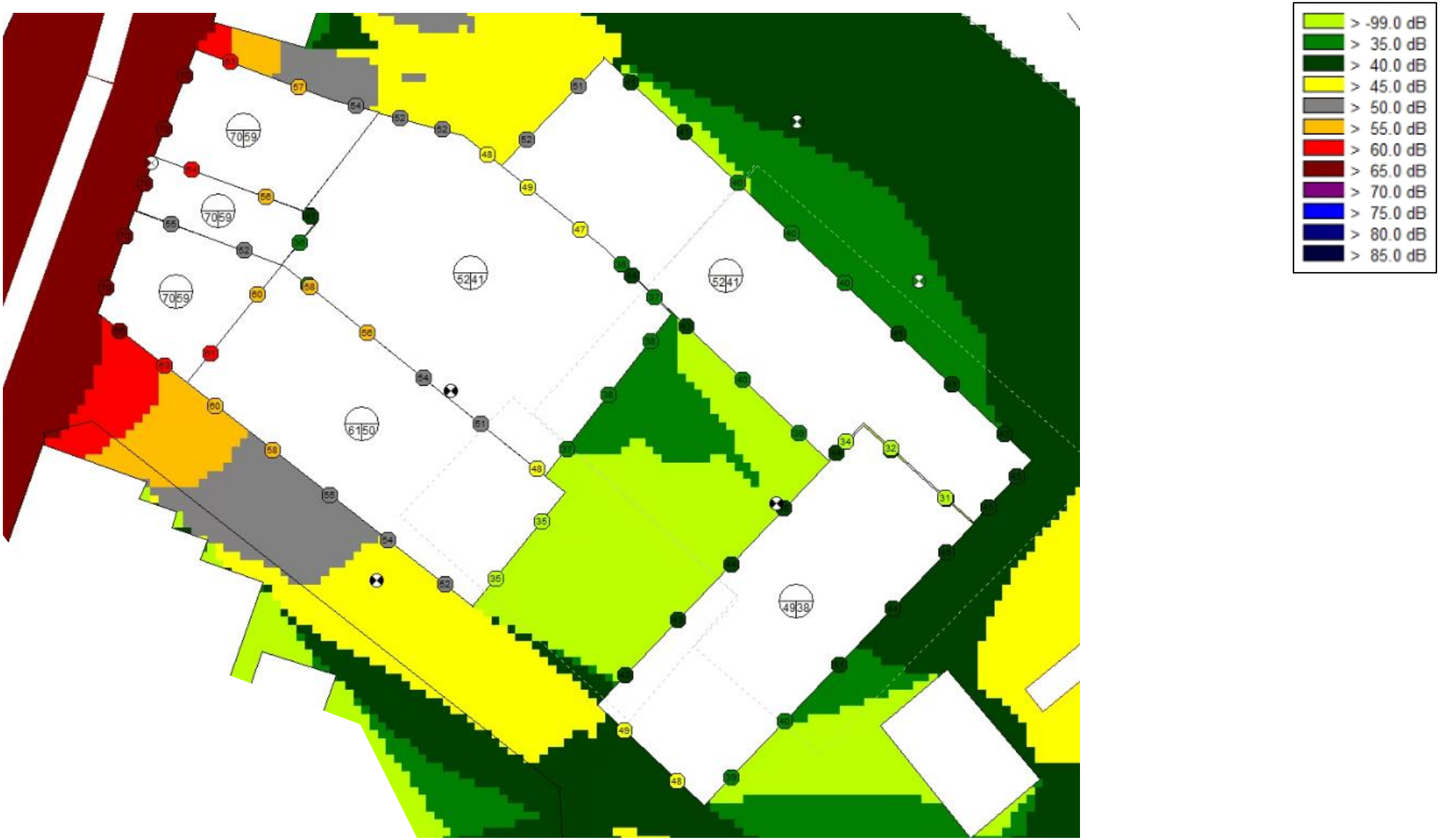
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Figure 9

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Predicted Daytime Noise Levels (shown at 4m height)

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Figure 10

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Not to Scale

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Guild Living, Uxbridge

Predicted Night-time Noise Levels (shown at 4m height)

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Figure 11

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