BETTER SOLUTIONS, INTELLIGENTLY ENGINEERED

ENVIRONMENT

Barratt Homes & David Wilson Homes

Halifax Road,

Barnsley

Noise Impact Assessment

LDP2246

www.bwbconsulting.com

ENVIRONMENT

Barratt Homes and David Wilson Homes

Halifax Road

Barnsley

Noise Impact Assessment

Birmingham
Livery Place, 35 Livery Street, Colmore Business District, Birmingham, B3 2PB
T: 0121 233 3322

Cambridge
14-16 High Street, Histon, Cambridge
CB24 9JD
T: 01223 235 173

Leeds
Whitehall Waterfront, 2 Riverside Way, Leeds
LS1 4EH
T: 0113 233 8000

London
11 Borough High Street
London, SE1 9SE
T: 0207 407 3879

Manchester
4th Floor Carvers Warehouse, 77 Dale Street
Manchester, M1 2HG
T: 0161 233 4260

Market Harborough
12a Woodcock House, Compass Point Market Harborough, Leicestershire, LE16 9HW
T: 01858 455020

Nottingham
Waterfront House, Station Street, Nottingham NG2 3DQ
T: 0115 924 1100

DECEMBER 2018

DOCUMENT ISSUE RECORD

Revision	Date of Issue	Status	Author:	Checked:	Approved:
1	23/11/2018	Draft	Lucy Elmer BA (Hons), MSc, AMIOA	Mike Barrett BSc (Hons), PGDip, MIOA	
2	03/12/2018	Draft	Lucy Elmer BA (Hons), MSc, AMIOA	Mike Barrett BSc (Hons), PGDip, MIOA	Mike Barrett BSc (Hons), PGDip, MIOA

Notice

EXECUTIVE SUMMARY

This noise assessment has been produced to support a detailed planning application for a proposed residential development at Land off Halifax Road, Barnsley.

The existing noise environment is dominated by road traffic on Halifax Road, Well House Lane and the surrounding road network.

A baseline noise survey was undertaken at the Site in November 2018. The results of the survey, and subsequent assessment work, have been assessed in accordance with current standards and guidance, following consultation with Barnsley Metropolitan Borough Council.

The assessment shows that, with appropriate consideration to noise mitigation measures, including the provision of appropriate glazing and ventilation to the façade facing directly onto Halifax Road and Well House Lane, an appropriate level of protection could be afforded to future noise sensitive receptors on the Site.

For the proposed dwelling located closest to Halifax Road, all criteria would be achieved with standard thermal double glazing such as a configuration of 4mm pane / 12mm airgap / 4mm pane, which would need to provide a minimum Rw + Ctr of 27 dB. Acoustic ventilators, which achieve a minimum performance of Dn,e,w + Ctr 35 dB would be required.

For the remaining dwellings located closest to Halifax Road, all criteria would be achieved with standard thermal double glazing such as a configuration of 4mm pane / 12mm airgap / 4mm pane, which would need to provide a minimum Rw + Ctr of 27 dB. Trickle ventilators, which achieve a minimum performance of Dn,e,w + Ctr 32 dB would be required.

For the proposed dwelling located closest to Well House Lane, all criteria would be achieved with standard thermal double glazing such as a configuration of 4mm pane / 12mm airgap / 4mm pane, which would need to provide a minimum Rw + Ctr of 27 dB. Acoustic ventilators, which achieve a minimum performance of Dn,e,w + Ctr 35 dB would be required.

For the remaining dwellings located closest to Well House Lane, all criteria would be achieved with standard thermal double glazing such as a configuration of 4mm pane / 12mm airgap / 4mm pane, which would need to provide a minimum Rw + Ctr of 27 dB. Trickle ventilators, which achieve a minimum performance of Dn,e,w + Ctr 32 dB would be required.

For rooms with no angle of view onto the roads, it is likely that internal noise levels will be achieved with open windows.

Based on the results of the assessment, it has been demonstrated that the Site is suitable for residential development. It is therefore considered that noise need not be a determining factor in the granting of detailed planning for the Proposed Development.

CONTENTS

FIGURES

APPENDICES

1. INTRODUCTION

Appointment & Background

1.1 BWB Consulting Ltd was appointed by the client to undertake an environmental noise assessment for a proposed residential development at Land off Halifax Road, Barnsley.

1.2 This assessment has been undertaken based on the results of a baseline noise survey on the Site. The results of the survey have been assessed in accordance with current standards and guidance, following consultation with Barnsley Metropolitan Borough Council.

1.3 Where appropriate, consideration has been given to noise mitigation measures to demonstrate how an appropriate level of protection could be afforded to future noise sensitive receptors on the Site.

1.4 This report is necessarily technical in nature, so to assist the reader, a glossary of acoustic terminology can be found in **Appendix A**.

Site Setting

1.5 The proposed development site currently comprises open land. To the north, the site is bordered by Halifax Road, with open land beyond. To the north east, the site is bordered by a railway line with open land and existing dwelling beyond. To the east, the site is bordered by existing dwellings off Well House Lane with Well House Lane beyond. To the south, the site is bordered by existing dwellings off Well House Lane with Barnsley Road beyond. To the west, the site is bordered by open land. To the north west, the site is bordered by an existing commercial premises off Halifax Road, with open land beyond.

1.6 **Figure 1.1** shows the Site location.

Figure 1.1: Site Context Plan

Proposed Development

1.7 The proposed development will comprise the construction of approximately 459 residential dwellings and associated infrastructure. An indicative layout is shown below in **Figure 1.2.**

Figure 1.2: Indicative Site Layout

2. STANDARDS AND GUIDANCE

National Planning Policy Framework (NPPF)

2.1 Published in July 2018, this document sets out the Government's planning policies for England and supersedes the previous NPPF published in 2012. It makes the following reference to noise in the section entitled *Conserving and enhancing the natural environment*:

"170. 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 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."

2.2 It also makes the following references to noise in the Section entitled *Ground conditions and pollution*:

"180. 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[60];

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.

[60] See Explanatory Note to the Noise Policy Statement for England (Department for Environment, Food & Rural Affairs, 2010)."

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

2.3 This standard provides guidance for the control of noise in and around buildings. The guidance provided within the document is applicable to the design of new buildings, or refurbished buildings undergoing a change of use, but does not provide guidance on assessing the effects of changes in the external noise levels to occupants of an existing building.

2.4 The guidance provided includes appropriate internal and external noise level criteria which are applicable to dwellings for steady external noise sources. It is stated that it is desirable that the internal ambient noise level does not exceed the following criteria set out in **Table 2.1** below:

Table 2.1: Summary of Internal Ambient Noise Levels to be achieved in Habitable Rooms when Assessed in Accordance with BS 8233

Activity	Location	Period	
		07:00 to 23:00 Hours, i.e. Daytime	23:00 to 07:00 Hours, i.e. Night-time
Resting	Living Room	35 dB $L_{Aeq, 16\ Hour}$	-
Dining	Dining Room/area	40 dB $L_{Aeq, 16\ Hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq, 16\ Hour}$	30 dB $L_{Aeq, 8\ Hour}$

2.5 Whilst BS 8233:2014 recognises that a guideline value may be set in terms of SEL or L_{AFmax} for the assessment of regular individual noise events that can cause sleep disturbance during the night-time, a specific criterion is not stipulated. Accordingly, reference has been made in this assessment to the World Health Organisation (WHO) 1999: *Guidelines for Community Noise* below.

2.6 With respect to external amenity space such as gardens and patios it is stated that it is desirable that the noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. It is then confirmed that higher external noise criteria may be appropriate under certain circumstances such as within city centres urban areas, and locations adjoining the strategic transportation network, where it may be necessary to compromise between elevated noise levels and other factors such as convenience of living, and efficient use of land resource.

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

2.7 As with the 'good' and 'reasonable' criteria in BS8233, the L_{AFmax} criterion in BS8233 is largely concordant with the World Health Organisation (WHO) guidance: 1999: *Guidelines for community noise*. This document draws upon guidance from Vallet and Vernay, which states:

> "For good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{AFmax} more than 10-15 times per night"

BS 4142: 2014 Methods for Rating and Assessing Industrial and Commercial Sound

2.8 The BS 4142 Standard describes methods for rating and assessing the following:

- Sound from industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical plant and equipment;

- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train movements on or around an industrial and/or commercial site.

2.9 The methods use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident. The Standard advises the purpose of the methodology includes the assessment of sound from any plant and activities associated with existing industrial and/or commercial uses at proposed residential dwellings.

2.10 If appropriate, the specific sound level of the source ($L_{Aeq,T}$) is corrected, by the application of one or more corrections for acoustic features such as tonal qualities and/or distinct impulses, to give a 'rating' level ($L_{Ar,Tr}$). The Standard effectively compares and rates the difference between the rating level of the specific sound and the typical background sound level ($L_{A90,T}$) in the absence of the specific sound.

2.11 The Standard advises that the time interval ('T') of the background sound measurement should be sufficient to obtain a representative or typical value of the background sound level at the time(s) the source in question operates or is proposed to operate in the future.

2.12 Comparing the rating level with the background sound level, BS 4142 states:

"Typically, the greater this difference, the greater the magnitude of impact.

A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."

Consultation with Barnsley Metropolitan Borough Council

2.13 Consultation was undertaken with Mr. James Gardham, Environmental Health Officer at Barnsley Metropolitan Borough Council on 18th October 2018. Mr. Gardham replied via email on 22nd October, stating that the proposed scope of works was acceptable.

2.14 Mr. Gardham stated that there were no existing concerns regarding vibration from the railway line.

3. BASELINE NOISE MONITORING

3.1 A baseline noise survey has been undertaken to determine the prevailing noise climate across the proposed development site. Measurement locations (MLs) adopted during the survey were selected to determine noise levels from road traffic on Halifax Road to the north, Well House Lane to the east, and train movements on the rail corridor to the north east. MLs adopted during the survey are identified in **Figure 3.1** below.

3.2 Details of monitoring undertaken at each location are provided below.

Figure 3.1 Site Location, Layout and Noise Monitoring Locations

ML1

3.3 Monitoring at ML1 was undertaken over a 24-hour period commencing at 00:00hrs on Thursday 22th November 2018. Measurement equipment was established in free-field conditions at a height of 1.5m above local ground level adjacent to the north eastern site boundary. The railway line adjacent to the site boundary is in a circa. 25m deep cutting. Measurement equipment was positioned circa. 1.5m from the edge of the cutting edge.

3.4 The noise environment at ML1 was generally dominated by road traffic on Halifax Road to the north and Barnsley Road to the South. Noise from train pass-bys was noted to be audible on occasion.

ML2

3.5 Monitoring at ML2 was undertaken over a 24-hour period commencing at 00:00hrs on Thursday 22th November 2018. Measurement equipment was established in free-field conditions at a height of 1.8m above local ground level and circa. 3m from the nearside carriageway of Well House Lane.

3.6 The noise environment at ML2 was noted to be dominated by local road traffic as well as distant road traffic on Halifax Road and Barnsley Road throughout.

ML3

3.7 Monitoring at ML3 was undertaken over a 24-hour period commencing at 23:00hrs on Wednesday 21st November 2018. Measurement equipment was established in free-field conditions at a height of 1.8m above local ground level and 11m from the nearside carriageway of Halifax Road.

3.8 The noise environment at ML3 was noted to be dominated by road traffic on Halifax Road throughout.

Equipment

3.9 The baseline noise survey was undertaken using the Class 1 specification noise measurement equipment detailed in **Table 3.1**. Equipment was calibrated using a portable calibrator immediately before and after the measurements with no significant drift in calibration observed. The sound level meters, pre-amplifiers and microphones were calibrated to traceable standards within the 24 months prior to the measurements. The portable calibrators were calibrated within the 12 months preceding the date of the survey.

Table 3.1: Equipment Summary

Position	Item	Make & Model	Serial Number	Calibration due Date
1	Sound Level Meter	Svantek 971	72615	June 2020
	Pre-amplifier	Svantek SV18	72283	
	Microphone	ACO Pacific 7052E	69463	
2	Sound Level Meter	Svantek 971	80342	March 2019
	Pre-Amplifier	Svantek SV18	71576	
	Microphone	ACO Pacific 7052E	59531	
3	Sound Level Meter	01 dB Fusion	11327	April 2019
	Pre-Amplifier	01 dB PRE 22	1605201	
	Microphone	Grass 40CE	259479	
1	Calibrator	SV33A	76650	July 2019
2, 3	Calibrator	01dB-Stell CAL21	34675335	August 2020

Meteorological Conditions

3.10 Weather conditions during periods of attendance were noted to be conducive to environmental noise measurement, it being dry with clear skies and negligible wind from the south west. Based on a review of publicly available metrological data at a nearby weather station, it is understood weather conditions remained suitable for environmental noise measurements throughout the survey.

Survey Results

3.11 The survey results, and representative noise levels are summarised in **Tables 3.2 to 3.6** below. Full results are provided in **Appendix B**.

Table 3.2 – Summary of measured sound pressure levels at ML1

Start Time	Period	dB $L_{Aeq,T}$	dB $L_{A90,T}$[1]	dB L_{AFmax}
07:00 22/11/2018	Daytime (07:00 – 23:00)	47	41	-
00:00 22/10/2018	Night-time (23:00 – 07:00)	42	29	53

[1] Mean $L_{A90,1hr}$ and $L_{A90,15mins}$ values during daytime and night time periods, respectively
[2] 10th highest discreet event at night (discreet events separated by at least 5-minutes)

Table 3.3 - Summary of measured octave band sound pressure levels at ML1

Period	Octave Band Sound Pressure Levels (L_{eq} dB)								dB(A)
	63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz	
Daytime	56	48	41	40	43	41	35	31	47
Night-time	51	43	37	36	38	35	33	33	42

Table 3.4 – Summary of measured sound pressure levels at ML2

Start Time	Period	dB $L_{Aeq,T}$	dB $L_{A90,T}$[1]	dB L_{AFmax}
07:00 22/11/2018	Daytime (07:00 – 23:00)	63	41	-
00:00 22/10/2018	Night-time (23:00 – 07:00)	53	29	77[2]

[1] Mean $L_{A90,1hr}$ and $L_{A90,15mins}$ values during daytime and night time periods, respectively
[2] 10th highest discreet event at night (discreet events separated by at least 5-minutes)

Table 3.5 - Summary of measured octave band sound pressure levels at ML2

Period	Octave Band Sound Pressure Levels (L_{eq} dB)								dB(A)
	63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz	
Daytime	63	57	54	54	58	57	55	52	63
Night-time	57	51	51	47	49	46	42	38	53

Table 3.6 – Summary of measured sound pressure levels at ML3

Start Time	Period	dB $L_{Aeq,T}$	dB $L_{A90,T}$[1]	dB L_{AFmax}
07:00 22/11/2018	Daytime (07:00 – 23:00)	60	45	-
23:00 21/10/2018	Night-time (23:00 – 07:00)	55	32	73[2]

[1] Mean $L_{A90,1hr}$ and $L_{A90,15mins}$ values during daytime and night time periods, respectively
[2] 10th highest discreet event at night (discreet events separated by at least 5-minutes)

Table 3.7 - Summary of measured octave band sound pressure levels at ML3

Period	Octave Band Sound Pressure Levels (L_{eq} dB)								dB(A)
	63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz	
Daytime	64	60	53	53	58	52	46	38	60
Night-time	60	55	52	51	50	47	40	36	55

4. ASSESSMENT

4.1 The results of the baseline noise survey have been used as a basis for the noise assessment of the Site's suitability for residential development. The assessment considers noise from road traffic and rail noise on proposed receptors.

Noise Model

4.2 A detailed noise model has been generated in order to calculate the daytime and night-time noise propagation across the site from the surrounding roads. The following predictions methodologies were adopted for the modelling exercise;

- The noise model was set up to apply the noise prediction methodology set out in the 1988 Department of Transport and the Welsh Office document Calculation of Road Traffic Noise for road traffic noise sources;
- The noise data collected from the Site was used to calibrate the road traffic noise sources;
- Mapping of the Site and the surrounding area was calibrated into the noise model based on known Ordinance Survey grid reference points;
- Indicative ground topography was approximated using OS Terrain 5 DTM information;
- Off-site buildings which would provide screening to the Site have been incorporated as reflective façades;
- To reflect the local ground cover, ground absorption was set to G = 0.5 (50% acoustically absorptive ground); and
- The model was set to include second order reflected noise from solid structures.

4.3 ML2 and ML3 have been included into the model and the resultant road traffic noise has been adjusted until the model is equal to the noise levels at ML2 and Ml3 for the daytime and night-time periods. The night-time maximum levels have been included in the model as a point source and calibrated to the monitoring locations.

4.4 The proposed site layout, shown in **Figure 1.2**, has been incorporated into the model, and the free-field level at the nearest façades has been calculated. Noise contours have been calculated showing the external free-field noise level in external areas, across the proposed development site. The predicted noise levels have been used to inform the assessment.

Noise from Road Traffic – Halifax Road

4.5 Noise levels measured at ML3 have been used as the basis for the assessment of road traffic noise from Halifax Road.

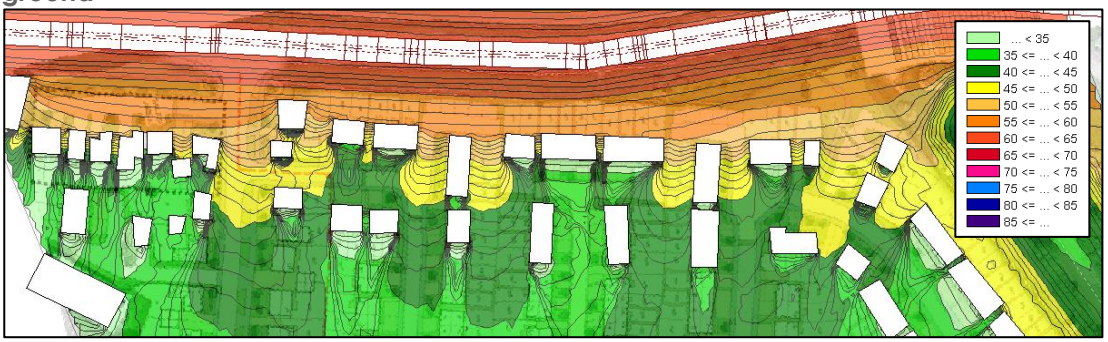
<u>External Daytime Noise Levels</u>

4.6 The indicative masterplan, shown in **Figure 1.2**, indicates that outdoor living areas will face Halifax Road.

4.7 The daytime noise contour, shown in **Figure 4.1**, indicates that for outdoor living areas located closest to Halifax Road, the noise levels will be above the upper guideline value of 55dB, $L_{Aeq,16h}$, in line with BS8233 and WHO guidance. Therefore, mitigation will be required.

4.8 The daytime noise contour plot indicates that for the majority of the site, noise levels in outdoor living areas will be below the 'desirable' guideline value of 50dB $L_{Aeq,T}$. Therefore, it is considered that mitigation measures are not required for these garden areas.

Figure 4.1 Noise levels in garden areas facing Halifax Road, dB $L_{Aeq,16h}$, 1.5m above ground



Internal Noise Levels

4.9 The results of the noise modelling indicate that the nearest proposed façade to Halifax Road would be exposed to free-field levels of 60dB $L_{Aeq,16hr}$ and 55dB $L_{Aeq,8hr}$. The 10th highest calculated night-time L_{AFmax} level of 71dB has been used.

4.10 Assuming a 15dB loss through a partially opened window, this would result in internal levels of 45dB $L_{Aeq,16h}$ and 40dB $L_{Aeq,8h}$ for daytime and night-time, respectively. A partially opened window would also result in an internal level of 56dB L_{AFmax} during the night-time. This will exceed the criteria of 35dB for the daytime and 30dB and 45dB for the night-time, assuming partially opened windows, therefore mitigation is required.

Noise from Road Traffic – Well House Lane

4.11 Noise levels measured at ML2 have been used as the basis for the assessment of road traffic noise from Well House Lane.

External Daytime Noise Levels

4.12 The indicative masterplan, shown in **Figure 1.2**, indicates that some outdoor living areas will face Well House Lane.

4.13 The daytime noise contour, shown in **Figure 4.2**, indicates that for outdoor living areas located closest to Well House Lane, the noise levels will be above the upper guideline value of 55dB, $L_{Aeq,16h}$, in line with BS8233 and WHO guidance. Therefore, mitigation will be required.

4.14 The daytime noise contour plot indicates that for the majority of the site, noise levels in outdoor living areas will be below the 'desirable' guideline value of 50dB $L_{Aeq,T}$. Therefore, it is considered that mitigation measures are not required for these gardens.

Figure 4.2 Noise levels in garden areas facing Well House Lane, dB $L_{Aeq,16h}$, 1.5m above ground

Internal Noise Levels

4.15 The results of the noise modelling indicate that the nearest proposed façade to Well House Lane would be exposed to free-field levels of 62dB $L_{Aeq,16hr}$ 52dB $L_{Aeq,8hr}$. The 10th highest calculated night-time L_{AFmax} level of 72dB has been used.

4.16 Assuming a 15dB loss through a partially opened window, this would result in internal levels of 47dB $L_{Aeq,16h}$ and 37dB $L_{Aeq,8h}$ for daytime and night-time, respectively. A partially opened window would also result in an internal level of 57dB L_{AFmax} during the night-time. This will exceed the criteria of 35dB for the daytime and 30dB and 45dB for the night-time, assuming partially opened windows, therefore mitigation is required. Consideration has been given to mitigation in Section 5.

Noise in the north eastern part of the Site

4.17 Onsite observations indicate that the noise environment was generally dominated by road traffic on Halifax Road and Barnsley Road. Noise from train pass-bys was noted to be occasionally audible.

4.18 Noise levels measured at ML1 have been used as the basis for the assessment of noise in the north eastern part of the site.

Daytime External Amenity Areas

4.19 The measured daytime noise level at ML1 is 47dB $L_{Aeq,16h}$. This is below the guideline value of 55dB $L_{Aeq,16h}$ as recommended in BS8233 and WHO guidance.

Internal Noise Levels

4.20 Onsite observations indicate that the noise levels in the north eastern part of the site are dominated by road traffic on the surrounding road network. The free-field measured noise levels during the daytime and night-time periods are 47dB $L_{Aeq,16hr}$ and 42dB $L_{Aeq,16hr}$ respectively. Assuming a 15dB loss through a partially opened window, this would result in internal levels of 32dB $L_{Aeq,16h}$ and 27dB $L_{Aeq,8h}$ for daytime and night-time, respectively. This will be below the criteria of 35dB for the daytime and 30dB for the night-time.

4.21 It is considered that the L_{AFmax} will be dominated by train pass-bys during the night-time period. The 10th highest night-time L_{AFmax} level is 53dB measured at ML1. A partially opened window would also result in an internal level of 38dB L_{AFmax} during the night-time. This will be below the criteria of 45dB for the night-time, assuming partially opened windows. Therefore, mitigation is not considered warranted at this time.

4.22 Furthermore, the railway line is located within a deep cutting. Therefore, it is likely that further screening will be afforded and the night-time L_{AFmax} level will be lower than that stated above.

Noise from the existing commercial premises

4.23 There is an existing commercial/industrial unit located adjacent to the north western boundary of the proposed development site. Onsite observations, undertaken during the site walkover, indicate that noise from the unit is not audible on the proposed development site. Furthermore, the unit is not operational during the night-time period.

4.24 There is a loading area on the north western façade of the unit, and it is considered that noise from deliveries may be audible at the proposed development site. Given the size of the access route of the commercial premises, it is considered likely that deliveries will take place using Light Goods Vehicles (LGV).

4.25 To assess the potential noise impact from the unloading and loading of LGVs, an assessment has been undertaken based on noise data from a library of historical measurement data which has been collected during surveys undertaken at similar developments.

4.26 A summary of the source noise data used within the assessment of noise from unloading/loading operations is presented in **Table 4.1** below.

Table 4.1 – Adopted noise emission data for noise sources associated with unloading/loading operations

Noise Source	Distance	SEL
Unloading Process	3m	71.7

4.27 The assessment has been based on the following assumptions;

- Unloading/loading operations will occur for a 20-minute period, every hour;
- No HGVs access the site;
- No activities are undertaken during the night-time period;
- Sources are treated as point sources; and,
- The nearest proposed receptors to the north are located adjacent to the loading area.

4.28 Based on the above information, the specific noise level associated with unloading/loading activities over a 20-minute daytime period have been calculated, without any mitigation in place.

4.29 This results in a specific noise level of 41dB $L_{Aeq,20min}$. This is below the lower guideline value of 50dB $L_{Aeq,16hr}$ as recommended in BS8233 and WHO guidelines. In addition, internal noise levels are likely to be achieved with windows partially open, when considering noise from loading/unloading activities.

4.30 Review of available information indicates that the premises are only open on weekdays between 0830 hours and 1530 hours. Therefore, it is considered likely that any loading and unloading activities will only occur during these hours, and will avoid the most sensitive times, i.e. early morning and late evening periods. Therefore, it is considered that noise from loading/unloading activities is unlikely to cause a significant impact at proposed receptors.

5. MITIGATION

5.1 In Section 4, it has been determined that consideration should be given to mitigation measures for external and internal habitable areas of the Proposed Development to provide a commensurate level of protection against road traffic noise for future occupants.

Road Traffic Noise

External Living Areas

5.2 Noise levels in outdoor living areas located closest to, and with a direct line of sight to Halifax Road are predicted to exceed the recommended guideline noise level. Therefore, mitigation is required to reduce noise levels from road traffic to within acceptable levels as recommended in BS8233 and WHO.

5.3 The Site has been remodelled with a 1.8m high close boarded fencing around the proposed garden areas located closest to Halifax Road and Well House Lane. With this in place, the results show that noise levels in outdoor living areas are below the upper guideline value of 55dB $L_{Aeq,16h}$. The garden areas requiring 1.8m high acoustic fences are shown in **Appendix C**.

5.4 It is considered that for proposed garden areas further into the site, or for garden areas located on the screened side of dwellings, the mitigation requirements will be less than those stated above, as garden areas will be located at a greater distance from the roads and will be screened by the development itself. The results of the modelling show that the noise levels in these gardens should be achieved without any mitigation in place.

5.5 The acoustic barriers should have a minimum mass per unit area of 15kg/m^2 and should be solid, with no gaps.

Halifax Road - Internal Living Areas

5.6 It is widely considered that first amelioration measure available to an occupant will be to close windows. Therefore, in order to assess the noise mitigation required to ensure an adequate level of protection against noise, it is appropriate to explore in the first instance the protection that could be afforded by the sound insulation performance of the external building fabric, and in particular the glazing elements.

5.7 Detailed noise break-in calculations have been undertaken in accordance with the rigorous method from section G.2 from BS 8233 based on the frequency spectra measured on-site and the following dimension:

- Room dimensions of 3m (width) x 4.4m (depth) x 3m (height);
- Double glazed window dimensions of 1.0m (width) x 2.5m (height);
- A reverberation time of 0.5 seconds; and,

- 1No. ventilator per habitable room.

5.8 To achieve the daytime internal noise criterion of 35 dB $L_{Aeq,16h}$ adopted for this assessment, based on the façade closest to Halifax Road experiencing 60dB $L_{Aeq,16h}$ free-field at the facade, a reduction of 25dB(A) would be required for habitable rooms. To achieve the internal criteria of 30 dB $L_{Aeq,8h}$ and 45 dB L_{AFmax} during the night-time, adopted for this assessment, a reduction of up to 28 dB(A) would be required for habitable rooms.

5.9 For the proposed dwelling located closest to Halifax Road, all criteria should be achieved with standard thermal double glazing such as a configuration of 4mm pane / 12mm airgap / 4mm pane, which would need to provide a minimum $R_w + C_{tr}$ of 27 dB. Acoustic ventilators, which achieve a minimum performance of $D_{n,e,w} + C_{tr}$ 35 dB, such as the Renson Sonovent 10mm-20mm air slot, would be required.

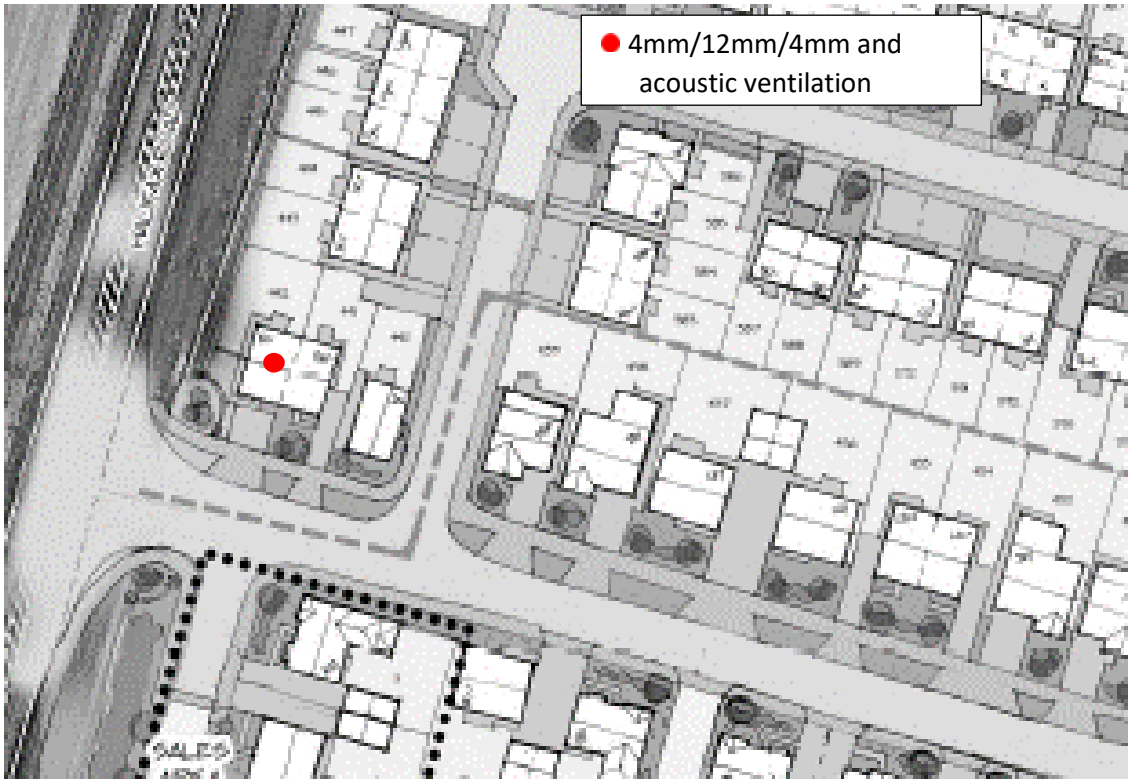
5.10 For the remaining dwellings located closest to Halifax Road, all criteria should be achieved with standard thermal double glazing such as a configuration of 4mm pane / 12mm airgap / 4mm pane, which would need to provide a minimum $R_w + C_{tr}$ of 27 dB. Trickle ventilators, which achieve a minimum performance of $D_{n,e,w} + C_{tr}$ 32 dB would be required.

5.11 The above presents solutions to satisfy the proposed internal ambient noise limits within habitable rooms during normal ventilation conditions to meet Part F minimum ventilation.

5.12 For dwellings which do not have a direct line of sight to the road, all criteria should be achieved with standard double glazing and open windows.

5.13 **Figure 4.1** shows the proposed dwellings which would require uprated ventilation to reduce noise from road traffic.

Figure 4.1 – Dwellings requiring uprated ventilation



Well House Lane - Internal Living Areas

5.14 To achieve the daytime internal noise criterion of 35 dB $L_{Aeq,16h}$ adopted for this assessment, based on the façade closest to Well House Lane experiencing 62dB $L_{Aeq,16h}$ free-field at the facade, a reduction of 27dB(A) would be required for habitable rooms. To achieve the internal criteria of 30 dB $L_{Aeq,8h}$ and 45 dB L_{AFmax} during the night-time, adopted for this assessment, a reduction of up to 27 dB(A) would be required for habitable rooms.

5.15 Based on these noise levels and typical room properties, discussed in paragraph 5.7, noise break-in calculations have been undertaken in accordance with the rigorous method from section G.2 of BS 8233:2014.

5.16 For the proposed dwelling located closest to Well House Lane, all criteria should be achieved with standard thermal double glazing such as a configuration of 4mm pane / 12mm airgap / 4mm pane, which would need to provide a minimum $R_w + C_{tr}$ of 27 dB. Acoustic ventilators, which achieve a minimum performance of $D_{n,e,w} + C_{tr}$ 35 dB, such as the Renson Sonovent 10mm-20mm air slot, would be required.

5.17 For the remaining dwellings located closest to Well House Lane, all criteria should be achieved with standard thermal double glazing such as a configuration of 4mm pane / 12mm airgap / 4mm pane, which would need to provide a minimum $R_w + C_{tr}$ of 27 dB. Trickle ventilators, which achieve a minimum performance of $D_{n,e,w} + C_{tr}$ 32 dB would be required.

5.18 The above presents solutions to satisfy the proposed internal ambient noise limits within habitable rooms during normal ventilation conditions to meet Part F minimum ventilation.

5.19 For dwellings which do not have a direct line of sight to the road, all criteria should be achieved with standard double glazing and open windows.

5.20 **Figure 4.2** shows the proposed dwellings which would require uprated ventilation to reduce noise from road traffic.

Figure 4.2 – Dwellings requiring uprated ventilation

6. CONCLUSION AND RECOMMENDATIONS

6.1 BWB Consulting Ltd has been appointed by the client to undertake an environmental noise assessment for a proposed residential development at Land off Halifax Road, Barnsley.

6.2 This assessment has been undertaken based on the results of a baseline noise survey on the Site. The results of the survey have been assessed in accordance with current standards and guidance.

6.3 The noise assessment shows that with appropriate consideration to noise mitigation measures, a commensurate level of protection can be afforded to future noise sensitive receptors on the site.

6.4 Based on the results of the assessment, it has been demonstrated that the Site is suitable for residential development. It is therefore considered that noise need not be a determining factor in the granting of detailed planning permission for the proposed development.

APPENDICES

APPENDIX A: Glossary of Terms

Noise

Noise is defined as unwanted sound. Human ears are able to respond to sound in the frequency range 20 Hz (deep bass) to 20,000 Hz (high treble) and over the audible range of 0 dB (the threshold of perception) to 140 dB (the threshold of pain). The ear does not respond equally to different frequencies of the same magnitude but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear.

Furthermore, the perception of noise may be determined by a number of other factors, which may not necessarily be acoustic. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time. In some cases, the time of day and other acoustic features such as tonality or impulsiveness may be important, as may the disposition of the affected individual. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source.

The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq}, L_{A90} etc., according to the parameter being measured.

The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10 dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dB(A) is generally regarded as the minimum difference needed to perceive a change under normal listening conditions.

Acoustic Terminology

dB (decibel)	The scale on which sound pressure level is expressed. Sound pressure level is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (2x10-5Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' - weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
$L_{Aeq,T}$	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time (T), would contain the same amount of acoustical energy as the A - weighted fluctuating sound measured over that period.
L_{Amax}	L_{Amax} is the maximum A - weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L_{10} and L_{90}	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 the L_{90} is the level exceeded for 90% of the time.
Free-field Level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces. Generally as measured outside and away from buildings.
Façade Level	A sound field determined at a distance of 1m in front of a large sound reflecting object such as a building façade.

APPENDIX B: Baseline Survey Data

Table B1: Results from ML1

Start Time & Date	Period (T)	dB $L_{Aeq,T}$	dB L_{AFmax}	dB $L_{A90,T}$	Sound Pressure Levels (dB $L_{eq,T}$) per octave band (Hz)							
					63 Hz	125 Hz	250 Hz	500 Hz	1k Hz	2kHz	4kHz	8 kHz
22/11/2018 00:00	15-mins	36	49	27	49	39	31	32	33	28	19	15
22/11/2018 00:15	15-mins	50	75	25	60	52	44	44	40	43	44	43
22/11/2018 00:30	15-mins	34	52	29	41	32	27	31	32	25	19	13
22/11/2018 00:45	15-mins	34	45	28	44	38	33	31	30	24	12	12
22/11/2018 01:00	15-mins	35	53	24	38	31	30	31	32	28	16	13
22/11/2018 01:15	15-mins	32	48	22	38	34	29	27	29	25	13	12
22/11/2018 01:30	15-mins	33	47	22	41	33	28	28	30	25	13	12
22/11/2018 01:45	15-mins	36	48	24	46	38	29	32	33	27	16	12
22/11/2018 02:00	15-mins	31	54	21	40	36	27	30	29	16	10	12
22/11/2018 02:15	15-mins	32	44	24	42	35	29	29	29	22	13	12
22/11/2018 02:30	15-mins	29	43	23	42	35	26	26	27	20	11	13
22/11/2018 02:45	15-mins	29	45	21	43	32	27	27	26	19	11	13
22/11/2018 03:00	15-mins	29	46	21	40	31	27	25	27	19	10	12
22/11/2018 03:15	15-mins	32	46	22	44	33	27	28	29	23	12	12
22/11/2018 03:30	15-mins	31	53	21	40	31	27	29	29	18	10	12
22/11/2018 03:45	15-mins	32	53	23	42	33	28	28	29	21	13	12
22/11/2018 04:00	15-mins	34	47	25	44	34	31	32	31	25	14	12
22/11/2018 04:15	15-mins	34	48	26	45	36	31	31	32	25	14	12
22/11/2018 04:30	15-mins	35	49	27	46	37	36	32	32	25	14	12

Start Time & Date	Period (T)	dB $L_{Aeq,T}$	dB L_{AFmax}	dB $L_{A90,T}$	Sound Pressure Levels (dB $L_{eq,T}$) per octave band (Hz)							
					63 Hz	125 Hz	250 Hz	500 Hz	1k Hz	2kHz	4kHz	8 kHz
22/11/2018 04:45	15-mins	37	47	31	47	39	33	33	34	27	15	12
22/11/2018 05:00	15-mins	41	52	35	48	40	34	36	39	34	18	12
22/11/2018 05:15	15-mins	42	53	37	49	39	34	37	40	34	19	12
22/11/2018 05:30	15-mins	43	51	38	53	41	38	38	41	35	22	13
22/11/2018 05:45	15-mins	43	52	39	50	42	37	39	41	34	21	13
22/11/2018 06:00	15-mins	43	50	39	49	41	38	38	40	34	21	15
22/11/2018 06:15	15-mins	46	66	41	56	47	43	40	42	38	33	33
22/11/2018 06:30	15-mins	46	62	42	57	46	42	40	43	38	29	27
22/11/2018 06:45	15-mins	47	61	43	55	47	41	40	45	40	26	15
22/11/2018 07:00	1-hour	49	65	44	58	47	41	41	46	43	32	26
22/11/2018 08:00	1-hour	50	71	46	58	49	42	42	47	44	33	28
22/11/2018 09:00	1-hour	46	64	41	57	47	41	40	43	40	30	22
22/11/2018 10:00	1-hour	48	68	38	58	51	42	40	42	40	42	32
22/11/2018 11:00	1-hour	44	64	36	56	47	41	37	40	37	30	23
22/11/2018 12:00	1-hour	44	67	37	56	44	39	37	40	38	31	25
22/11/2018 13:00	1-hour	49	78	39	57	53	42	39	42	45	38	36
22/11/2018 14:00	1-hour	46	71	40	56	48	41	39	42	39	34	35
22/11/2018 15:00	1-hour	47	64	43	57	46	41	40	43	40	36	35
22/11/2018 16:00	1-hour	48	66	45	58	47	42	42	45	42	37	32

Start Time & Date	Period (T)	dB $L_{Aeq,T}$	dB L_{AFmax}	dB $L_{A90,T}$	Sound Pressure Levels (dB $L_{eq,T}$) per octave band (Hz)							
					63 Hz	125 Hz	250 Hz	500 Hz	1k Hz	2kHz	4kHz	8 kHz
22/11/2018 17:00	1-hour	49	68	45	56	49	43	42	45	42	35	28
22/11/2018 18:00	1-hour	46	64	41	56	44	40	40	44	39	31	25
22/11/2018 19:00	1-hour	46	67	41	54	49	46	41	43	38	30	23
22/11/2018 20:00	1-hour	45	63	39	53	42	38	39	42	38	31	27
22/11/2018 21:00	1-hour	44	63	37	55	44	39	38	41	38	32	30
22/11/2018 22:00	1-hour	43	64	36	52	41	35	36	39	36	31	28
22/11/2018 23:00	15-mins	42	55	35	45	40	36	35	38	35	29	29
22/11/2018 23:15	15-mins	43	61	33	52	41	39	38	39	36	31	29
22/11/2018 23:30	15-mins	52	76	35	59	52	45	45	42	44	46	45
22/11/2018 23:45	15-mins	40	61	32	46	46	41	33	35	32	28	28

Table B2: Results from ML2

Start Time & Date	Period (T)	dB $L_{Aeq,T}$	dB L_{AFmax}	dB $L_{A90,T}$	Sound Pressure Levels (dB $L_{eq,T}$) per octave band (Hz)							
					63 Hz	125 Hz	250 Hz	500 Hz	1k Hz	2kHz	4kHz	8 kHz
22/11/2018 00:00	15-mins	52	80	28	59	51	43	43	48	47	39	33
22/11/2018 00:15	15-mins	44	73	27	51	42	37	37	41	38	29	22
22/11/2018 00:30	15-mins	46	75	29	47	35	34	38	42	40	31	24
22/11/2018 00:45	15-mins	43	70	28	47	43	38	37	40	37	29	23
22/11/2018 01:00	15-mins	44	70	24	42	36	37	37	42	36	28	20
22/11/2018 01:15	15-mins	32	49	23	37	35	30	25	30	24	9	9

Start Time & Date	Period (T)	dB $L_{Aeq,T}$	dB L_{AFmax}	dB $L_{A90,T}$	Sound Pressure Levels (dB $L_{eq,T}$) per octave band (Hz)							
					63 Hz	125 Hz	250 Hz	500 Hz	1k Hz	2kHz	4kHz	8 kHz
22/11/2018 01:30	15-mins	48	74	24	49	40	40	42	45	41	33	28
22/11/2018 01:45	15-mins	33	48	26	45	37	29	29	31	23	9	9
22/11/2018 02:00	15-mins	30	52	24	38	37	28	26	28	17	9	9
22/11/2018 02:15	15-mins	31	44	26	41	34	28	27	29	20	8	9
22/11/2018 02:30	15-mins	45	72	23	53	42	42	40	42	37	29	23
22/11/2018 02:45	15-mins	29	43	23	41	33	26	25	26	17	8	9
22/11/2018 03:00	15-mins	46	70	23	48	41	43	39	44	40	32	25
22/11/2018 03:15	15-mins	46	72	24	47	40	39	39	43	40	30	24
22/11/2018 03:30	15-mins	29	46	22	39	32	26	27	27	17	8	9
22/11/2018 03:45	15-mins	45	72	24	47	41	36	39	42	37	31	26
22/11/2018 04:00	15-mins	45	72	24	48	38	41	40	43	38	29	21
22/11/2018 04:15	15-mins	34	48	27	43	35	29	29	32	22	8	9
22/11/2018 04:30	15-mins	50	76	28	56	46	46	43	47	44	37	31
22/11/2018 04:45	15-mins	46	73	30	50	43	38	40	44	40	31	23
22/11/2018 05:00	15-mins	50	76	35	52	44	43	43	47	44	36	29
22/11/2018 05:15	15-mins	55	77	37	58	47	46	48	52	49	41	35
22/11/2018 05:30	15-mins	56	78	38	58	50	49	50	53	50	43	38
22/11/2018 05:45	15-mins	53	76	38	56	47	47	47	50	47	38	32
22/11/2018 06:00	15-mins	53	78	37	57	47	46	47	51	47	39	34

Start Time & Date	Period (T)	dB $L_{Aeq,T}$	dB L_{AFmax}	dB $L_{A90,T}$	Sound Pressure Levels (dB $L_{eq,T}$) per octave band (Hz)							
					63 Hz	125 Hz	250 Hz	500 Hz	1k Hz	2kHz	4kHz	8 kHz
22/11/2018 06:15	15-mins	54	80	39	59	51	56	48	50	47	42	42
22/11/2018 06:30	15-mins	59	83	41	66	57	54	52	55	53	46	41
22/11/2018 06:45	15-mins	62	90	43	67	64	64	60	58	53	46	41
22/11/2018 07:00	1-hour	62	84	44	65	56	54	56	58	56	48	43
22/11/2018 08:00	1-hour	63	84	46	66	64	56	56	60	57	49	45
22/11/2018 09:00	1-hour	61	89	42	65	55	55	56	57	54	48	44
22/11/2018 10:00	1-hour	59	82	40	61	55	52	52	55	53	46	42
22/11/2018 11:00	1-hour	60	88	36	63	56	55	55	56	54	49	46
22/11/2018 12:00	1-hour	60	80	37	62	52	51	52	56	55	51	47
22/11/2018 13:00	1-hour	63	84	40	65	57	54	54	58	57	56	53
22/11/2018 14:00	1-hour	64	84	42	63	56	55	55	58	58	57	54
22/11/2018 15:00	1-hour	67	92	42	65	56	56	57	60	61	60	57
22/11/2018 16:00	1-hour	67	84	44	67	59	56	56	61	62	61	58
22/11/2018 17:00	1-hour	66	93	45	65	59	57	58	61	60	60	56
22/11/2018 18:00	1-hour	63	80	42	63	55	52	53	58	57	55	51
22/11/2018 19:00	1-hour	60	88	40	60	55	55	54	56	54	52	47
22/11/2018 20:00	1-hour	58	84	39	57	49	49	49	54	53	51	47
22/11/2018 21:00	1-hour	60	87	36	57	53	49	50	54	54	53	49
22/11/2018 22:00	1-hour	59	82	33	56	47	45	47	53	53	53	48

Start Time & Date	Period (T)	dB $L_{Aeq,T}$	dB L_{AFmax}	dB $L_{A90,T}$	Sound Pressure Levels (dB $L_{eq,T}$) per octave band (Hz)							
					63 Hz	125 Hz	250 Hz	500 Hz	1k Hz	2kHz	4kHz	8 kHz
22/11/2018 23:00	15-mins	56	79	33	52	47	44	45	50	51	50	46
22/11/2018 23:15	15-mins	54	83	30	53	45	41	42	48	48	47	43
22/11/2018 23:30	15-mins	58	81	30	58	50	45	46	51	52	51	48
22/11/2018 23:45	15-mins	56	81	26	56	51	48	47	51	50	49	45

Table B3: Results from ML3

Start Time & Date	Period (T)	dB $L_{Aeq,T}$	dB L_{AFmax}	dB $L_{A90,T}$	Sound Pressure Levels (dB $L_{eq,T}$) per octave band (Hz)							
					63 Hz	125 Hz	250 Hz	500 Hz	1k Hz	2kHz	4kHz	8 kHz
21/11/2018 23:00	15-mins	65	98	35	71	67	66	64	58	54	52	51
21/11/2018 23:15	15-mins	53	75	34	57	49	53	46	49	48	37	25
21/11/2018 23:30	15-mins	51	76	33	58	60	47	42	48	46	35	24
21/11/2018 23:45	15-mins	49	73	31	60	50	45	46	45	41	34	26
22/11/2018 00:00	15-mins	50	70	31	54	48	44	44	46	44	34	23
22/11/2018 00:15	15-mins	47	68	29	48	39	34	38	43	43	31	18
22/11/2018 00:30	15-mins	46	66	32	49	42	37	40	43	41	30	19
22/11/2018 00:45	15-mins	46	65	30	48	41	36	37	43	40	30	18
22/11/2018 01:00	15-mins	50	71	27	48	46	45	44	46	44	35	24
22/11/2018 01:15	15-mins	44	66	26	45	40	34	37	41	39	28	17
22/11/2018 01:30	15-mins	46	66	27	48	40	35	38	43	41	30	18
22/11/2018 01:45	15-mins	51	74	26	57	49	43	47	48	42	35	26

Start Time & Date	Period (T)	dB $L_{Aeq,T}$	dB L_{AFmax}	dB $L_{A90,T}$	Sound Pressure Levels (dB $L_{eq,T}$) per octave band (Hz)							
					63 Hz	125 Hz	250 Hz	500 Hz	1k Hz	2kHz	4kHz	8 kHz
22/11/2018 02:00	15-mins	46	67	25	51	46	41	44	42	38	32	22
22/11/2018 02:15	15-mins	41	64	26	46	37	32	34	38	36	24	16
22/11/2018 02:30	15-mins	36	60	26	45	33	30	31	34	28	18	12
22/11/2018 02:45	15-mins	44	71	26	54	46	38	40	38	38	28	19
22/11/2018 03:00	15-mins	45	72	26	52	44	39	42	42	38	32	24
22/11/2018 03:15	15-mins	42	64	25	47	38	34	36	39	36	27	19
22/11/2018 03:30	15-mins	45	72	26	49	43	39	42	41	36	30	22
22/11/2018 03:45	15-mins	47	68	27	54	44	42	43	44	40	32	24
22/11/2018 04:00	15-mins	50	72	29	55	50	44	48	47	42	35	26
22/11/2018 04:15	15-mins	49	70	30	56	48	44	46	45	42	35	27
22/11/2018 04:30	15-mins	47	70	30	50	46	41	42	44	41	33	23
22/11/2018 04:45	15-mins	52	72	36	58	50	44	48	49	45	38	28
22/11/2018 05:00	15-mins	53	71	39	56	51	46	48	51	47	39	29
22/11/2018 05:15	15-mins	55	73	39	62	52	48	49	51	48	40	31
22/11/2018 05:30	15-mins	56	75	42	59	55	51	51	52	49	41	31
22/11/2018 05:45	15-mins	56	71	41	61	52	48	50	52	50	41	31
22/11/2018 06:00	15-mins	57	72	43	59	53	50	51	54	51	42	31
22/11/2018 06:15	15-mins	58	73	44	60	53	49	52	55	52	43	33
22/11/2018 06:30	15-mins	59	72	46	66	58	53	53	56	53	45	35

Start Time & Date	Period (T)	dB $L_{Aeq,T}$	dB L_{AFmax}	dB $L_{A90,T}$	Sound Pressure Levels (dB $L_{eq,T}$) per octave band (Hz)							
					63 Hz	125 Hz	250 Hz	500 Hz	1k Hz	2kHz	4kHz	8 kHz
22/11/2018 06:45	15-mins	60	75	46	66	57	53	54	57	54	46	37
22/11/2018 07:00	1-hour	62	74	52	65	57	53	55	59	56	47	36
22/11/2018 08:00	1-hour	62	75	49	66	59	54	55	59	56	47	36
22/11/2018 09:00	1-hour	60	75	43	63	57	52	54	56	54	45	35
22/11/2018 10:00	1-hour	60	80	41	63	64	53	54	57	54	47	37
22/11/2018 11:00	1-hour	59	79	38	63	63	53	53	55	53	48	39
22/11/2018 12:00	1-hour	60	80	40	63	64	51	53	56	54	49	42
22/11/2018 13:00	1-hour	60	76	41	64	57	52	54	56	55	50	42
22/11/2018 14:00	1-hour	61	92	44	67	66	59	56	57	55	50	44
22/11/2018 15:00	1-hour	62	78	48	65	58	52	54	60	54	50	44
22/11/2018 16:00	1-hour	62	76	54	65	57	52	54	62	45	24	8
22/11/2018 17:00	1-hour	62	76	54	64	59	52	53	62	45	22	7
22/11/2018 18:00	1-hour	60	78	49	62	56	49	50	59	43	19	7
22/11/2018 19:00	1-hour	57	73	43	62	56	49	49	56	45	18	10
22/11/2018 20:00	1-hour	53	69	40	60	54	46	44	51	47	16	11
22/11/2018 21:00	1-hour	55	73	40	61	54	48	46	54	41	17	7
22/11/2018 22:00	1-hour	54	72	39	58	53	44	44	53	36	14	6

APPENDIX C: Gardens requiring acoustic fencing

Halifax Road, Barnsley
Barratt Homes and David Wilson Homes
December 2018
LDP2246

BWB

BETTER SOLUTIONS, INTELLIGENTLY ENGINEERED

www.bwbconsulting.com