Miller Goodall
Environmental Services

NOISE ASSESSMENT

on behalf of

JANET DIXON TOWN PLANNERS LTD

FOR THE SITE AT

LODEMATIC, PRIMROSE WORKS, PRIMROSE ROAD, CLITHEROE, BB7 1BS

REPORT DATE: 4TH FEBRUARY 2015

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Miller Goodall Environmental Services Ltd
214 Turton Road
Bradshaw
Bolton
Lancashire
BL2 3EE

Tel: 01204 596166

www.millergoodall.co.uk

Company registration number 5201673

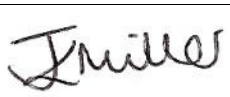
Summary

A noise assessment was undertaken to predict the potential impact of the existing noise climate on a proposed redevelopment of a former mill building currently occupied by Lodematic, Primrose Works, Primrose Road, Clitheroe, BB7 1BS. This was requested by the Local Authority to support a planning application for the development.

Measurements were made at the location of the proposed residential apartments overlooking the surrounding mill complex on the site to identify the pre-development ambient noise levels.

The measurement data was subsequently used to predict the potential noise levels within the proposed apartments. Noise mitigation measures have subsequently been recommended to control noise to appropriate levels.

With the implementation of the recommended mitigation measures, it is predicted that noise from activities associated with the adjacent Primrose Mill industrial estate may be controlled to acceptable levels and as such we do not see any reason why planning permission need be refused on the basis of noise.

Prepared By	Simon Faircloth MIOA	Reviewed By	Joanne Miller MIOA
Signed		Signed	
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Record of changes

Version	Date	Change	Initials
1	28/10/14	Draft issue for review	SF
2	29/01/15	Revised with latest plans	SF
3	04/02/15	Updated site location plan	SF

Contents

1 Introduction

1.1 Miller Goodall Environmental Services Ltd (MGES) has, on behalf of Janet Dixon Town Planners Ltd of 144 Woone Lane, Clitheroe, Lancs, BB7 1BN, undertaken a noise assessment in respect of the impact of noise from existing noise sources on a proposed residential development on the Lodematic (Components) Ltd site at Primrose Works, Primrose Road, Clitheroe ("the site"). This was requested by Ribble Valley Borough Council (RVBC) to support a planning application.

2 Site Description

2.1 The proposed site comprises a three storey former mill building and smaller ancillary workshop buildings owned and operated by Lodematic (Components) Ltd and used for the manufacturing of hydraulic components.

2.2 The site is located north-west and adjacent to Primrose Mill Business Park, a series of former mill buildings located off Primrose Road which are currently used predominantly for various light industrial uses and retail. The closest unit to the Lodematic building is Decron Ltd (a scaffolding contractor) with access to this unit via roller shutter doors located directly opposite the building to the south.

2.3 The site is located approximately 1 km south west from the centre of Clitheroe and access to the site is provided via a junction with Primrose Road and Woone Lane. The main mill building overlooks a communal car park used by the adjacent Primrose Studios office building and tenants of Primrose Mill. There is also access to a single detached private residence (Primrose House) to the south-west of the site.

2.4 Another site of former mill buildings to the immediate north of the site (Montgomerie Gardens) is currently undergoing extensive re-development to form housing consisting of 2 bed apartments and 3/4 bed homes.

3 Proposed Development

3.1 Proposals for the redevelopment of the Lodematic site include:

- Conversion of No. 3 workshop and demolition of No. 1 and No. 2 workshop to provide 14 units
- New build block of flats to the north of the main mill building to form four additional 2 bedroom units

3.2 The proposed site plan s provided in Appendix 1.

4 Local Authority Requirements

4.1 Pre-application advice was provided by RVBC in a document produced by Rachel Horton, a Pre-Planning Advice Officer, in July 2014 (document ref. RV/2014/ENQ/00064).

4.2 The following advice was issued relating to noise:

Given the potential close proximity of the dwellings to existing business premises at Primrose Mill, consideration will need to be made as to whether the site is suitable for residential development given potential noise disturbance, and therefore a noise assessment should be submitted with any subsequent application. I am also mindful of the potential conflict with existing businesses in the area and para. 123 of the NPPF which states that "existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established".

5 Policy Context

5.1 Noise Policy Statement for England

5.1.1 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."

5.1.2 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.

5.1.3 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".

5.1.4 Importantly, the NPSE goes on to state:

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

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

5.1.5 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"

5.1.6 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.

5.2 National Planning Policy Framework

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

5.2.2 Paragraph 109 of the NPPF states that the planning system should contribute to and enhance the natural and local environment by, (amongst others) "preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, water or noise pollution or land stability".

5.2.3 The NPPF goes on to state in Paragraph 123 "planning policies and decisions should aim to:

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

5.2.4 The NPPF document does not refer to any other documents regarding noise other than NPSE.

5.3 Planning Practice Guidance – Noise

5.3.1 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

[2] National Planning Policy Framework, DCLG, March 2012
[3] Planning Policy Guidance 24: Planning and Noise, DCLG, September 1994
[4] Planning Practice Guidance – Noise, http://planningguidance.planningportal.gov.uk/blog/guidance/noise/, 06 March 2014

- Whether or not a good standard of amenity can be achieved.

5.3.2 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".

5.3.3 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.

5.3.4 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".

5.3.5 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.

6 Acoustic Standards and Guidance

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

6.1.1 This recently updated 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)[5]. These guideline noise levels are shown in **Error! Reference source not found.**, 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:

> *"regular individual noise events…can cause sleep disturbance. A guideline value may be set in terms of SEL[6] 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[7] makes reference to research that indicates sleep disturbance from noise events at indoor levels as low as 42 dB L_{AFmax}.

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}.

[5] World Health Organisation Guidelines for Community Noise, 1999
[6] Sound exposure level or L_{AE}
[7] WHO Night Noise Guidelines for Europe 2009

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 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.

7 Noise Survey

7.1 Measurements of Existing Noise Sources

7.1.1 Noise measurements were undertaken at the site in accordance with BS 7445-1: 2003[8] by Simon Faircloth and Jack Caton of Miller Goodall Environmental Services 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 Sound Analyser	Type NOR 140	Norsonic	1406017	26/06/14	476899108
Microphone	Type NOR 1225	Norsonic	180243	26/06/14	476899108
Calibrator	Type NOR 1251	Norsonic	34123	01/07/14	CAL 022-2014-4644

7.1.2 Background and ambient noise monitoring was undertaken at the times specified in Table 3 below.

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

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

Measurement Location	Date	Time	Weather conditions
Noise logger	01/10/14 to 02/10/14	14:32 (01/10) to 15:00 (02/10)	Overcast with bright spells, dry, 5 - 15°C and a light west to south westerly breeze with a speed of approximately 1 – 5 m/s.

7.1.3 Measurements were made over a 24 hour period to determine noise levels impacting the proposed residential premises during both daytime and night-time periods. A microphone was installed out of a 2nd storey window of the main Lodematic building facing south towards the wider industrial estate at a distance of approximately 1 m from the facade. The results from the noise logger will therefore include a facade reflection component necessitating a correction to convert them to free-field for subsequent analysis.

7.1.4 The measurement location is shown in the aerial photograph in Figure 1 and the photograph in Figure 2, below.

Figure 1: Site plan and measurement location

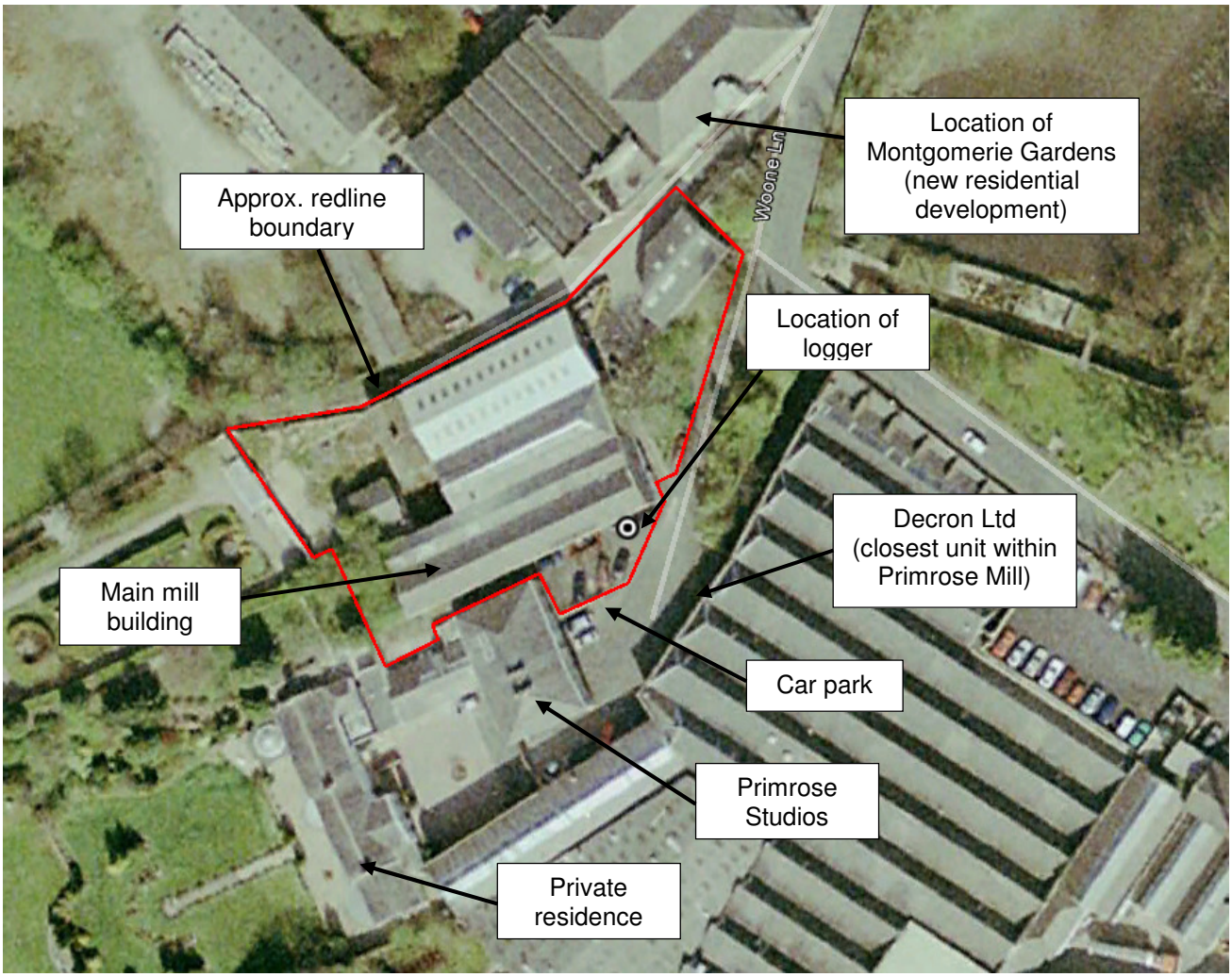


Figure 2: Photograph of measurement location (microphone circled)

7.1.5 In addition to measuring the sound pressure levels at the microphone location, the equipment was set to automatically trigger a sound recording function, should the instantaneous sound pressure level exceed a value of 65 dB L_A. Subsequent play-back of the recordings allowed key noise events to be analysed and identified.

7.1.6 The noise sources affecting the proposed site at the location of the microphone included the following:

- Constant underlying noise from nearby stream;
- Occasional noise from waste materials associated with Lodematic being loaded into a skip;
- Occasional bangs and clatters from an industrial unit to the immediate south of Lodematic (Decron Ltd – scaffolding contractors);
- Vehicles entering and leaving car park, including noise from loose metal drainage grate at car park entrance;
- Occasional distant traffic on Woone Lane/Primrose Road.

7.2 Monitoring Results

7.2.1 A summary of the free-field broadband measurement data is provided in Table 4, having been corrected for facade reflections by deducting 3 dB from the as-measured levels. All data are sound pressure levels in dB re 20 μPa.

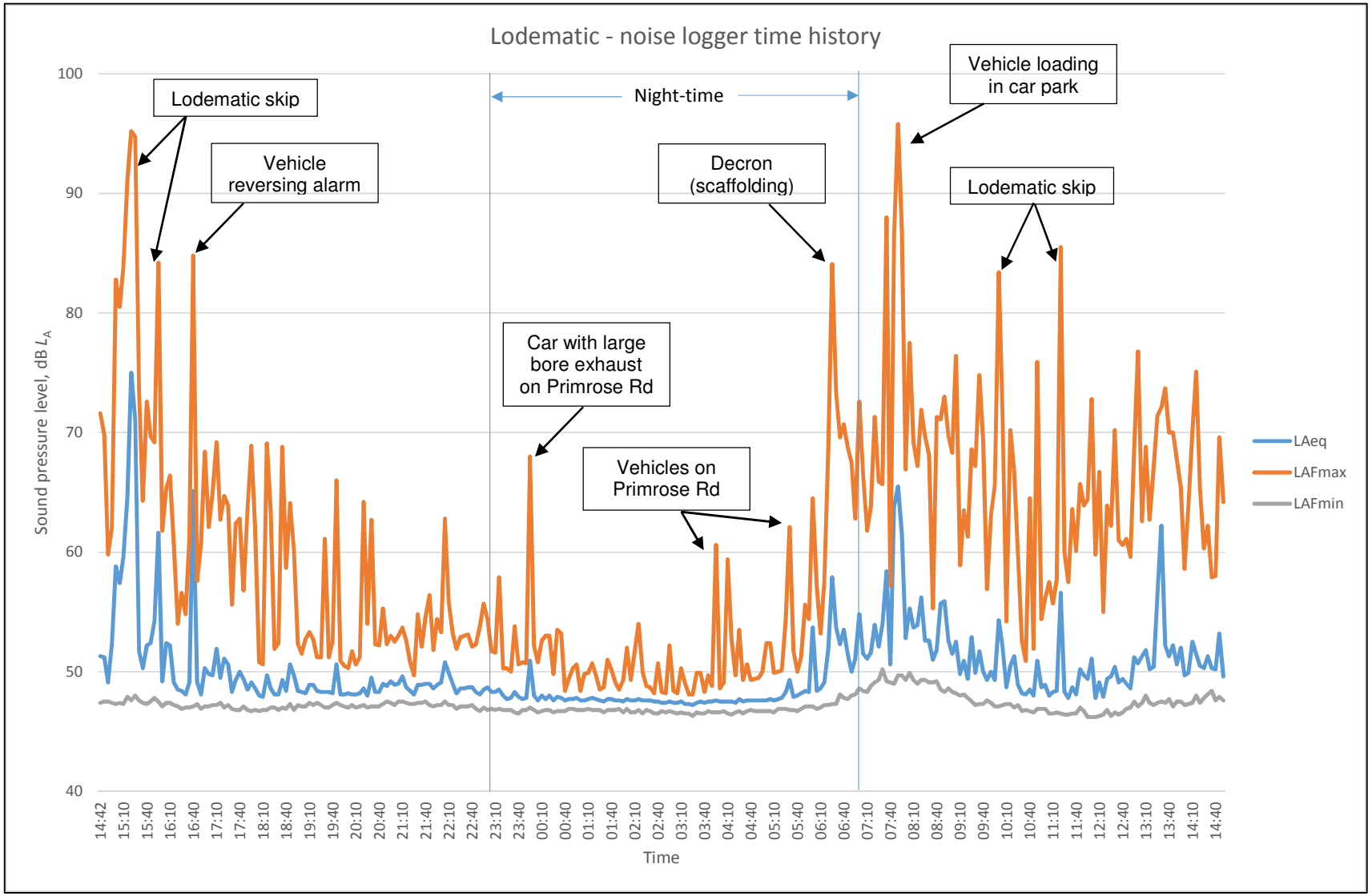
Table 4: Summary of noise measurements at noise logger location (night-time period highlighted)

Date	Start Time	Elapsed Time (hr:min:sec)	$L_{Aeq,T}$ (dB)	Overall L_{AFmax} (dB)	$L_{AF10,T}$ (dB)	$L_{AF90,T}$ (dB)	$L_{AFmin,T}$ (dB)
01/10/14	14:32	00:27:55	65	100	55	48	41
01/10/14	15:00	01:00:00	66	95	58	48	47
01/10/14	16:00	01:00:00	56	85	51	48	47
01/10/14	17:00	01:00:00	50	69	51	48	47
01/10/14	18:00	01:00:00	49	69	49	48	47
01/10/14	19:00	01:00:00	49	66	49	48	47
01/10/14	20:00	01:00:00	49	64	49	48	47
01/10/14	21:00	01:00:00	49	56	50	48	47
01/10/14	22:00	01:00:00	49	63	50	48	47
01/10/14	23:00	01:00:00	48	68	49	47	47
02/10/14	00:00	01:00:00	48	54	48	47	47
02/10/14	01:00	01:00:00	48	51	48	47	47
02/10/14	02:00	01:00:00	48	54	48	47	47
02/10/14	03:00	01:00:00	47	61	48	47	46
02/10/14	04:00	01:00:00	48	59	48	47	46
02/10/14	05:00	01:00:00	48	62	49	47	47
02/10/14	06:00	01:00:00	53	84	54	48	47
02/10/14	07:00	01:00:00	59	96	55	50	48
02/10/14	08:00	01:00:00	54	78	54	50	48
02/10/14	09:00	01:00:00	51	76	52	48	47
02/10/14	10:00	01:00:00	50	83	50	48	47
02/10/14	11:00	01:00:00	50	86	50	47	46
02/10/14	12:00	01:00:00	50	73	50	47	46
02/10/14	13:00	01:00:00	55	77	53	48	47
02/10/14	14:00	01:00:00	52	76	52	49	42

7.2.2 Each hour long measurement period contained contiguous 5 minutes measurements which enabled a time history to be generated (see Figure 3). Where the loudest noise events could be identified from triggered sound recordings, these have been annotated to the time history. The full 5 minute measurement data have not been reported in this document but will be kept on file for future reference.

7.2.3 A log of the recorded noise events that exceeded 65 dB L_A is provided in Appendix 2.

Figure 3: Time history at logger location



7.2.4 Following analysis of the time history in Figure 3, the log of recorded noise events in Appendix 2 and from site observations, the following conclusions were made:

- There is constant background noise affecting the site that is generally no lower than 47 dB L_{A90} and is due to the stream passing the site to the east;
- Many of the high-noise events measured during the day were generated by activities associated with Lodematic, e.g. emptying of waste materials into a skip;
- There were only four occasions where relatively high noise level events (>60 dB L_{AFmax}) occurred overnight between the hours of 23:00 and 06:00 and these were all due to individual vehicles on Primrose Road;
- From 06:00, several noisy events were measured and these were found to be caused by scaffolding poles being loaded onto a trailer in the Decron unit opposite the Lodematic building. It is our understanding that Decron regularly load their vehicles from 06:00 on weekdays.

7.2.5 Although the overall night-time noise levels were not considered excessively high, the period between 06:00 and 07:00 experienced elevated noise levels (particularly the L_{AFmax} level) as a result of activities within the Decron unit and car park. As these are likely to occur regularly, it is considered appropriate that any assessment of night-time noise should take this loudest part of the night into account.

7.2.6 Designing an external facade to a single noise event that occurred towards the end of the night is considered excessive. It is, however, considered reasonable to assess noise based on a 'typical' noise level during that loudest 1 hour period. In doing so, noise generated by existing commercial uses operating from Primrose Mill should be adequately mitigated against. This should, therefore, enable these businesses to continue normal operations without unduly disturbing any future residential neighbours, in line with guidance provided in the NPPF PPG for noise (see Section 5.3).

7.2.7 For the purposes of assessment, it is considered that the 95th percentile of measured $L_{Fmax,5min}$ noise levels between 06:00 and 07:00 would be an appropriate design noise source level; this equates to a broadband noise level of 78 dB $L_{AFmax.}$ Night-time L_{eq} levels were again assessed between 06:00 and 07:00 (53 dB L_{Aeq}); daytime noise levels were assessed using logarithmically averaged L_{eq} levels for the period between 07:00 and 23:00 (58 dB L_{Aeq}).

7.2.8 This source data is provided in Table 5 below. The data is free-field corrected at the location of the logger. Ground floor rooms were also assessed and noise levels were corrected for the slightly shorter source-to-receiver distance compared to the second floor location of the logger.

Table 5: Octave band free-field external noise level spectra

Measurement Descriptor	Sound Pressure Level, dB in Octave Band Centre Frequency, Hz								dB L_A
	63	125	250	500	1k	2k	4k	8k	
Daytime L_{eq}	58	51	49	49	51	53	50	42	58
Night-time L_{eq}	56	48	47	48	49	47	40	32	53
Night-time L_{max}	77	74	71	73	72	74	68	57	78

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. As indicated in section 6.3, these levels could equate to the LOAEL. The proposed upper limit for individual noise events is an indoor level of 45 dB $L_{AFmax.}$ This level could be attributed to the SOAEL since it is generally accepted that noise events that regularly exceed this level may cause disturbance to sleep.

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[9] 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_{AFmax} during the night.

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[10]. Measurements of room dimensions were assumed, based on indicative layouts provided by the client.

8.1.4 Noise ingress calculations were undertaken for the south facade of the proposed development (where noise levels are highest) for both daytime and night-time periods, although the standards are more onerous for night-time periods.

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

[10] 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 An example of a noise ingress calculation is provided in Appendix 3 with a summary of the results in Table 6.

Table 6: 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)	54	79	20	44	30	45	-10	-1	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 35 dB $R_W + C_{tr}$ (e.g. 10/12/6.4 laminated); ventilators with a minimum element normalised sound level difference of 46 dB $D_{ne,W}$.
  Where required: South and east facing bedrooms in plots 2, 5, 6, 7, 8, 11, 12, 13.
- **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 30 dB $D_{ne,W}$.
  Where required: South and east facing living rooms/dining kitchens in plots 2, 4, 5, 6, 7, 8, 12, 13, 14.

8.1.6 The above glazing and ventilation options are required to all habitable rooms on the south and east facing elevations of the main Lodematic building. Habitable rooms located on north and west facing elevations of the Lodematic building, or to the new building housing plots 15 to 19 located to the north of the main building, do not have any specific glazing or ventilation requirements, as the main mill building will provide significant acoustic shielding to dwellings behind it.

8.1.1 There are a number of ventilator suppliers who will be able to advise on acoustically rated trickle ventilators. These include: Rytons, Renson, Caice, Greenwood and Vent-Axia. Additional information on ventilation is provided in Section 9.

8.1.2 It is to be appreciated that many of the loud individual noise events measured during the survey were generated by Lodematic itself and would not, therefore, be present following redevelopment of the site. This is likely to result in slightly lower ambient noise levels during the day although night-time noise would not generally be affected. Note that Lodematic's current operational hours are between 08:00 and 16:40 weekdays only, with occasional overtime between 07:00 and 08:00 (plus up to 18:00 if necessary).

8.2 External Noise Levels

8.2.1 The current masterplan indicates some external amenity space to the north of the retained mill building plus some new planting to the south. Although the measured daytime noise level was 58 dB $L_{Aeq,07:00-23:00}$, this included the contribution of noise from existing Lodematic operations. In the absence of this

activity noise, it is anticipated that any amenity areas to the south of the main mill building will achieve the target WHO external daytime noise limit of 55 dB $L_{Aeq,T}$ without any further mitigation.

8.2.2 Amenity areas to the north of the mill building, including any associated with plots 15 – 18, will benefit from shielding provided by the mill and are therefore likely to achieve daytime noise levels below 55 dB $L_{Aeq,T}$ without any further mitigation.

9 Recommended Mitigation Measures

9.1 Building Envelope - Glazing and Ventilation

9.1.1 As detailed in Table 6, the following acoustic performance specifications are required to habitable rooms on the south and east facing facades of the mill building:

- **Option 1** - Glazing with minimum weighted sound reduction index of 35 dB $R_W + C_{tr}$ (e.g. 10/12/6.4 laminated); ventilators with a minimum element normalised sound level difference of 46 dB $D_{ne,W}$.
  Where required: South and east facing bedrooms in plots 2, 5, 6, 7, 8, 11, 12, 13.
- **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 30 dB $D_{ne,W}$.
  Where required: South and east facing living rooms/dining kitchens in plots 2, 4, 5, 6, 7, 8, 12, 13, 14.

9.1.2 All other rooms on west and north facing elevations and those to plots 15 to 18 are not exposed to high levels of noise and have no specific acoustic requirements.

9.1.3 It can be seen from Table 6, however, that the L_{Amax} levels of individual noise events (e.g. noise from vehicles being loaded in the Decron unit) are significantly higher than those considered appropriate for basic open window ventilation solutions.

9.1.4 Whilst the provision of acoustic trickle ventilators will allow background ventilation to be achieved in conjunction with the required indoor noise levels, it may be necessary to consider alternative ventilation solutions in order to achieve compliance both with Part F of the Building Regulations (ventilation) and with the required indoor noise levels. These alternative solutions could be in the form of continuous mechanical extract (MEV) or continuous mechanical supply and extract with heat recovery (MVHR) systems. The M&E consultant will be able to advise on the suitability of mechanical ventilation systems.

9.1.5 Should such a system be considered, it is important that they be selected for low noise operation and it is recommended that a noise level of no more than 28 dB L_A as a result of the operation of the ventilation system should be targeted within habitable rooms. Furthermore, any openings to south or east facing facades that may be required for supply and/or extract ducting would need to be acoustically attenuated to prevent noise break-in (the same acoustic specification as specified for trickle vents would be appropriate).

10 Conclusions

10.1 A noise assessment has been undertaken at the site of a proposed redevelopment of a former mill to residential use to support a planning application. Continuous unattended noise measurements have been made to determine the ambient noise levels affecting the proposed dwellings at the site. The measured data has been used to predict the impact of existing noise sources on future users of the residential accommodation. A recommended glazing and ventilation specification has been provided to enable the recommended internal noise limits to be achieved within the properties.

10.2 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.

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 only perceptible under controlled conditions.

dB(A) Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB (A) broadly agree with people's assessment of loudness. A change of 3 dB (A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise level in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 meter; heavy road traffic about 80 dB(A) at 10 meters; the level near a pneumatic drill about 100 dB(A).

$L_{A90,T}$ The A weighted noise level exceeded for 90% of the specified measurement period (T). In BS 4142: 1990 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.

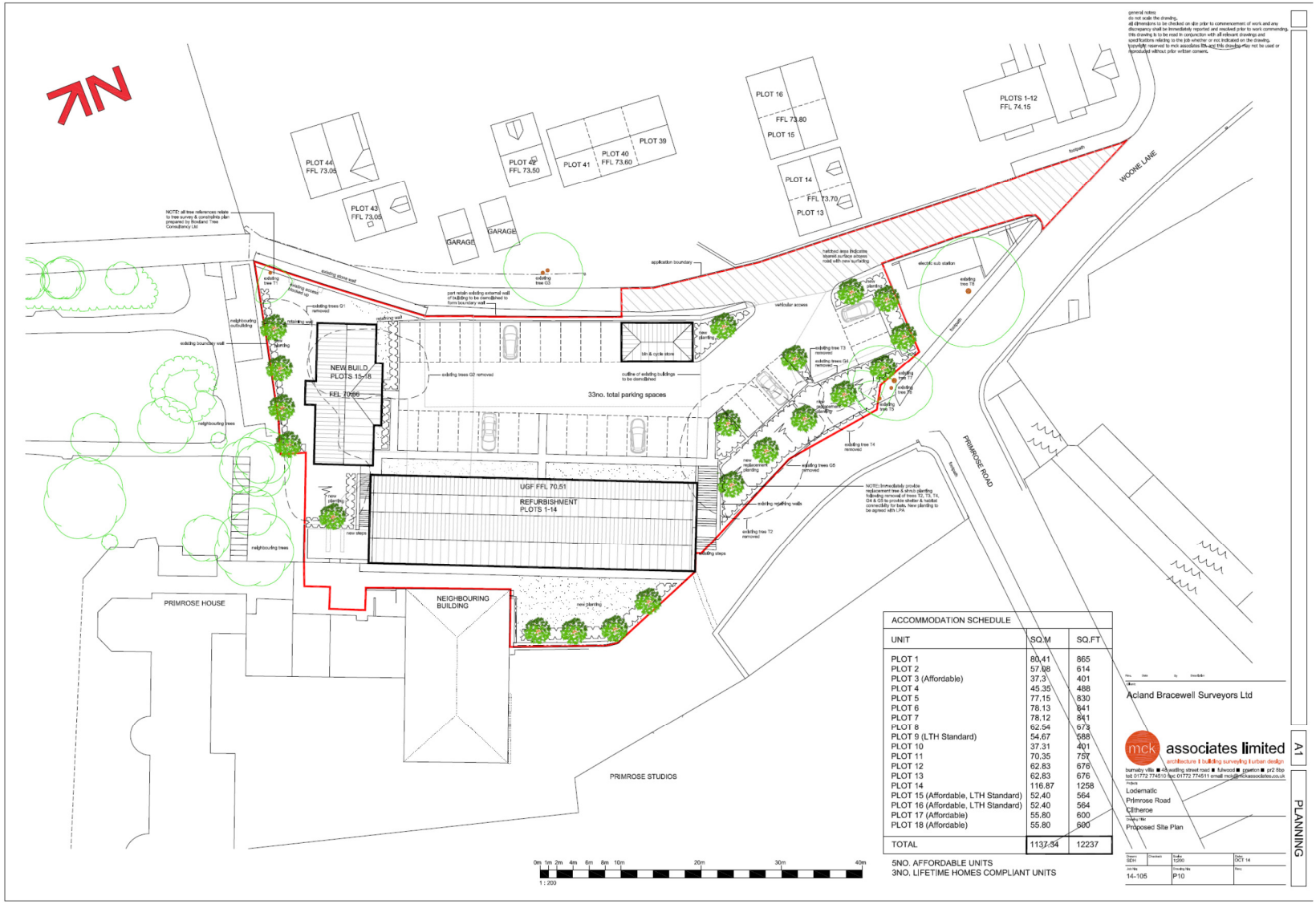
L_{Amax} The highest A weighted noise level recorded during the time period. It is usually used to describe the highest noise level that occurred during the event.

R_w *S*ingle number rating used to describe the sound insulation of building elements and is defined in BSEN ISO 140-3: 1995. It is derived by measurement under laboratory conditions and does not take into account the effects of flanking transmissions.

$D_{ne,w}$ 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 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 spectrum adaptation term used to characterise the sound insulation rating with respect to urban traffic.

Appendix 1: Proposed site plan



Appendix 2: Log of noise events that exceeded 65 dB L_A trigger level

Log of events from start of measurement period on 01/10/14 until 08:00 on 02/10/14. Shaded events occurred during night-time period (23:00 – 07:00).

Time	Description
14:46	Car in car park starting up
14:50	Car in car park starting up and pulling away
14:58	Alarm within Lodematic
15:00	Clatter of metal on metal (scaffolding - Decron)
15:07	Clatter of metal from loading bay at Lodematic
15:10	Clatter of metal from loading bay at Lodematic
15:18	Clatter of metal from loading bay at Lodematic
15:20	Loading skip below mic (Lodematic)
15:25	Loading skip below mic (Lodematic)
15:30	Clatter of metal (Lodematic)
15:38	Loud thump
15:40	Reversing alarm - vehicle in car park
15:45	Clatter of metal from loading bay at Lodematic
15:50	Clatter of metal from loading bay at Lodematic
15:55	Clatter of metal from loading bay at Lodematic
15:58	Reversing alarm - vehicle in car park
16:05	Moving materials
16:10	Vehicle leaving car park
16:42	Prolonged vehicle horn sounding
16:57	Vehicle leaving car park
17:02	Vehicle leaving car park
17:06	Vehicle entering car park
17:11	Vehicle leaving car park
17:17	Vehicle leaving car park
17:23	Goods vehicle leaving car park
17:27	Vehicle leaving car park
17:35	Alarm within Lodematic
17:44	Vehicle leaving car park
17:50	Vehicle leaving car park
17:57	Vehicle leaving car park
18:01	Vehicle leaving car park
18:16	Goods vehicle leaving car park
18:24	Goods vehicle leaving car park
18:38	Vehicle entering car park
18:47	Vehicle entering car park
18:50	Goods vehicle leaving car park
19:49	Wheeled trolley in yard
20:23	Dog barking
20:34	Dog barking
22:07	Clatter
23:59	Car with large bore exhaust on road
05:30	Car with large bore exhaust on road
06:01	Vehicle entering car park (Decron)
06:21	Clattering of metal on metal (scaffolding - Decron)
06:25	Clattering of metal on metal (scaffolding - Decron)
06:30	Vehicle entering car park
06:35	Clattering of metal on metal (scaffolding - Decron)
06:40	Vehicle entering car park
06:46	Vehicle entering car park
06:53	Clattering of metal on metal (scaffolding - Decron)
06:59	Birdsong

07:01	Vehicle entering car park
07:05	Wheeled trolley below (Lodematic?)
07:05	Item being dropped in skip (Lodematic?)
07:18	Vehicle entering car park
07:21	Clattering of metal on metal (Decron?)
07:26	Clattering of metal on metal (Decron?)
07:33	Vehicle entering car park
07:35	Talking on phone
07:45	Vehicle entering car park
07:50	Loading of vehicle?
07:55	Vehicle entering car park
07:59	Item being dropped in skip (Lodematic?)

Appendix 3: Example of noise ingress calculation

Miller Goodall Environmental Services: Noise Ingress Calculation

Miller Goodall Environmental Services

Project:	Lodematic, Clitheroe	**Calcs By:**	JC
Description:	South facing bedroom, GF, NT	**Date:**	27/01/2015

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

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

where A = 0.16V/T

This can be broken down further to:

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

The above terms are described below.

Description	Term	Value	
Total facade area (m2)	S_f	8.5	Room assessed: Bedroom, 3.4 m wide x 2.35 m deep x 2.5 m high
Window area (m2)	S_{wi}	2.7	
External wall area (Sf - Swi)	S_{ew}	5.8	
Area of ceiling (m2)	S_{rr}	0	
Total area of elements (Sf + Srr)	S	8.5	
Volume of receiving room (m3)	V	20	
Reference absorption area (m2)	A_0	10	
Number of ventilators in facade:		2	

	Octave band centre frequency, Hz												
	63	125	250	500	1k	2k	4k	8k	dBA	Rw	Ctr	Rw+ Ctr	Notes
External Leq, freefield (dB Leq,ff)	57	49	48	49	50	48	41	33	54	-	-	-	Freefield night-time level (06:00 - 07:00) - assumed 1
External Lmax, freefield (dB Lmax,ff)	78	75	72	74	73	75	69	58	79	-	-	-	Freefield 98th % Lmax over night-time period - assum
Dne of each ventilator	29	33	39	41	48	52	52	52		46	-4	42	Greenwood AAF/S mech vent system
Total Dne of all ventilators	26	30	36	38	44	49	49	49		43	-4	39	
SRI of window (Rwi)	21	27	29	36	41	42	52	52		39	-4	35	10/12/6.4
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 w
SRI of roof and ceiling (Rrr)	25	31	37	43	48	52	58	58		47	-5	42	Tiles on felt, pitched roof with 270 mm wool on plast
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
All ventilators [eqn. B]	0	0	0	0	0	0	0	0					A0/S x 10^(-Dne/10)
Glazing [eqn. C]	0	0	0	0	0	0	0	0					Swi/S x 10^(-Rwi/10)
External wall [eqn. D]	0	0	0	0	0	0	0	0					Sew/S x 10^(-Rew/10)
Ceiling [eqn. E]	0	0	0	0	0	0	0	0					Srr/S x 10^(-Rrr/10)
All ventilators [10 x log "B"]	-25.1	-29.1	-34.9	-37.0	-43.8	-48.3	-48.3	-48.3					
Glazing [10 x log "C"]	-26.0	-32.0	-34.0	-41.0	-46.0	-47.0	-57.0	-57.0					
External wall [10 x log "D"]	-36.7	-38.7	-43.7	-53.7	-61.7	-64.7	-69.7	-69.7					
Ceiling [10 x log "E"]	#####	#####	#####	#####	#####	#####	#####	#####					
All elements combined [eqn. F]	-22.3	-27.0	-31.1	-35.5	-41.7	-44.5	-47.7	-47.7					Log sum of equations B,C,D,E
Equiv. absorption area of rec. room (m	6	6	6	6	6	6	6	6					
10 x log(S/A) [eqn. G]	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2					

	63	125	250	500	1k	2k	4k	8k	dBA		Target	Exc.	
Internal Leq,2	39	26	22	18	12	7	-2	-11	20		30	-10	Equations (A+F+G) +3 dB
Internal Lmax,2	60	52	45	42	36	34	25	14	44		45	-1	Equations (A+F+G) +3 dB