MILLER GOODALL
ACOUSTICS AND AIR QUALITY

NOISE ASSESSMENT

on behalf of

GLADMAN DEVELOPMENTS LTD

for the site at

LAND OFF SOUTH NEWINGTON ROAD, BLOXHAM, OX15 4HU

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Summary

A noise assessment was undertaken to predict the potential impact on a proposed development of residential dwellings at Land off South Newington Road, Bloxham, OX15 4HU. This was requested by the Local Authority to support a planning application for the development.

Measurements were made at a location of the proposed residences to identify the pre-development background noise levels. This data was subsequently used to predict the potential impact of noise from existing sources to the proposed development.

A recommended glazing and ventilation specification has been provided to enable the recommended internal noise limits to be achieved within the properties.

With the implementation of the recommendations, it is considered that a suitable and commensurate level of protection against noise will be provided to the occupants of the proposed accommodation.

Record of changes

Prepared By	Gareth Willox TechIOA	Reviewed By	Joanne Miller MIOA
Signed	[redacted]	Signed	[redacted]
Date	15th March 2019	Date	15th March 2019

Version	Date	Change	Initials
1	15th March 2019	Final issue	GW
2	5th June 2017	Minor Changes	GW
3	15th March 2019	Minor changes to reflect new National Planning Policy Framework	RM

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Contents

1 Introduction

1.1 Miller Goodall Ltd has, on behalf of Gladman Developments Ltd, undertaken a noise assessment in respect of the impact of existing noise from road traffic on a proposed residential development. The noise assessment is to support a planning application for the site.

2 Site Description

2.1 The site is located Land off South Newington Road, Bloxham, OX15 4HU. The site location is shown outlined in red in Appendix 1.

2.2 The proposed site is located approximately 8 km south of Banbury.

2.3 The south and west of the site is bounded by active farmland. South Newington Road runs directly to the east of the proposed site. To the north of the site lies a playing field which is bounded by the outskirts of Bloxham.

3 Proposed Development

3.1 The proposal is to develop a greenfield site of approximately 14.6 acres for residential use. The mix of dwellings has not been fixed and layout is reserved for consideration at a later date.

3.2 The aim of this assessment is to predict the impact of the existing noise sources on the proposed residential accommodation and to recommend mitigation measures where necessary.

4 Policy Context

4.1 Noise Policy Statement for England

4.1.1 The Noise Policy Statement for England (NPSE[1]), published in March 2010, sets out the long-term vision of Government noise policy. The Noise Policy aims, as presented in this document, are:

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- avoid significant adverse effects on health and quality of life;
- mitigate and minimise adverse effects on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life."

4.1.2 The NPSE makes reference to the concepts of NOEL (No Observed Effect Level) and LOAEL (Lowest Observed Adverse Effect Level) as used in toxicology but applied to noise impacts. It also introduces the concept of SOAEL (Significant Observed Adverse Effect Level) which is described as the level above which significant adverse effects on health and the quality of life occur.

[1] Noise Policy Statement for England, Defra, March 2010

4.1.3 The first aim of the NPSE is to avoid significant adverse effects, taking into account the guiding principles of sustainable development (as referenced in Section 1.8 of the Statement). The second aim seeks to provide guidance on the situation that exists when the potential noise impact falls between the LOAEL and the SOAEL, in which case:

"…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".

4.1.4 Importantly, the NPSE goes on to state:

"This does not mean that such adverse effects cannot occur".

4.1.5 The Statement does not provide a noise-based measure to define SOAEL, acknowledging that the SOAEL is likely to vary depending on the noise source, the receptor and the time in question. NPSE advises that:

"Not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available"

4.1.6 It is therefore likely that other guidance will need to be referenced when applying objective standards for the assessment of noise, particularly in reference to the SOAEL, whilst also taking into account the specific circumstances of a proposed development.

4.2 National Planning Policy Framework

4.2.1 The National Planning Policy Framework (NPPF[2]) initially published in March 2012, was updated in February 2019. One of the documents that the NPPF replaces is Planning Policy Guidance Note 24 (PPG 24) "Planning and Noise"[3].

4.2.2 The revised NPPF advises that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives). One of these is an environmental objective which is described in par. 8 (c):

"to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy."

4.2.3 At par. 170 we are advised that:

"Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development

[2] National Planning Policy Framework, Ministry of Housing, Communities and Local Government, July 2018

[3] Planning Policy Guidance 24: Planning and Noise, DCLG, September 1994

should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans.

4.2.4 Par. 180 goes on to state:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

4.3 Planning Practice Guidance – Noise

4.3.1 As of March 2014, a Planning Practice Guidance[4] for noise was issued which provides additional guidance and elaboration on the NPPF. It advises that when plan-making and decision-taking, the Local Planning Authority should consider the acoustic environment in relation to:

- Whether or not a significant adverse effect is occurring or likely to occur;
- Whether or not an adverse effect is occurring or likely to occur; and
- Whether or not a good standard of amenity can be achieved.

4.3.2 In line with the Explanatory Note of the NPSE, the PPG goes on to reference the LOAEL and SOAEL in relation to noise impact. It also provides examples of outcomes that could be expected for a given perception level of noise, plus actions that may be required to bring about a desired outcome. However, in line with the NPSE, no objective noise levels are provided for LOAEL or SOAEL although the PPG acknowledges that:

"…the subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation".

4.3.3 Examples of these factors include:

- The source and absolute noise level of the source along with the time of day that it occurs;
- Where the noise is non-continuous, the number of noise events and pattern of occurrence;
- The frequency content and acoustic characteristics of the noise;
- The effect of noise on wildlife;
- The acoustic environment of external amenity areas provided as an intrinsic part of the overall design;
- The impact of noise from certain commercial developments such as night clubs and pubs where activities are often at their peak during the evening and night.

[4] Planning Practice Guidance – Noise, http://planningguidance.planningportal.gov.uk/blog/guidance/noise/, 06 March 2014

4.3.4 The PPG also provides general advice on the typical options available for mitigating noise. It goes on to suggest that Local Plans may include noise standards applicable to proposed developments within the Local Authority's administrative boundary, although it states that:

"Care should be taken, however, to avoid these being implemented as fixed thresholds as specific circumstances may justify some variation being allowed".

4.3.5 The PPG was amended in December 2014 to clarify guidance on the potential effect of noise from existing businesses on proposed new residential accommodation. Even if existing noise levels are intermittent (for example, from a live music venue), noise will need to be carefully considered and appropriate mitigation measures employed to control noise at the proposed accommodation.

5 Local Authority Consultation

5.1 CDC were consulted in respect of the methodology used in this assessment[5]. No feedback has been received to date.

6 Acoustic Standards and Guidance

6.1 BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings

6.1.1 This standard provides recommended guideline values for internal noise levels within dwellings which are similar in scope to guideline values contained within the World Health Organisation (WHO) document, Guidelines for Community Noise (1999)[6]. These guideline noise levels are shown in Table 1, below.

Table 1: BS 8233: 2014 guideline indoor ambient noise levels for dwellings

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

6.1.2 BS 8233:2014 advises that:

[5] Email sent with consultation document to planning@cherwell-dc.gov.uk

[6] World Health Organisation Guidelines for Community Noise, 1999

"regular individual noise events…can cause sleep disturbance. A guideline value may be set in terms of SEL[7] or $L_{Amax,F}$ depending on the character and number of events per night. Sporadic noise events could require separate values".

6.1.3 BS 8233:2014 adopts guideline external noise values provided in WHO for external amenity areas such as gardens and patios. The standard states that it is "desirable" that the external noise does not exceed 50 dB $L_{Aeq,T}$ with an upper guideline value of 55 dB $L_{Aeq,T}$ whilst recognising that development in higher noise areas such as urban areas or those close to the transport network may require a compromise between elevated noise levels and other factors that determine if development in such areas is warranted. In such circumstances, the development should be designed to achieve the lowest practicable noise levels in external amenity areas.

6.2 World Health Organisation (WHO) Guidelines for Community Noise 1999

6.2.1 The WHO Guidelines 1999 recommends that to avoid sleep disturbance, indoor night-time guideline noise values of 30 dB L_{Aeq} for continuous noise and 45 dB L_{AFmax} for individual noise events should be applicable. It is to be noted that the WHO Night Noise Guidelines for Europe 2009[8] makes reference to research that indicates sleep disturbance from noise events at indoor levels as low as 42 dB L_{AFmax}. The number of individual noise events should also be taken into account and the WHO guidelines suggest that indoor noise levels from such events should not exceed approximately 45 dB L_{AFmax} more than 10 – 15 times per night.

6.2.2 The WHO document recommends that steady, continuous noise levels should not exceed 55 dB L_{Aeq} on balconies, terraces and outdoor living areas. It goes on to state that to protect the majority of individuals from moderate annoyance, external noise levels should not exceed 50 dB L_{Aeq}.

6.3 Possible LOAEL and SOAEL Noise Standards

6.3.1 It is acknowledged that the NPSE and the Planning Practice Guidance both advise caution when attempting to set objective standards in relation to LOAEL and SOAEL that may be applicable to a new development.

6.3.2 That said, the guideline values for internal noise within the WHO documents are set at the level of the lowest adverse health effect (the critical health effect) and as such, the values could form the basis of the LOAEL as referenced in the NPSE and PPG. Targeting the WHO guideline levels as the LOAEL should, therefore, provide a robust basis for assessment. No levels are provided within the WHO guidance that may be directly applicable to the SOAEL and any such threshold levels will, as indicated in the above guidance, vary depending on the specific circumstances of the development and the noise climate in which it is located.

6.3.3 With reference to external noise levels in gardens, the WHO lower guideline value of 50 dB L_{Aeq} during the day is intended to protect the majority of people from moderate annoyance and could, therefore, equate to the LOAEL. The upper guideline value of 55 dB L_{Aeq} is intended to protect the majority of people from serious annoyance and whilst this does not necessarily imply that this guideline value would equate to the SOAEL, it would be reasonable to suggest that the SOAEL might occur at a level at or above the guideline value of 55 dB L_{Aeq}.

[7] Sound exposure level or L_{AE}

[8] WHO Night Noise Guidelines for Europe 2009

6.3.4 Where an assessment of noise impact to BS 4142:2014 is undertaken, a Rating Level that is 10 dB or more above the prevailing Background Sound Level (BSL) could be indicative of the SOAEL, depending on the context. BS 4142:2014 does not provide guidance on what may constitute the LOAEL but suggests that a Rating Level that is 5 dB or more above the BSL could result in an adverse impact with a Rating Level at or below the BSL indicative of a low likelihood of adverse impact, again depending on the context. The LOAEL could, therefore, fall somewhere between 0 and + 5 dB above the BSL.

7 Noise Survey

7.1 Measurements of Existing Noise Sources

Noise measurements were undertaken at a location consistent with the proposed development in accordance with BS 7445-1: 2003[9] by Gareth Willox of Miller Goodall Ltd. The calibration of the sound level meter was checked before and after measurements with negligible deviation (<0.1 dB). Details of the equipment used are shown in Table 2, below.

Table 2: Noise monitoring equipment

Equipment Description	Type Number	Manufacturer	Serial No.	Date Calibrated	Calibration Certification Number
Class 1[10],[11] Integrating Real Time 1/3 Octave Sound Analyser	Type NOR 140	Norsonic	1406017	22/05/15	U18820
Microphone	Type NOR 1225	Norsonic	151206	22/05/15	18658
Class 1 Calibrator[12]	Type NOR 1251	Norsonic	34123	05/07/16	02777/1
Outdoor microphone housing	Type NOR 1217	Norsonic	12175146	N/a	N/a

7.1.1 Specific, background and ambient noise monitoring was undertaken at the times specified in Table 3, below. Weather conditions were determined both at the start and on completion of the survey. It is considered that meteorological conditions were appropriate for environmental noise measurements. Measurement locations are shown in Appendix 1.

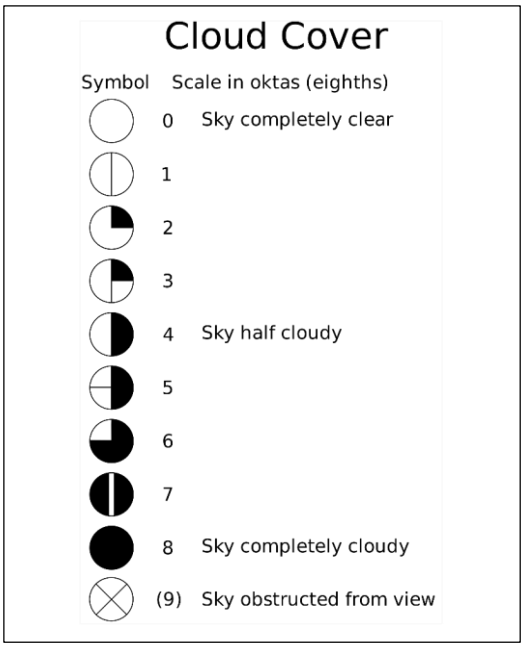
[9] BS 7445-1: 2003 Description and measurement of environmental noise - Part 1: Guide to quantities and procedures

[10] IEC 61672-1 (2002) Electroacoustics – Sound level meters Part 1: Specifications

[11] IEC 61260 (1995) Electroacoustics – Octave-band and fractional-octave-band filters

[12] IEC 60942 (2003) Electroacoustics – Sound calibrators

Table 3: Dates, times and weather conditions during noise measurements

Measurement Locations	Date/Time	Weather conditions		
		Description	At Start of Survey	On Completion
P1	21/05/15, 14:45 to 22/05/15, 16:10	Temperature:	12 ºC	16 ºC
		Precipitation:	Dry	Dry
		Cloud cover (oktas – see opposite):	4	2
		Any fog/snow/ice?	No	No
		Any damp roads/wet ground?	No	No
		Wind speed:	3 m/s	1 m/s
		Wind direction:	Variable, generally westerly	
		Any conditions that may cause temp. inversion (e.g. calm nights with no cloud):	No	No

7.1.2 Measurements were taken at times considered to be representative of the periods during which the proposed residential accommodation would be subject to the highest levels of ambient noise. Measurements were made under free-field conditions at a height of 1.5 m above the ground.

7.1.3 The measurement location is detailed.

- P1 approximately 20 m from South Newington Road.

7.1.4 The noise sources within the vicinity of the measurement locations are summarised in Table 4, below:

Table 4: Description of noise sources affecting the site

Measurement Locations	Noise Sources
P1	Road traffic from South Newington Road, bird song.

7.2 Monitoring Results

7.2.1 A summary of the broadband measurement data is provided in Table 5 below with full data in Appendix 2. All data are sound pressure levels in dB re 20 μPa.

Table 5: Summary of noise measurements

Measurement Location	Start Time	Elapsed Time (hr:min:sec)	$L_{Aeq,T}$ (dB)	Overall L_{AFmax} (dB)	$L_{AF10,T}$ (dB)	$L_{AF90,T}$ (dB)
MP1	16:00:00	01:00:00	61.6	78.6	66.0	47.7
MP1	17:00:00	01:00:00	61.6	76.1	66.8	44.1
MP1	18:00:00	01:00:00	60.2	78.1	65.6	42.8
MP1	19:00:00	01:00:00	58.8	75.8	64.4	41.2
MP1	20:00:00	01:00:00	56.5	72.8	61.3	38.8
MP1	21:00:00	01:00:00	56.0	78.7	60.2	34.7
MP1	22:00:00	01:00:00	54.5	75.3	56.4	38.4
MP1	23:00:00	01:00:00	51.5	73.0	50.1	27.5
MP1	00:00:00	01:00:00	50.0	78.6	46.4	24.5
MP1	01:00:00	01:00:00	47.8	76.6	40.8	23.1
MP1	02:00:00	01:00:00	49.9	76.4	41.6	19.1
MP1	03:00:00	01:00:00	46.9	71.3	43.4	20.0
MP1	04:00:00	01:00:00	56.8	80.5	53.8	37.4
MP1	05:00:00	01:00:00	56.5	74.2	60.3	39.8
MP1	06:00:00	01:00:00	60.4	85.4	64.7	44.5
MP1	07:00:00	01:00:00	61.8	80.3	66.0	49.5
MP1	08:00:00	00:30:01	62.0	77.0	66.0	50.6

7.2.2 Each measurement period consisted of sequential 1 second samples which therefore allowed the variation in noise level over time to be assessed. This data was subsequently used to determine a 'typical' L_{AFmax} noise level and octave band spectrum based on the 95th percentile of individual 5 minute measurements. This data was subsequently utilised within the noise model.

7.2.3 The 1 second noise levels have not been presented in this report but are kept on file for future reference.

7.2.4 Octave band frequency data was also obtained and this was utilised within the noise ingress calculations. This source data is provided in Table 6, below.

Table 6: Octave band free-field external noise level spectra

Measurement Descriptor	Sound Pressure Level, dB in Octave Band Centre Frequency, Hz								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Night Time $L_{Aeq,(23:00-07:00)}$	57	51	46	48	52	48	45	39	55
Night Time 95th % $L_{AFmax,5min}$	82	76	73	75	72	68	66	63	77
Daytime $L_{Aeq,(16:00-23:00)}$	59	55	50	51	56	51	45	39	58

8 Impact of Existing Noise Sources on the Development

8.1 Predicted Internal Noise Levels Assessed to BS 8233 Criteria

8.1.1 It is proposed that noise from the development is controlled to 30 dB L_{Aeq} in bedrooms at night and 35 dB L_{Aeq} in habitable rooms during the day. This is in line with the recommended levels advised in BS 8233 for both daytime and night-time noise and the recommended night-time noise level within bedrooms suggested by WHO. It is also proposed that noise from individual events such as vehicle pass-bys does not regularly exceed an indoor level of 45 dB L_{AFmax}.

8.1.2 The generally accepted rule of thumb is that a window left open for ventilation provides 10 - 15 dB attenuation from external noise sources with the WHO Guidelines for Community Noise suggesting 15 dB. The DEFRA report NANR116: Open/Closed Window Research[13] suggests the figure to be between 12 and 18 dB for road and rail traffic. Where external noise levels are more than around 15 dB higher than the internal noise targets, openable windows should not be relied upon as the sole means of ventilation and some form of acoustically attenuated ventilation may be required. This equates to an external noise level of 45 dB L_{Aeq} / 60 dB L_{Amax} during the night or 50 dB L_{Aeq} during the day.

8.1.3 In order to assess the potential glazing and ventilation requirements for dwellings, noise ingress calculations were undertaken based on the methodology in BS EN 12354-3[14]. The following assumptions were made regarding the internal rooms:

- Assessed within first floor bedrooms with an internal volume of 30 m^3
- 'Normal' internal surface finishes e.g. carpeted with curtains etc.
- Glazed area of 1.5 m^2 per room.

8.1.4 The areas of the proposed site where internal noise may exceed the standards are bedrooms on elevations closest to, and facing, South Newington Road. Night-time periods have been assessed as the standards are more onerous than for daytime periods.

[13] NANR116: 'Open/closed window research' Sound Insulation through ventilated open windows, Defra April 2007

[14] BS EN 12354-3:2000 Building acoustics. Estimation of acoustic performance in buildings from the performance of elements - Airborne sound insulation against outdoor sound

8.1.5 Noise ingress calculations are provided in Appendix 5 with a summary of the results in Table 7, below:

Table 7: Predicted internal noise levels

Description	External Noise Levels		Predicted Internal Noise Levels		BS 8233 Criteria		Exceedance of Criteria		Proposed Glazing and Ventilation
	dB $L_{Aeq,T}$	dB L_{AFmax}	dB $L_{Aeq,T}$	dB L_{AFmax}	dB $L_{Aeq,T}$	dB L_{AFmax}	dB $L_{Aeq,T}$	dB L_{AFmax}	
South and east facing bedrooms (night-time)	55	77	21	45	30	45	-9	0	Option 1
South and east facing living rooms/dining kitchens (daytime)	58	N/a	33	N/a	35	N/a	-2	N/a	Option 2

- **Option 1** - Glazing with minimum weighted sound reduction index of 33 dB $R_W + C_{tr}$ (e.g. 10/12/6); ventilators with a minimum element normalised sound level difference of 41 dB $D_{ne,W}$.
- **Option 2** - Glazing with minimum weighted sound reduction index of 27 dB $R_W + C_{tr}$ (e.g. 4/12/4); ventilators with a minimum element normalised sound level difference of 31 dB $D_{ne,W}$.

8.1.6 It can be seen from Table 7 that rooms on the noisiest elevations are predicted to satisfy the internal noise level requirements on the 1st floor elevations with glazing with a sound reduction index of 33 dB $R_w + C_{tr}$; this could be achieved using double glazing with a 10/12/6 configuration. Background ventilation could be provided by trickle ventilators with a minimum element normalised sound level difference of at least 41 dB $D_{ne,w} + C_{tr.}$

8.1.7 The ground floor elevations are predicted to satisfy the internal noise level requirements with glazing with a sound reduction index of 27 $R_w + C_{tr}$; this could be achieved using double glazing with a 4/12/4 configuration. Background ventilation could be provided by trickle ventilators with a minimum element normalised sound level difference of at least 31 dB $D_{ne,w} + C_{tr.}$

8.1.8 For dwellings with habitable rooms facing away from South Newington Road or where shielding from other buildings is provided, a lower specification of glazing or ventilation may be feasible. Final proposals for glazing and ventilation options would need to be reviewed as the final master plan of the site is developed at the reserved matters stage.

8.2 External Noise Levels

8.2.1 The predicted daytime noise levels across the open site are currently around 58 dB $L_{Aeq.}$ It is recommenced that gardens should be designed facing away from South Newington Road and final mitigation should be considered at the reserved matters phase of the development. With consideration to careful design, orientation and access of the residential properties it is expected that the Local Authority's daytime noise criteria in external amenity spaces will be achieved. It is expected that this level will reduce across the site with further distance from South Newington Road.

9 Mitigation Measures

9.1 Building Envelope – Roof Construction

9.1.1 It is recommended that the pitched slate roof is lined with a minimum of 1 layers of 12 mm plasterboard with a minimum 100 mm cavity between the roof and the inner lining and filled with 100 mm mineral wool insulation with a minimum density of 10 kg/m^3.

9.2 Building Envelope: Glazing and Ventilation

9.2.1 Table 8 provides a summary of the proposed glazing and ventilation scheme at the development. These are:

- **Option 1** - Glazing with the minimum sound reduction index stated in Table 8, below (to achieve 33 dB $R_W + C_{tr}$); this could be met using glazing with a 10/12/6 laminate configuration, i.e. 10 mm and 6 mm to be confirmed by the glazing supplier.
- **Option 1** - Glazing with the minimum sound reduction index stated in Table 8, below (to achieve 27 dB $R_W + C_{tr}$); this could be met using glazing with a 4/12/4 laminate configuration, i.e. 10 mm and 4 mm to be confirmed by the glazing supplier.

Table 8: Minimum sound reduction indices of glazing

Glazing Option	Sound Reduction Index, dB R_w in Octave Band Centre Frequency, Hz								R_w	C_{tr}	$R_w + C_{tr}$
	63	125	250	500	1k	2k	4k	8k			
Option 1	20	26	27	34	40	38	46	46	37	-4	33
Option 2	18	24	20	25	35	38	35	35	31	-4	27

9.2.2 Trickle ventilators with a minimum element normalised sound level difference at 1st floor level of 41 dB $D_{ne,W} + C_{tr}$ of and 27 dB $D_{ne,W} + C_{tr}$ at ground floor would be acceptable.

9.3 Consideration of Other Discipline Requirements

9.3.1 It is recommended that you confirm the suitability of all recommended noise mitigation measures with your architects, structural engineers, building contractors, fire consultants and material manufacturers prior to procurement and field application so that when the recommended noise control measures are implemented on site they will satisfy the requirements of all disciplines, therefore, should not cause any health and safety issues.

10 Conclusions

10.1 A noise assessment has been undertaken at the site of a proposed residential development to support a planning application. Measurements have been taken to determine the existing ambient noise levels at the site. The measured data has been used to predict the impact of existing noise sources on future user of the site. A recommended glazing and ventilation specification has been provided to enable the recommended internal noise limits to be achieved within the properties.

10.2 The assessment has identified that with consideration to the careful design and orientation of residential properties and screening to the gardens from South Newington Road both internal and external levels can be achieved at the proposed development site.

10.3 With the implementation of these recommendations it is considered that a suitable and commensurate level of protection against noise will be provided to the occupants of the proposed accommodation.

11 Health and Safety Information

The Construction (Design and Management) Regulations (CDM 2015) are the main set of regulations for managing the health, safety and welfare of construction projects. CDM 2015 applies to all building and construction work and includes new build, demolition, refurbishment, extensions, conversions, repair and maintenance in order to reduce injury and ill health.

Under the regulation we are Designers. As a Designer, our decisions can affect the health and safety of workers and others who will construct, maintain, repair, clean, refurbish and eventually demolish or remove the building or structure, as well as those who will use it as a completed workplace. Taking risks arising from the design into account can positively affect the project and make it easier for these risks to be managed by contractors and those who will maintain or use the structure. Our designs must contribute to the safe delivery of a project without risks to health.

As Designers we must:

- understand and be aware of significant risks that workers and users can be exposed to and how these can arise from our design decisions;
- have the right skills, knowledge, and experience and be adequately resourced to address the health and safety issues likely to be involved in the design;
- check that Clients are aware of their duties;
- co-operate with others who have responsibilities, in particular the Principal Designer;
- take into account the general principles of prevention when carrying out our design work;
- provide information about the risks arising from our design;
- co-ordinate our work with that of others in order to improve the way in which risks are managed and controlled.

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APPENDICES

Appendix 1: Site Outline & Measurement Positions

Appendix 2: Measurement Data

Start Time	Elapsed Time (min:sec)	L_{Aeq} (dB)	L_{AFmax} (dB)	L_{AF1} (dB)	L_{AF10} (dB)	L_{AF90} (dB)	L_{AF99} (dB)	L_{AFmin} (dB)
15:38:07	00:15:00	67.5	96.5	80.6	66.1	48.0	45.9	41.2
15:53:07	00:15:00	60.6	74.9	68.2	65.2	47.0	45.4	44.0
16:08:07	00:15:00	60.7	70.4	67.6	65.0	48.0	45.7	42.8
16:23:07	00:15:00	60.7	78.6	68.3	65.3	48.0	46.7	45.2
16:38:07	00:15:00	62.4	75.0	70.8	67.2	47.0	45.0	44.1
16:53:07	00:15:00	62.7	76.2	70.7	67.6	44.0	40.9	37.7
17:08:07	00:15:00	62.6	75.1	70.6	67.7	46.0	43.9	39.8
17:23:07	00:15:00	61.5	74.3	69.8	66.5	46.0	43.8	42.2
17:38:07	00:15:00	60.8	76.1	68.9	66.2	43.0	41.8	39.4
17:53:07	00:15:00	60.7	72.4	69.1	66.4	44.0	41.9	37.7
18:08:07	00:15:00	61.0	73.6	68.8	66.2	44.0	42.7	39.8
18:23:07	00:15:00	59.3	73.7	68.9	64.9	42.0	40.4	38.0
18:38:07	00:15:00	60.2	78.1	69.0	65.2	42.0	39.3	35.2
18:53:07	00:15:00	59.6	71.9	69.1	65.0	43.0	42.0	40.5
19:08:07	00:15:00	59.5	75.8	68.4	65.0	44.0	42.0	39.3
19:23:07	00:15:00	57.4	70.9	67.1	63.3	39.0	37.0	34.7
19:38:07	00:15:00	58.6	73.8	68.8	63.9	42.0	41.0	38.0
19:53:07	00:15:00	58.0	72.5	67.8	63.4	42.0	41.2	38.4
20:08:07	00:15:00	56.8	72.8	66.7	62.1	39.0	36.2	33.0
20:23:07	00:15:00	56.8	70.8	67.4	61.6	38.0	35.3	32.7
20:38:07	00:15:00	55.8	70.9	67.6	59.9	38.0	37.0	34.1
20:53:07	00:15:00	55.7	71.4	67.8	59.7	36.0	34.0	31.6
21:08:07	00:15:00	57.1	72.3	67.9	62.2	37.0	33.6	30.5
21:23:07	00:15:00	56.2	72.7	66.7	61.1	39.0	36.5	33.4
21:38:07	00:15:00	56.0	78.7	66.6	59.2	31.0	28.1	24.1
21:53:07	00:15:00	52.2	70.3	65.3	53.4	34.0	31.3	28.0
22:08:07	00:15:00	55.5	71.1	67.2	59.2	39.0	37.8	35.6
22:23:07	00:15:00	53.9	72.2	66.4	56.2	32.0	31.2	30.4
22:38:07	00:15:00	55.5	75.3	68.0	56.7	43.0	41.2	34.9
22:53:07	00:15:00	51.6	73.3	65.2	50.5	30.0	28.7	27.9
23:08:07	00:15:00	53.3	72.5	66.7	54.5	33.0	30.5	26.9
23:23:07	00:15:00	52.2	73.0	67.0	50.2	29.0	28.0	26.8
23:38:07	00:15:00	47.4	68.5	62.6	43.5	26.0	25.4	24.5
23:53:07	00:15:00	52.5	71.4	66.6	52.3	27.0	26.0	24.8
00:08:07	00:15:00	51.8	78.6	64.1	46.8	26.0	25.1	24.3
00:23:07	00:15:00	46.3	71.5	59.0	40.6	24.0	23.1	22.5
00:38:07	00:15:00	49.6	71.4	64.0	47.3	25.0	24.5	23.5
00:53:07	00:15:00	48.2	70.2	62.8	46.1	25.0	24.5	23.8
01:08:07	00:15:00	50.7	76.6	62.8	41.5	24.0	23.2	22.7
01:23:07	00:15:00	45.4	70.2	56.0	38.9	24.0	23.4	22.7
01:38:07	00:15:00	45.1	72.0	50.4	30.5	23.0	22.7	21.9
01:53:07	00:15:00	48.4	75.7	54.8	30.8	20.0	19.1	18.5
02:08:07	00:15:00	43.8	70.3	52.6	36.4	20.0	19.1	18.6
02:23:07	00:15:00	51.0	75.3	64.4	43.1	21.0	20.2	19.5

02:38:07	00:15:00	51.5	76.4	62.4	43.3	18.0	17.9	17.6
02:53:07	00:15:00	47.8	70.9	62.8	43.1	20.0	19.6	19.1
03:08:07	00:15:00	45.7	71.3	59.2	40.5	19.0	19.0	18.5
03:23:07	00:15:00	48.1	69.8	62.6	45.2	20.0	19.9	19.3
03:38:07	00:15:00	44.5	68.0	57.6	41.2	21.0	20.4	19.8
03:53:07	00:15:00	47.8	71.1	62.2	46.8	30.0	28.2	25.6
04:08:07	00:15:00	61.1	80.5	73.0	65.7	37.0	35.6	34.2
04:23:07	00:15:00	54.5	74.9	68.1	53.8	40.0	39.1	36.0
04:38:07	00:15:00	52.5	72.7	66.6	51.1	40.0	38.3	35.3
04:53:07	00:15:00	54.3	74.0	67.4	54.6	37.0	35.2	33.6
05:08:07	00:15:00	54.8	70.9	66.5	58.3	40.0	36.6	33.5
05:23:07	00:15:00	57.3	72.8	68.2	61.8	42.0	40.0	36.8
05:38:07	00:15:00	57.7	74.2	68.2	61.9	41.0	38.5	34.9
05:53:07	00:15:00	60.8	83.3	74.4	63.6	41.0	39.5	36.3
06:08:07	00:15:00	59.3	85.4	69.2	63.5	43.0	40.8	37.8
06:23:07	00:15:00	59.7	80.7	69.0	64.8	46.0	43.8	41.9
06:38:07	00:15:00	59.9	71.7	68.5	65.1	46.0	43.5	38.8
06:53:07	00:15:00	61.0	74.9	69.9	65.6	48.0	47.1	44.7
07:08:07	00:15:00	61.6	76.4	69.4	65.9	50.0	48.0	45.7
07:23:07	00:15:00	62.4	80.3	70.8	66.2	50.0	48.2	46.7
07:38:07	00:15:00	61.7	74.8	69.6	66.0	49.0	47.1	44.6
07:53:07	00:15:00	61.9	76.7	69.2	65.8	51.0	48.7	45.6
08:08:07	00:15:00	62.3	77.0	70.0	66.2	51.0	49.9	47.9
08:23:07	00:11:07	64.1	93.2	75.1	66.7	50.0	47.2	44.8

Appendix 3: Noise ingress calculations

Miller Goodall Environmental Services: Noise Ingress Calculation

MILLER GOODALL
ACOUSTICS AND AIR QUALITY

Project:	Land off South Newington Road	**Calcs By:**	Gareth Willox
Description:	First Floor Bedroon Night Time	**Date:**	31/05/2017

Calculation is based on methodology within BS 8233:2014 & BSEN ISO 12354-3. The following equation is utilised:

$L_{internal} = L_{external} - \Sigma R + 10 \log S/A - DL_{fs} + 3$

where A = 0.16V/T

and DL_{fs} is a correction to account for the influence of façade shape (e.g. where balconies or terraces are present)

This can be broken down further to:

$L_{eq,2} = L_{eq,ff}+10\text{xlog}\ ((A_0/Sx10^{(-D_{n,e}/10)})+(S_{wi}/Sx10^{(-R_{wi}/10)})+(S_{ew}/Sx10^{(-R_{ew}/10)})+(S_{rr}/Sx10^{(-R_{rr}/10)}))+10\text{xlog}\ (S/A)-DL_{fs}+3$

The above terms are described below:

Description	Term	Value
Total facade area (m2)	S_f	7.5
Window area (m2)	S_{wi}	1.5
External wall area (Sf - Swi)	S_{ew}	6
Area of ceiling (m2)	S_{rr}	12
Total area of elements (Sf + Srr)	S	19.5
Volume of receiving room (m3)	V	30
Reference absorption area (m2)	A_0	10
Number of ventilators in facade:		1
Façade shape correction	DL_{fs}	0

Room assessed:

Height: 2.5

Width: 3

Length: 4

Width is horizontal length of façade in question

See Annex C of BS EN 12354-3

Input	Octave band centre frequency, Hz								dBA	R_w	C_{tr}	$R_w + C_{tr}$	Description	Source
	63	125	250	500	1k	2k	4k	8k						
External Leq, freefield (dB Leq,ff)	57	51	46	48	52	48	45	39	55	-	-	-	Freefield night-time level	
External Lmax, freefield (dB Lmax,ff)	82	76	73	75	72	68	66	63	77	-	-	-	loudest Lmax Freefield night-time level	
Dne of each ventilator	30	34	40	39	42	49	49	49	-	44	-3	41	Greenwood Airvac Fusion HRV95	Mfrs test data
Total Dne of all ventilators	30	34	40	39	42	49	49	49	-	44	-3	41		
SRI of window (Rwi)	20	26	27	34	40	38	46	46	-	37	-4	33	10/12/6	Crib book
SRI of external wall (Rew)	35	37	42	52	60	63	68	68	-	54	-6	48	Double leaf 112 mm brickwork, 50 mm cavity, rigid wall ties	Crib book
SRI of roof and ceiling (Rrr)	22	28	34	40	45	49	55	55	-	44	-5	39	Tiles on felt, pitched roof with 100 mm wool on plasterboard ceilin	BS8233
Rev time of receiving room (T) - secs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	Habitable room ref Part E					Part E
All ventilators [eqn. B]	5E-04	2E-04	0	0	0	0	0	0	A0/S x 10^(-Dne/10)					
Glazing [eqn. C]	8E-04	2E-04	0	0	0	0	0	0	Swi/S x 10^(-Rwi/10)					
External wall [eqn. D]	1E-04	6E-05	0	0	0	0	0	0	Sew/S x 10^(-Rew/10)					
Ceiling [eqn. E]	0.004	1E-03	0	0	0	0	0	0	Srr/S x 10^(-Rrr/10)					
All ventilators [10 x log "B"]	-32.9	-36.9	-42.9	-41.9	-44.9	-51.9	-51.9	-51.9						
Glazing [10 x log "C"]	-31.1	-37.1	-38.1	-45.1	-51.1	-49.1	-57.1	-57.1						
External wall [10 x log "D"]	-40.1	-42.1	-47.1	-57.1	-65.1	-68.1	-73.1	-73.1						
Ceiling [10 x log "E"]	-24.1	-30.1	-36.1	-42.1	-47.1	-51.1	-57.1	-57.1						
All elements combined [eqn. F]	-22.8	-28.4	-33.3	-38.0	-42.2	-45.8	-49.8	-49.8	Log sum of equations B,C,D,E					
Equiv. absorption area of rec. room (m^2)	10	10	10	10	10	10	10	10						
10 x log(S/A) [eqn. G]	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1						
Façade shape correction, DL_{fs}	0	0	0	0	0	0	0	0						

Linear Spectra	63	125	250	500	1k	2k	4k	8k	dBA	Target	Exc.	
Internal Leq,2	40	29	19	16	16	8	1	-5	**21**	30	**-9**	Equations (A+F+G) - DLfs +3 dB
Internal Lmax,2	65	54	46	44	36	28	23	20	**45**	45	**0**	Equations (A+F+G) - DLfs +3 dB

DESIGNERS RISK ASSESSMENT

Project:	Land off South Newington Road, Bloxham, OX15 4HJ	**Job No.**	101539
		By/Date	31/05/17
		Approved **(Acoustic Consultant)**	JLM

Checklist of potential operations and hazards					
Potential Hazards	**Present**		**Potential Hazards/Operation**	**Present**	
Installing Gyproc planking	YES ☐	NO ☒	Overloading of structures	YES ☒	NO ☐
Noise	YES ☐	NO ☒	Manual handling	YES ☒	NO ☐
Vibration	YES ☐	NO ☒	Electricity	YES ☐	NO ☒
Fall from height	YES ☒	NO ☐	Water	YES ☐	NO ☐
Gas	YES ☐	NO ☒	Services	YES ☒	NO ☐
Falling material	YES ☐	NO ☐	Use of caulking or sealants	YES ☒	NO ☐
Unstable structure	YES ☒	NO ☐	Use of mineral wool	YES ☐	NO ☒
Dust	YES ☐	NO ☒		YES ☐	NO ☐
	YES ☒	NO ☐		YES ☐	NO ☐
	YES ☐	NO ☐		YES ☐	NO ☐
	YES ☐	NO ☐		YES ☐	NO ☐
	YES ☐	NO ☐		YES ☐	NO ☐
	YES ☐	NO ☐		YES ☐	NO ☐
	YES ☐	NO ☐		YES ☐	NO ☐
	YES ☐	NO ☐		YES ☐	NO ☐
	YES ☐	NO ☐		YES ☐	NO ☐
	YES ☐	NO ☐		YES ☐	NO ☐

Project:	Land off South Newington Road, Bloxham OX15 4HJ	**Job No.**	101539
		By/Date	31/05/17
		Approved (Acoustic Consultant)	JLM

Stage: Construction		**Sheet 1 of 4**
Hazard	**Action By Designer**	**Residual Hazard**
Installing plasterboard	**1. To eliminate hazard** Cannot eliminate.	
	2. To reduce hazard Advise the main contractor/ builder to undertake a detailed risk assessment and develop a suitable method statement in respect of installing plasterboard, in particular installing plasterboard ceilings at height. Use of board lifters and board handling equipment.	Follow manufacturers recommended safety guidelines during construction. Refer to data sheets from suppliers for more information. Risk of stability and durability issues. Client to seek further guidance from qualified and competent building designers on suitability of plasterboard constructions.
Overloading of structures	**1. To eliminate hazard** Do not exceed the maximum weight and loading restrictions, as advised by an experienced, competent and qualified structural engineer.	
	2. To reduce hazard Keep within recommended guidelines of acoustic design criteria and available construction products to achieve desired design output. Select products with lightest weights that can achieve required acoustic requirements.	Collapse of structure or falling materials through overloading. Client to seek advice and calculations from an experienced, competent and qualified structural engineer to ensure acoustic materials selected will not overload the structure.

Stage: Construction		**Sheet 1 of 4**
Hazard	**Action By Designer**	**Residual Hazard**
Dust	**1. To eliminate hazard** Cannot eliminate.	
	2. To reduce hazard Main contractor/ builder to keep materials in packaging until ready for use. Consider the use of face masks when cutting. See material data sheet for minimum FFP requirement. Operative must be face fit tested. Consider use of EN 166 eye protection to avoid dust in eyes. Carry out CoSHH assessment.	Cutting of Gyproc planking is generally low risk. However it may be an irritant to skin or respiratory system.
Noise	**1. To eliminate hazard** Cannot eliminate.	
	2. To reduce hazard Manual Handling Main contractor/ builder to undertake a detailed risk assessment and develop a suitable method statement in respect of construction phase noise and impact upon construction workers and surrounding areas. Consider establishing soundproofed areas for cutting and other noisy operations.	Risk of hearing damage. Risk of loss of acoustic amenity to neighbouring areas.
Manual Handling	**1. To eliminate hazard** Cannot eliminate.	
	2. To reduce hazard Main contractor/ builder to undertake a detailed risk assessment and develop a suitable method statement in respect of manual handling during construction. Consider use of smaller sizes of plasterboard to reduce weights.	Risk of musculoskeletal damage.

Stage: Construction		**Sheet 1 of 4**
Hazard	**Action By Designer**	**Residual Hazard**
Vibration	**1. To eliminate hazard** Cannot eliminate.	
	2. To reduce hazard Main contractor/ builder to undertake a detailed risk assessment and develop a suitable method statement in respect of construction phase vibration.	Risk of Hand Arm Vibration Syndrome to workers
Use of caulking or sealants	**1. To eliminate hazard** Cannot eliminate.	
	2. To reduce hazard Main contractor/ builder to undertake a detailed risk assessment and develop a suitable method statement in respect of use of caulking and sealants.	Follow manufacturers recommended safety guidelines during construction. Refer to data sheets from suppliers for more information. Consider wearing gloves
Falls from height	**1. To eliminate hazard** Cannot eliminate.	
	2. To reduce hazard Main contractor/ builder to undertake a detailed risk assessment and develop a suitable method statement in respect of falls from height. Consider the use of scaffolding, suitable work platforms and fall arrest systems.	Risk of injury and death.
Use of Mineral Wool	**1. To eliminate hazard** Cannot eliminate.	
	2. To reduce hazard Main contractor/ builder to undertake a detailed risk assessment and develop a suitable method statement in respect of use of mineral wool. Consider wearing gloves	Follow manufacturers recommended safety guidelines during construction. Refer to data sheets from suppliers for more information.

Stage: Construction		**Sheet 1 of 4**
Hazard	**Action By Designer**	**Residual Hazard**
Falling Material	**1. To eliminate hazard** Cannot eliminate.	
	2. To reduce hazard Main contractor/ builder to undertake a detailed risk assessment and develop a suitable method statement in respect of falling material Consider use of platforms, scaffold or similar to catch any falling materials.	Risk of injury from falling materials.
Unstable Structure	**1. To eliminate hazard** Cannot eliminate.	
	2. To reduce hazard Competent and qualified structural engineer to undertake calculations and determine if structure is capable of supporting additional weights associated with the acoustic design elements such as plasterboard ceilings to top floor and acoustic rated glazing.	Follow manufacturers recommended safety guidelines during construction. Refer to data sheets from suppliers for more information. Risk of stability and durability issues. Client to seek further guidance from qualified and competent building designers on suitability.

Glossary of Terms

Decibel (dB) The unit used to quantify sound pressure levels; it is derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure level the reference quantity is 20 µPa, the threshold of normal hearing is in the region of 0 dB, and 140 dB is the threshold of pain. A change of 1 dB is usually only perceptible under controlled conditions.

$L_{A90,T}$ The A weighted noise level exceeded for 90% of the specified measurement period (*T*). In BS 4142: 1997 it is used to define background noise level.

$L_{Aeq,T}$ The equivalent continuous sound level. The sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (*T*). $L_{Aeq,T}$ is used to describe many types of noise and can be measured directly with an integrating sound level meter.

L_{Amax} The highest A weighted noise level recorded during the time period. It is usually used to describe the highest noise level that occurred during the event.

NOEL No observed effect level: the level of noise exposure below which no effect at all on health or quality of life can be detected.

LOAEL Lowest observed adverse effect level: the level of noise exposure above which adverse effects on health or quality of life can be detected.

SOAEL Significant observed adverse effect level: the level of noise exposure above which significant adverse effects on health or quality of life can be detected.

R_w Single number rating used to describe the sound insulation of building elements and is defined in BS EN ISO 10140-2: 2010 (formerly BSEN ISO 140-3:1995). It is derived by measurement under laboratory conditions and does not take into account the effects of flanking transmissions.

$D_{nT,w}$ The weighted standardized level difference is a single figure rating used to describe the sound insulation of a construction separating two rooms, for example a wall or floor, and is defined in BS EN ISO 16283-1:2014 (formerly BSEN ISO 140-4:1998). It is derived by measurement of an in-situ construction and therefore takes into account the effects of flanking transmissions, workmanship etc.

$D_{ne,w}$ The weighted element-normalized level difference is a single figure rating used to describe the sound insulation of small elements within a larger construction and is defined in BS EN ISO 10140-2:2010 (BSEN ISO 140-10:1991). It is most often used to rate the sound insulation performance of ventilator units e.g. trickle vents.

C_{tr} A single-number spectrum adaptation term used to characterise the sound insulation rating with respect to urban traffic. It is defined in ISO 717-1:20-13.

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