NOISE & VIBRATION

CONTENTS

APPENDICES

1.0 INTRODUCTION

Overview

1.1. Hawkins Environmental Limited has been instructed by Satnam Millennium Ltd to undertake a noise and vibration assessment for the proposed redevelopment of Peel Hall, Warrington.

1.2. The Scoping Report of the Environmental Impact Assessment has identified that the site may require a noise and vibration assessment to determine whether the site is suitable for residential use and to determine whether the proposed development would have any adverse impact on the surrounding environment.

1.3. The following areas would normally be considered as part of an ES:

- The impact of the changes in road traffic flows on the noise levels at nearby sensitive receptors;
- The impact of proposed plant on the noise levels at nearby sensitive receptors;
- The impact of construction noise and vibration at nearby sensitive receptors; and
- The constraints that the existing noise and vibration environment has on the proposed scheme, including details of mitigation to ensure suitable noise levels both internally and at outdoor amenity space.

1.4. All noise measurements were conducted in accordance with BS 7445-2: 1991 *'Description and measurement of environmental noise Part 2: Guide to the acquisition of data pertinent to land use'*, with the assessment methodology used to assess noise ingress into the proposed development conducted in accordance with BS 8233: 2014 *'Guidance on sound insulation and noise reduction for buildings'*, and the National Planning Policy Framework.

Site Description

1.5. The site is generally open grassland and scrub vegetation with mature hedges and trees along field boundary drains. There is a small woodland coppice with further mature vegetation surrounding sports pitches towards the eastern boundary. A detailed assessment of the habitats and vegetation within the site is set out in section 6 of the ES.

1.6. The highest point of the site is to the east of Peel Hall at 20.57 metres A.O.D. From that point the land falls to the North West boundary at 17.4 metres A.O.D and to approximately 10 metres A.O.D along the Southern boundary. The general visual impression gained on site is that it is predominantly flat without major undulations.

1.7. Peel Cottage and Peel Hall are both located on Peel Cottage Lane which is located to the north west of the site. Peel Cottage and Peel Hall are not included in this application.

The Development Proposals

1.8. The proposals subject of this ES are for the construction of a new residential neighbourhood comprising up to 1200 houses, together with up to 2.3 hectares of employment uses (B1 uses) and a local centre including a food store (A1 and A5 uses), healthcare (D1) and a family pub (A4). The site will also contain a primary school site and open space provision including sports pitches with ancillary facilities, together with means of access and buffer planting zones. The total site area is circa 63 hectares (158 acres). The location of the site is shown on **Appendix 1**.

2.0 PLANNING POLICY

The Nature, Measurement and Effect of Noise

2.1. Noise is often defined as sound that is undesired by the recipient. Whilst it is impossible to measure nuisance caused by noise directly, it is possible to measure the loudness of that noise. 'Loudness' is related to both sound pressure and frequency, both of which can be measured. The human ear is sensitive to a wide range of sound levels. The sound pressure level of the threshold of pain is over a million times that of the quietest audible sound. In order to reduce the relative magnitudes of the numbers involved, a logarithmic scale of decibels (dB) is normally used, based on a reference level of the lowest audible sound.

2.2. The response of the human ear is not constant over all frequencies. It is therefore usual to weight the measured frequencies to approximate the human response. The resulting 'A' weighted decibel, dB(A), has been shown to correlate closely to the subjective human response.

2.3. When related to changes in noise, a change of ten decibels from say 60 dB(A) to 70 dB(A) would represent a doubling in 'loudness'. Similarly, a decrease in noise from 70 dB(A) to 60 dB(A) would represent a halving in 'loudness'. A change of 3 dB(A) is generally considered to be just perceptible[1]. **Table 2.1** details typical noise levels.

[1] Communities & Local Government (1994). Planning Policy Guidance 24: Planning & Noise.

Table 2.1: Typical Noise Levels

Approximate Noise Level (dB(A))	Example
0	Limit of hearing
30	Rural area at night
40	Library
50	Quiet office
60	Normal conversation at 1 m
70	In car noise without radio
80	Household vacuum cleaner at 1 m
100	Pneumatic drill at 1 m
120	Threshold of pain

The Nature, Measurement and Effect of Vibration

2.4. When two objects come into contact through movement (such as the wheels of a car and a road), the mechanical energy from the movement causes vibrations in the vicinity of the two objects. Vibrations in the air causes sound, but some vibrations can be felt through the ground or through structures, especially when large amounts of energy are exerted, such as the passage of heavy goods vehicles.

2.5. Groundborne vibration, especially within structures, has a number of affects both to people and to the structures themselves.

2.6. The effects of groundborne vibration on buildings are dependent upon a whole range of factors, not least the magnitude and duration of the vibration, the structure of the soil, the properties and quality of the building materials, the design of the structure, as well as the general condition and age of the structure. In extreme cases, vibration can cause severe structural damage, but most vibration damage manifests itself in minor cosmetic damage such as cracks in rendering and roof tiles slipping, which in turn can cause other problems such as damp. Groundborne vibration on buildings is measured using the Peak Particle

Velocity (PPV) expressed in mm/s. This is the maximum instantaneous velocity of a particle at a point during a given time interval.

2.7. Human exposure to vibration can cause annoyance, but in some cases can also cause health problems, especially from the stress and anxiety of prolonged annoyance. Humans are known to be very sensitive to vibration, with a threshold of perception typically in the particle velocity range of 0.15 mm/s to 0.3 mm/s at frequencies between 8 Hz and 80 Hz. Human exposure to vibration is measured using a Vibration Dose Value (VDV) expressed in $m/s^{1.75}$. This measures the overall dose of vibration that a person might receive over a given time period.

The National Planning Policy Framework

2.8. In March 2012, the National Planning Policy Framework (NPPF) was published to replace the thousands of pages of national planning policy guidance, including guidance on noise. The intention was to let councils decide their own priorities though their Local Plans and reduce the amount of "red tape" to enable growth and development. Amongst many other documents, the NPPF replaces the 1994 document Planning Policy Guidance Note 24 (PPG 24) 'Planning and Noise' published by the then Department of Environment, which is now officially withdrawn as official government guidance.

2.9. The NPPF includes 12 core planning principles which include:

- *Always seek to secure high quality design and a good standard of amenity for all existing and future occupants of buildings;*
- *Take account of the different roles and character of different areas, promoting the vitality of the main urban areas, protecting the Green Belts around them, recognising the intrinsic beauty of the countryside;*
- *Contribute to conserving and enhancing the natural environmental and reducing pollution; and*
- *Take account of and support local strategies to improve health, social and cultural wellbeing for all.*

2.10. It also states that the planning system "should contribute to enhance the natural environment, by... preventing both new and existing development from contributing to or being put at risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution…To prevent unacceptable risks from pollution, planning policies and decisions should ensure that new development is appropriate for its location".

2.11. Section 123 of the NPPF talks specifically about noise stating that *"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 through the 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 uses 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 for this reason."*

2.12. The purpose of the NPPF is for Local Planning Authorities to determine for themselves whether a *"new development is appropriate for its location"* or how to determine what constitutes *"a good standard of amenity for all…future occupants of buildings".*

Noise Policy Statement for England

2.13. The Noise Policy Statement for England(NPSE)[2] provides further guidance on the interpretation of Section 123 of the NPPF and states that: *"Within the context of sustainable development:*

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

[2] The Noise Policy Statement for England, March 2010, Defra.

2.14. NPSE introduces established concepts originally from the field of toxicology that are now being applied to noise impacts. They are:

- **NOEL – No Observed Effect Level** - This is the level of noise below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.
- **LOAEL – Lowest Observed Adverse Effect Level** - This is the level of noise above which adverse effects on health and quality of life can be detected.
- **SOAEL – Significant Observed Adverse Effect Level** - This is the level above which significant adverse effects on health and quality of life occur.

2.15. NPSE goes on to state that "it is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available."

National Planning Practice Guidance on Noise

2.16. The NPPG provides more guidance on the assessment of noise for planning purposes and builds on the concepts of NOEL, LOAEL etc introduced in NPSE to establish whether noise is a factor that needs to be taken into account. It states: *"Local planning authorities' plan-making and decision taking should take account of the acoustic environment and in doing so consider:*

- *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.*

In line with the Explanatory Note of the Noise Policy Statement for England, this would include identifying whether the overall effect of the noise exposure (including the impact during the construction phase wherever applicable) is, or would be, above or below the

significant observed adverse effect level and the lowest observed adverse effect level for the given situation."

2.17. However, it goes into more detail about the subjective nature of noise and how the results of any assessment must be treated flexible and pragmatically. The guidance states: *"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. These factors include:*

- *the source and absolute level of the noise together with the time of day it occurs. Some types and level of noise will cause a greater adverse effect at night than if they occurred during the day – this is because people tend to be more sensitive to noise at night as they are trying to sleep. The adverse effect can also be greater simply because there is less background noise at night;*
- *for non-continuous sources of noise, the number of noise events, and the frequency and pattern of occurrence of the noise;*
- *the spectral content of the noise (ie whether or not the noise contains particular high or low frequency content) and the general character of the noise (ie whether or not the noise contains particular tonal characteristics or other particular features). The local topology and topography should also be taken into account along with the existing and, where appropriate, the planned character of the area.*

More specific factors to consider when relevant:

- *where applicable, the cumulative impacts of more than one source should be taken into account along with the extent to which the source of noise is intermittent and of limited duration;*
- *consideration should also be given to whether adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time. In both cases a suitable alternative means of ventilation is likely to be necessary. Further information on ventilation can be found in the Building Regulations.*
- *In cases where existing noise sensitive locations already experience high noise levels, a development that is expected to cause even a small increase in the overall noise level*

may result in a significant adverse effect occurring even though little to no change in behaviour would be likely to occur.

- *Where relevant, Noise Action Plans, and, in particular the Important Areas identified through the process associated with the Environmental Noise Directive and corresponding regulations should be taken into account. Defra's website has information on Noise Action Plans and Important Areas. Local authority environmental health departments will also be able to provide information about Important Areas.*
- *The effect of noise on wildlife. Noise can adversely affect wildlife and ecosystems. Further information may be found on Defra's website. Particular consideration should be given to noisy development affecting designated sites.*
- *If external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces should be considered so that they can be enjoyed as intended.*
- *The potential effect on an existing business of a new residential development being located close to it should be carefully considered as the existing noise levels from the business may be regarded as unacceptable by the new residents and subject to enforcement action. In the case of an established business, the policy set out in the third bullet of paragraph 123 of the Framework should be followed.*
- *Some commercial developments including fast food restaurants, night clubs and public houses can have particular impacts, not least because activities are often at their peak in the evening and late at night. Local planning authorities will wish to bear in mind not only the noise that is generated within the premises but also the noise that may be made by customers in the vicinity."*

Local Policy

2.18. Policy QE 6 of Warrington Borough Council's Local Plan Core Strategy (Adopted July 2014) states that "The Council, in consultation with other Agencies, will only support development which would not lead to an adverse impact on the environment or amenity of future occupiers or those currently occupying adjoining or nearby properties, or does not have an unacceptable impact on the surrounding area. The Council will take into consideration the following: … Noise… the effect and timing of traffic movement to, from and within the site and car parking including impacts on highway safety."

3.0 ASSESSMENT CRITERIA

BS 8233: 2014 'Guidance on sound insulation and noise reduction for buildings'

3.1. Originally published in 1999, the 2014 edition of BS 8233 significantly updates the guidance in light of the policy changes as a result of the advent of the NPPF and the withdrawal of PPG 24. The 2014 edition of BS 8233 sees a change in the title of the Standard, moving from a *'Code of Practice'* to *'Guidance'*, as the text *'largely comprises guidance that does not support claims of compliance'*.

3.2. BS 8233:2014 indicates that to control external noise ingress into a proposed development, a number of planning stages should occur as follows:

"a) Assess the site, identify significant existing and potential noise sources, measure or estimate noise levels, and evaluate layout options.
b) Determine design noise levels for spaces in and around the building(s).
c) Determine sound insulation of the building envelope, including the ventilation strategy".

3.3. BS 8233:2014 suggests design noise levels for various types of building. The recommended noise levels for dwelling houses, flats and rooms in residential use (when unoccupied) can be seen in **Table 3.1** below. This is replicated from Table 4 of Section 7.7.2 of BS 8233:2014. The guidance suggests that *"In general, for steady external noise sources, it is desirable that the internal ambient noise level does not exceed the guideline values".* The noise levels in **Table 3.1** are marginally different to those published in BS 8233:1999 *'Sound insulation and noise reduction for buildings –Code of practice'*, but are based on the existing guidance from the current World Health Organisation (WHO) *"Guidelines on Community Noise".*

Table 3.1: Summary of Noise Criteria: BS8233:2014

Activity	Location	07:00 to 23:00	23:00 to 0700
Resting	Living room	35 dB $L_{Aeq.16hour}$	-
Dining	Dining	40 dB $L_{Aeq.16hour}$	-

Activity	Location	07:00 to 23:00	23:00 to 0700
	room/area		
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq.16hour}$	30 dB $L_{Aeq.8hour}$

3.4. When considering the noise level criteria considered in **Table 3.1**, the following points should be noted:

1. BS 8233: 2014 suggests that the above criteria should be adopted flexibly and that *"where development is considered necessary or desirable... the internal target level may be relaxed by up to 5 dB and reasonable internal conditions still achieved".*
2. The noise levels quoted above are annual averages and *"do not need to be achieved in all circumstances"* e.g. New Years Eve or fireworks night.
3. The noise levels in **Table 3.1** are "*for steady external noise sources"* such as traffic noise or plant noise. This is a departure from the 1999 version of BS 8233, where the recommended internal noise levels were irrespective of the external noise source and therefore included the suggestion that in order to achieve *"reasonable"* noise levels within bedrooms at night, L_{AFmax} noise levels should not exceed 45 dB. Whilst this has been omitted from the 2014 version of BS 8233, it does state that "*Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values."* Therefore, at sites which may be affected by individual noise events, it is more appropriate to use the guidance contained within the WHO *"Guidelines on Community Noise"* which suggest that good sleep will not generally be affected if internal levels of L_{AFmax} 45 dB are not exceeded more than 10-15 times per night.
4. BS 8233:2014 notes that if the design of the building is *"relying on closed windows to meet the guide values, there needs to be appropriate alternative ventilation that does not compromise the facade insulation or resulting noise level".*
5. BS 8233 provides guidance for noise in gardens and outdoor amenity space. It suggests that *"it is desirable that the external 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." The guidance does go on to say that these guideline values are not achievable in all circumstances and in some areas, *"such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited."*

World Health Organisation Guidelines

3.5. BS 8233 is based upon the current World Health Organisation (WHO) *guidance "Guidelines on Community Noise*". A summary of the noise criteria can be seen in **Table 3.2.**

Table 3.2: Summary of Noise Criteria: WHO

Residential Environment	**Critical Health Effect(s)**	**L_{Aeq}**	**L_{AFmax}**	**Time Base**
Outdoor living area	Serious annoyance, daytime and evening	55	-	07:00-23:00
	Moderate annoyance, daytime and evening	50	-	07:00-23:00
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	-	07:00-23:00
Inside bedrooms	Sleep disturbance, night-time	30	45	23:00-07:00
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	60	23:00-07:00

BS 4242: 2014 'Methods for rating and assessing industrial and commercial sound'

3.6. British Standard BS 4142: 2014 *'Methods for rating and assessing industrial and commercial sound"* provides a method for the measurement and rating of industrial noise or noise of an industrial nature and background noise levels outside dwellings in mixed residential and industrial areas. The rating level (defined in the BS) is used to rate the industrial noise source outside residential dwellings (this is defined as the *"specific noise source"*).

3.7. The procedure defined in BS 4142 for predicting the likelihood of complaints is based on establishing the difference between the rating level and the background level outside the residential property of interest. The greater the difference the greater the likelihood of complaints and more specifically:

- *"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.*
- *Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact."*

3.8. The guidance goes on to state that "where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night." Consequently, when considering the impact within a BS 4142 assessment, it is often also necessary to consider the absolute noise levels experienced at the receptor location within relation to BS 8233 and World Health Organisation guidelines.

IEMA Guidelines for Environmental Noise Assessment

3.9. The 2014 IEMA Guidelines for Environmental Noise Assessment address the key principles of noise impact assessment and are applicable to all development proposals where noise effects may occur. The guidance provides advice with regards to the collection of baseline noise data, prediction of noise levels and how noise should be assessed. The guidance recognises that the effect associated with a particular noise impact will be dependent on a number of factors including but not limited to the sensitivity of the receptor, frequency and duration of the noise source and time of day. However, it stops short of providing specific assessment criteria which developments should achieve but instead suggests that the methodology adopted should be selected on a site by site basis with reference to relevant national and local standards. However, it does provide descriptors used to describe noise impacts, which can be used to assess the impact of changes in traffic flow. The scale can be seen in **Table 3.3** below.

Table 3.3: Classification of magnitude of noise impacts

Criteria for Extent of Noise Impact	Noise Impact Magnitude
> 10 dB	Severe
5 to 10 dB	Substantial
3 to 5 dB	Moderate
1 to 3 dB	Slight
< 1 dB	No Impact

3.10. Table 7.7 of the 2014 IEMA Guidelines also presents the relationship between noise impact magnitude, the noise effect and the evaluation of the effect significance. However, the guide does stress that the evaluation of significance is subjective and down to professional judgement taking into account of range of factors including impact magnitude, sensitivity of the receptors and duration of impact. **Table 3.4** summarises this guidance.

Table 3.4: Noise Impact Magnitude, Description and Significance

Magnitude		Description	Significance
Substantial	**Beneficial**	**Receptor Perception = Marked Change** Causes a material change in behaviour and/or attitude; e.g. people begin to engage in activities previously avoided due to noise conditions.	**More Likely to be Significant**
Moderate		**Receptor Perception = Noticeable Improvement** Improved noise climate resulting in small changes in behaviour and/or attitude, e.g. opening windows.	⇳
Slight		**Receptor Perception = Just Noticeable Improvement** Improved noise climate resulting in small changes in behaviour and/or attitude, e.g. turning down volume on television; speaking more quietly; opening windows.	**Less Likely to be Significant**
Negligible		**N/A = No noticeable effect on the receptor**	**Not Significant**
Slight	**Adverse**	**Receptor Perception = Just Noticeable Improvement** Noise impact can be heard, but does not cause any change in behaviour or attitude, e.g. closing of windows.	**Less Likely to be Significant**
Moderate		**Receptor Perception = Just Noticeable Improvement** Noise impact can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television. Potential for sleep disturbance.	⇳
Substantial		**Receptor Perception = Disruptive** Causes a material change if behaviour and/or attitude, e.g. avoided certain activities during periods of intrusion. Potential for sleep disturbance resulting in difficulty getting to sleep.	**More Likely to be Significant**
Severe		**Receptor Perception = Physical Harm** Significant changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening and medically definable harm.	**Significant**

3.11. It should be noted that to bring the noise chapter of the ES in line with the other ES chapters, the magnitude impacts will be described as Negligible, Minor, Moderate and Major. For the purposes of this report, these terms are seen as interchangeable to Negligible, Slight, Moderate and Substantial/Severe.

"Possible Options for the Identification of SOAELs and NOAELs in Support of the NPSE"

3.12. This Defra Research Project prepared by AECOM attempts to give values to the concepts of SOAELs and NOAELs, introduced by the NPSE. After the withdrawal of PPG24: Planning and Noise in 2012, which included Noise Exposure Categories, with specific numerical boundaries, the NPSE was heavily criticised for having no specific numerical guidance. Whilst the NPSE and NPPF encourages the development of location specific criteria, in the context of the specific environment, the absence of guidance meant the implementation of the NPSE was difficult. Consequently, the project identifies both specific possible values and possible ranges of values for SOAELs and NOAELs for different noise sources. These values can be seen in **Table 3.5**.

Table 3.5: Possible Values & Range of Values for LOAEL & SOAEL

Source	Effect	LOAEL	SOAEL
Road	Annoyance (Daytime)	**56** *(53-59)*	**66** *(64-68)*
	Sleep (Night-time)	**46** *(43-52)*	**56** *(51-64)*
Rail	Annoyance (Daytime)	**63** *(61-66)*	**72** *(70-74)*
	Sleep (Night-time)	**55** *(52-63)*	**68** *(61-77)*
Air	Annoyance (Daytime)	**52** *(50-54)*	**60** *(58-62)*
	Sleep (Night-time)	**41** *(40-49)*	**53** *(47-60)*

Assessment Criteria for Impact of Vibration on Humans

3.13. The assessment criteria for the impact of vibration on humans is based upon the Vibration Dose Value (VDV) and the criteria is given in **Table 3.6** below. This guidance is given in BS

6472-1:2008 *Guide to evaluation of human exposure to vibration in buildings – Part 1: Vibration sources other than blasting*.

Table 3.6: Summary of Vibration Criteria: BS6472-1: 2008

Place and time	**Low probability of adverse comment ($m/s^{1.75}$)[1]**	**Adverse comment possible ($m/s^{1.75}$)**	**Adverse comment probable ($m/s^{1.75}$)[2]**
Office buildings 16hr day	0.4 to 0.8	0.8 to 1.6	1.6 to 3.2
Residential buildings 16hr day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8hr night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

1) Below these ranges adverse comment is not expected

2) Above these ranges adverse comment is very likely

Assessment Criteria for Impact of Vibration on Buildings

3.14. People who are exposed to perceptible levels of vibration often believe that the vibration they can feel is capable of causing damage to the building they occupy. Humans, however, are relatively sensitive to vibration whereas buildings are not. Consequently, vibration levels at which the onset of building damage occurs are substantially greater than thresholds of perceptibility.

3.15. **Table 3.7** gives the limits above which cosmetic damage could occur for transient vibration. Minor damage is possible at vibration magnitudes which are greater than twice those given in **Table 3.7**, and major damage to a building structure can occur at values greater than four times the tabulated values. These values only relate to transient vibration. If there is a

continuous vibration the guide values given in **Table 3.7** might need to be reduced by up to 50%. This guidance is reproduced from BS 5228-2:2009 and BS 7385-2:1993.

Table 3.7: Transient vibration guide values for cosmetic damage

Type of Building	Peak component particle velocity in frequency range of predominant pulse	
	4Hz to 15Hz	**15Hz and above**
Reinforced or framed structures Industrial and heavy commercial buildings	50mm/s at 4Hz and above	50mm/s at 4Hz and above
Unreinforced or light framed structures Residential or light commercial buildings	15mm/s at 4Hz increasing to 20mm/s at 15Hz	20mm/s at 15Hz increasing to 50mm/s at 40Hz and above
Reinforced or framed structures Industrial and heavy commercial buildings	50mm/s at 4Hz and above	50mm/s at 4Hz and above

4.0 BASELINE CONDITIONS

Noise Measurement Overview

4.1. In order to determine the extent to which the site is affected by noise and how noise may change as a consequence of the proposed development, a detailed noise measurement study has been carried out at the proposed development site and its environs.

4.2. Noise monitoring was conducted over several days in September, October and December 2014. All survey work was supervised by Nick Hawkins of Hawkins Environmental Limited. Nick is a Member of the Institute of Acoustics and holds the Institute of Acoustic's Certificate of Competence in Environmental Noise Measurement.

4.3. All noise monitoring was conducted using two Norsonic 140 sound level meters, which both conform to BS EN IEC 61672 as a Class 1 precision measurement system. A Norsonic 1251 field calibrator was used before and after the measurement periods in order to ensure that the equipment had remained within reasonable calibration limits (+/- 0.5 dB). All of the equipment used has current certificates of calibration.

4.4. All noise monitoring has been conducted in accordance with the guidance set out in BS 7445-2: 1991 *'Description and measurement of environmental noise Part 2: Guide to the acquisition of data pertinent to land use'*. This standard details information that should be recorded in addition to the actual measured levels such as meteorological data, and a description of the noise source itself. The following statistical parameters were recorded during the survey: L_{Aeq}, L_{Amax}, L_{A10}, L_{A50}, L_{A90}. During all monitoring periods, the weather conditions were conducive to successful monitoring, with no rainfall and windspeeds of less than 3 m/s.

4.5. The monitoring positions could broadly be placed in two categories:

1. Locations representative of new dwellings within the proposed development (i.e. on-site measurements); and
2. Locations representative of sensitive receptors that could be affected by the proposed development (i.e. off-site measurements).

4.6. Noise monitoring data from Category 1 sites would be used to determine the whether the noise environment of the site constrains the development of the site, whereas Category 2 sites would be used to determine the impacts of the proposed development on surrounding sites. **Appendix 1** shows a site location plan displaying the locations of the noise monitoring positions.

Off-Site Measurements

4.7. To assess the impact of changes in road traffic as a consequence of a development, it is common to use the $L_{A10, 18hr}$ noise descriptor as this is used to describe daytime road traffic noise levels. As an alternative to conducting eighteen-hour noise surveys at each sensitive receptor, it is possible to use a shortened measurement procedure for road traffic dominated sites. The Calculation of Road Traffic Noise (CRTN) describes the shortened measurement procedure, which requires L_{A10} noise levels to be measured during three consecutive hours between 10:00 and 17:00. The shortened measurement procedure requires that the measured L_{A10} noise levels to be arithmetically averaged to provide an assumed $L_{A10.3hr}$ noise level, from which the $L_{A10.18hr}$ can then be estimated. Using the shortened measurement procedure from CRTN it has been possible to estimate the $L_{A10, 18hr}$ for the locations representative of sensitive receptors likely to experience a change in traffic flows as a consequence of the proposed development. The noise measurement data is summarised in **Table 4.1** below.

Table 4.1: Summary of Off Site Noise Measurements

Receptor Location	$L_{A10, 18hr}$*
Rear of Bowling Green Farm, Mill Lane	50.8
334-338 Poplars Avenue	54.9
460 Poplars Avenue	53.9
11 Sandy Lane West	66.3

* = Noise measurements, where appropriate, have been corrected in accordance with CRTN so that all measurements are displayed as freefield noise levels.

On-Site Measurements

4.8. To determine whether a site is suitable for housing and to determine whether additional mitigation is required to ensure a good level of amenity for the future residents of the proposed development, extensive noise monitoring has been conducted on the site, to determine the existing noise climate of the area.

4.9. Noise monitoring was conducted at eight locations across the proposed development site. Long term noise measurements were conducted at a location in the centre of the site (Location F) to characterise the diurnal pattern of noise on the site. Short duration noise measurements were conducted at the other seven locations during the daytime utilising the shortened measurement procedure contained within the Calculation of Road Traffic Noise (CRTN). In order to characterise night time noise at these locations, the Hawkins Approximation of night time noise measurement has been utilised (Hawkins, NC. (2015) *'The use of short duration night-time noise measurements to estimate* $L_{Aeq.8hour}$*.'* Proceedings of Acoustics 2015, Harrogate, UK. The Institute of Acoustics. Vol. 37. Pt. 2.). The Hawkins Approximation determines that for sites where noise is primarily attributed to road traffic noise, the $L_{Aeq.11pm\text{-}1am}$ is a very accurate approximation to determine the night time $L_{Aeq.8hour}$. Comparisons show that on average this approximation over predicts $L_{Aeq.8hour}$ by just 0.6 dB, yet the instances of under prediction are reduce to less than 10% of noise measurements, ensuring that this Approximation is a valid alternative when full unattended night time noise measurements are not possible.

4.10. **Table 4.2** summarises the noise measurements conducted on the proposed development site. **Figure 4.1** summarises the noise measurements conducted at the long term monitoring location (Location F). **Figure 4.2** shows the reduction in measured noise levels plotted against distance from the M62. **Appendix 1** shows the location of these noise monitoring locations.

Table 4.2: Summary of On Site Noise Measurements

Receptor Identifier	Distance from the M62	$L_{Aeq, 16hr}$* Daytime	$L_{Aeq, 8hr}$* Night Time
A	35m	65.5	60.9

Receptor Identifier	Distance from the M62	$L_{Aeq, 16hr}$* Daytime	$L_{Aeq, 8hr}$* Night Time
B	240m	43.3	38.7
C	390m	43.9	39.3
D	55m	62.5	57.9
E	155m	52.3	47.7
F	188m	52.6	48.0
G	440m	46.2	41.6
H	53m	59.8	55.2

* = Noise measurements, where appropriate, have been corrected in accordance with PPG 24/BS 8233 so that all measurements are displayed as freefield noise levels.

Figure 4.1: Location F Noise Monitoring

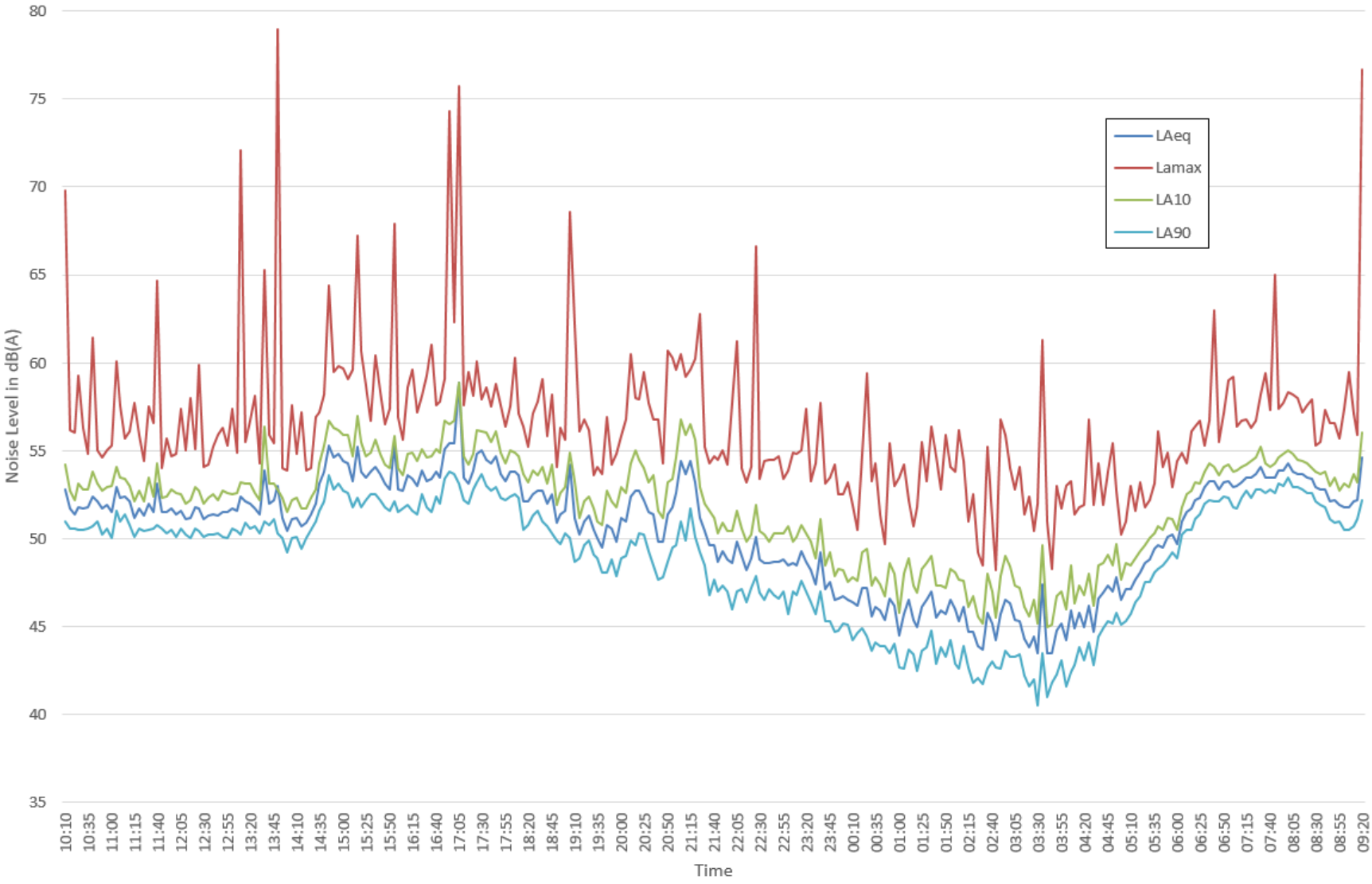


Figure 4.2: Measured Noise Levels Against Distance From the M62 - Daytime

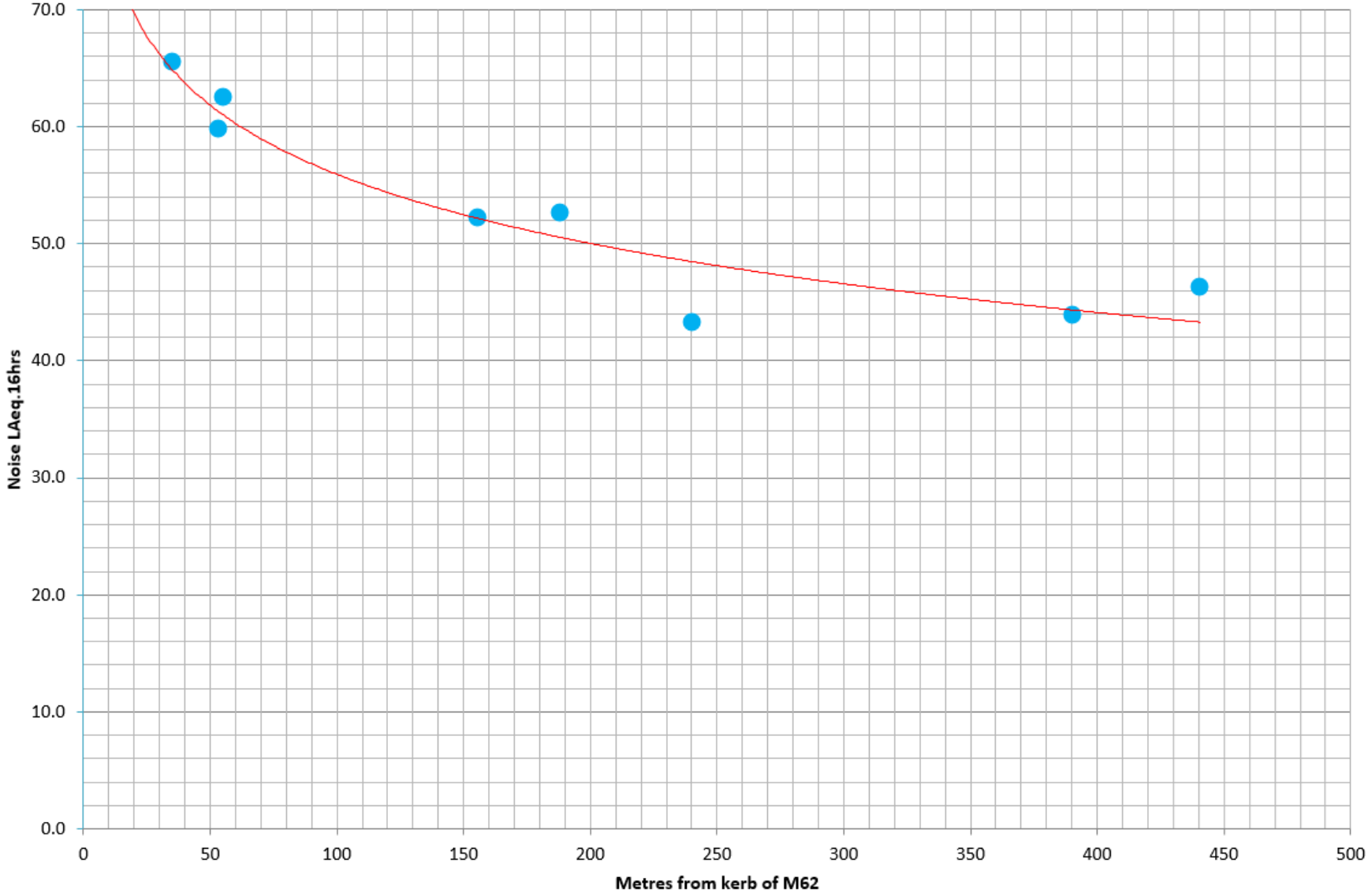
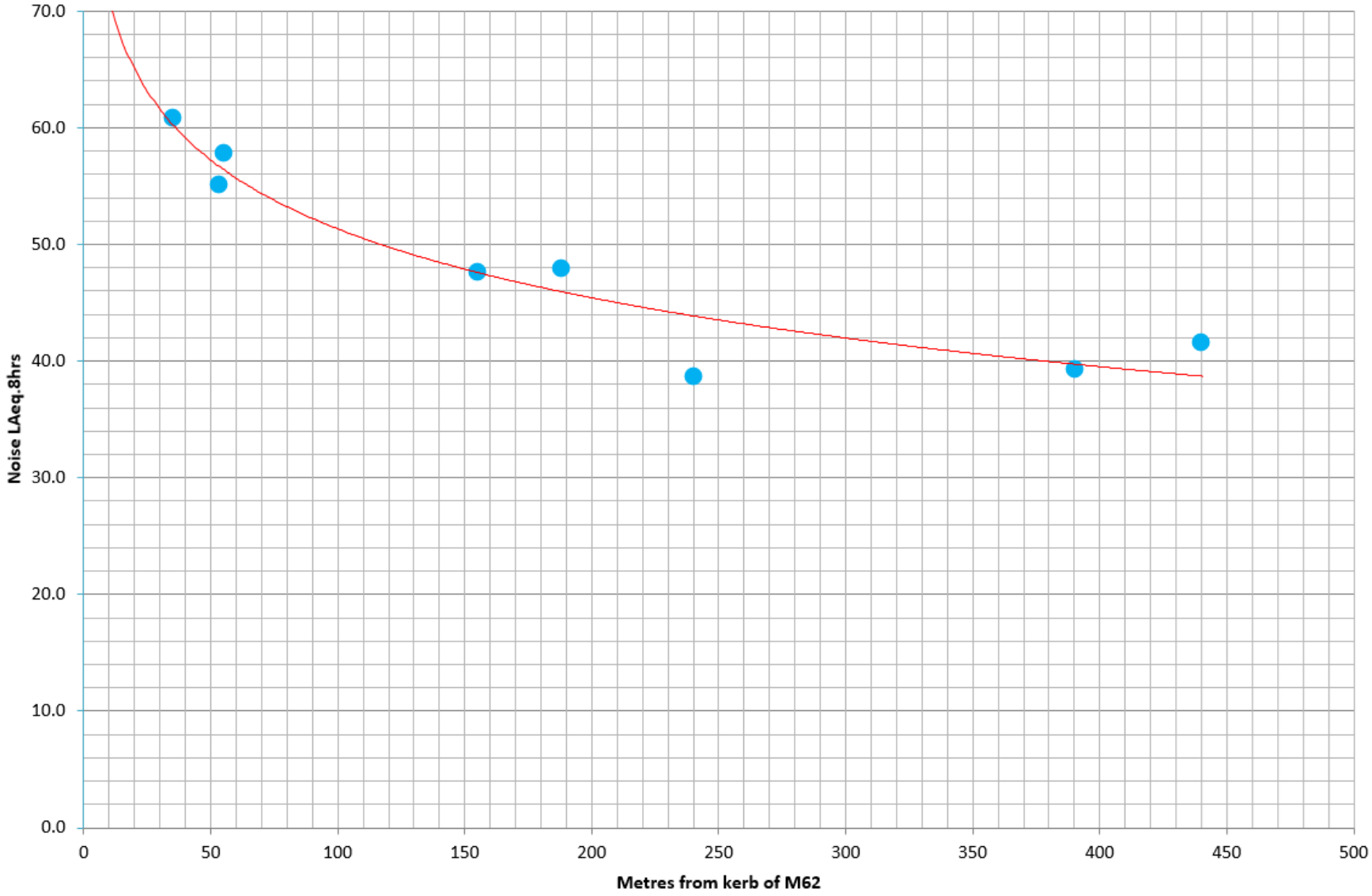


Figure 4.3: Measured Noise Levels Against Distance From the M62 – Night-time



Overview of the Noise Environment

4.11. The proposed development site is characterised mainly by road traffic noise, primarily from the M62 which bounds the proposed development site to the north. To the east, south and west of the site, the noise environment is also characterised by noise from surrounding roads; however generally, the M62 remains the dominant source across the whole site and is ever present.

4.12. Noise from aircraft is also at time audible on the proposed development site.

Overview of the Vibration Environment

4.13. A site walk over survey was conducted to determine whether vibration requires consideration in connection with this Environmental Statement. The development site was visited on a number of occasions between September and December 2014. Due to the separation distances proposed between dwellings and the M62, vibration was not perceptible on the development site. Whilst it is always important to ensure that buildings are designed such that vibration and the propagation of vibration is kept to a minimum, it is not anticipated that vibration is a concern and therefore does not require any more consideration in this Environmental Statement.

5.0 IMPACTS OF THE LOCAL AREA ON THE DEVELOPMENT

5.1. Since the development site is situated close to a number of existing noise sources, noise ingress into the proposed dwellings on site is a significant consideration in the assessment of the site. The assessment of the noise ingress into the proposed rooms for residential purposes and the determination of the facade noise insulation has been assessed using BS 8233: 2014 'Guidance on sound insulation and noise reduction for buildings'.

5.2. The noise measurement survey determined the noise levels to be used in the BS 8233 assessment, which are displayed in **Table 3.1**.

5.3. Since the withdrawal of PPG24, the guidance from NPSE regarding NOEL, LOAEL and SOAEL has been used to assess the overall level of likely impact of noise on a proposed development site, albeit without specific noise levels. Unless local policy dictates otherwise, in the absence of further detailed research on levels of noise impact, Hawkins Environmental use the guideline levels contained within *"Possible Options for the Identification of SOAELs and NOAELs in Support of the NPSE",* as demonstrated in **Table 5.1** for road traffic noise, the dominant noise source at this site.

Table 5.1: Noise Impact Levels

	NOEL $L_{Aeq.T}$	**LOAEL $L_{Aeq.T}$**	**SOAEL $L_{Aeq.T}$**
07:00 to 23:00	<56	56 – 66	>66
23:00 to 0700	<46	46 - 56	>56

5.4. By comparing the noise levels in **Table 5.1** to those in **Table 4.2** and **Figure 4.2** it has been possible to calculate the distance from the M62 at which the action levels of NOEL and SOAEL occur. The results of this assessment can be shown in **Table 5.2**.

Table 5.2: Location of NOEL & SOAEL Contours from the M62

	NOEL	SOAEL
07:00 to 23:00	100m	30m
23:00 to 0700	185m	56m

5.5. **Table 5.2** shows that the NOEL is considered to be 100m from the M62 during the daytime and 185m from the M62 at night-time. At these distances, there will be no detectable effect on health and quality of life due to the noise. The SOEAL is considered to be 30m from the M62 during the daytime and 56m from the M62 at night-time. At locations closer than these distances to the M62, significant adverse effects on health and quality of life could occur. Between these distances (i.e. between 30m and 100m from the M62 during the day and between 56m and 185m from the M62 during the night), adverse effects on health and quality of life can be detected.

5.6. It is clear from **Table 5.2** that any proposed dwellings to be located at a distance greater than 185m from the M62 will be acceptable in terms of noise and no further mitigating measures will be required. However, for dwellings proposed closer than 185m from the M62, they may require additional mitigating measures to ensure that suitable internal noise levels are achieved.

Outdoor Amenity Space

5.7. BS 8233 provides guidance for noise in gardens and outdoor amenity space. It suggests that "it is desirable that the external 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." The guidance does go on to say that these guideline values are not achievable in all circumstances and in some areas, "such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a

situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited."

5.8. At this development site, the locations of the 55dB and 50dB $L_{Aeq.16hour}$ contours have been calculated and determined to be at 110m and 200m from the M62 respectively. It is proposed that only apartments with mechanical ventilation would be situated between 40m and 50m from the M62 and these would have no amenity space other than balconies facing away from the M62.These balconies are likely to benefit from the barrier effects of the proposed apartment blocks and are likely to benefit from noise levels of around 15 dB lower than the front façade of the apartments blocks depending on the mass and size of the proposed apartment blocks. Consequently, any dwellings situated between 40m and 50m from the M62 are likely to benefit from amenity space with noise levels of less than 55 dB(A) due to the barrier effects of themselves.

5.9. Dwelling houses with gardens are proposed at distances from the M62 of 50m or more. At distances of between 50m and 110m, gardens may experience noise levels in excess of the *"upper guideline value of 55 dB $L_{Aeq,T}$"*.

6.0 IMPACTS OF THE DEVELOPMENT ON THE LOCAL AREA

6.1. It has been identified in the scoping phase of the Environmental Impact Assessment, that the following aspects of the proposed development may have an impact on the surrounding environment:

- The impact of the changes in road traffic flows on the noise levels at nearby sensitive receptors;
- The impact of proposed plant on the noise levels at nearby sensitive receptors; and
- The impact of construction noise and vibration (including traffic movements) at nearby sensitive receptors.

The Impact of Changes in Traffic Flow

6.2. The proposed development will see traffic generation on the surrounding road network. The transport consultants for the scheme (Highgate Transportation) have provided traffic data for surrounding roads both with and without the proposed development in place, for the proposed opening year of 2019. The traffic data was provided in AADT flows, but have been converted for purposes of the noise assessments to an 18-hour traffic flow (6am to midnight) using conversion factors derived from local traffic count data. Flows with and without other committed development has also been provided in order to assess the cumulative impact of the proposed development. **Table 6.1** summarises the traffic data used in the assessment.

Table 6.1: Summary of Traffic Data

Road	18-hour Flow – 2019			Change
	Base Flow	Base + Committed	Base + Committed + Development	
Poplars Avenue	6827	7179	11472	60%
Mill Lane (Blackbrook Av - site access)	9855	10713	16052	50%
Mill Lane (Radley Lane - Delph Lane)	882	894	2264	153%
Mill Lane (site access - Delph Lane)	9855	10678	12430	16%
Delph Lane	9673	10466	12089	16%

Road	18-hour Flow – 2019			Change
	Base Flow	Base + Committed	Base + Committed + Development	
Blackbrook Av (Mill Ln - Capesthorne Rd)	8626	9673	14847	53%
Blackbrook Av (Capesthorne Rd - Insall Rd)	10308	10513	13359	27%
Blackbrook A (Insall Rd - Birchwood Way)	11172	11184	14188	27%
Birch Avenue	600	600	788	31%
Cotswold Road	2370	2370	3322	40%
Cleveland Road	5198	5221	6227	19%
Sandy Lane West	13465	13530	15494	15%
Sandy Lane	5104	5127	5398	5%
Winwick Road (M62 - Sandy Ln West)	39273	39455	40813	3%
Winwick Rd (Sandy Ln W - Hawleys Ln)	39990	40196	40713	1%
Winwick Road (south of Hawleys Lane)	36150	36244	36838	2%
Capesthorne Road	11648	12354	13659	11%
Enfield Park Road	7097	8808	10419	18%
Crab Lane	10549	12571	14059	12%
Birchwood Way (A50 - Blackbrook Av)	16764	17493	18322	5%
Birchwood Way (Blackbrook Av - Crab Ln)	17370	18681	19175	3%
Birchwood Way (Crab Ln - Birchwood)	18081	21503	22291	4%
Howson Road	3834	3863	4516	17%
A50 Long Lane	15429	15623	16893	8%
Statham Avenue	2187	2287	2852	25%
Northway	3616	3640	4004	10%
Hilden Road	7238	7391	9220	25%
Insall Road/Fernhead Lane	8085	8473	8620	2%
Cromwell Avenue	10849	11578	12954	12%
Myddleton Lane	2458	3052	4392	44%

Road	18-hour Flow – 2019			Change
	Base Flow	Base + Committed	Base + Committed + Development	
Winwick Link Road	16652	16823	17487	4%
Winwick Road (north of M62)	35186	35462	36344	2%
M62 west	119282	119470	120011	0%
M62 east	11837	11856	11910	0%
M62 west on slip	11409	11427	11478	0%
M62 east	115648	115871	116500	1%
M62 east off slip	9409	9424	9467	0%
M62 east on slip	10191	10207	10254	0%

6.3. Using the changes in traffic flow, the changes in noise levels have been calculated using the methodology contained within the Calculation of Road Traffic Noise (CRTN). **Table 6.2** summarises the results of these calculations for thirteen representative receptor locations. Locations of the thirteen representative receptors can be seen in **Appendix 2**.

Table 6.2: Summary of Traffic Noise Impacts at Representative Receptor Locations

Receptor Location	Change in $L_{A10, 18hr}$
61 Mill Lane	0.8
2 Mill Lane	0.2
15 Colstream Close	1.1
112 St Bridgets Close	1.2
132 Capesthorne Road	0.4
2 Birch Avenue	1.2
36 Cotswold Road	1.5
21 Sandy Lane West	0.6

Receptor Location	Change in $L_{A10, 18hr}$
83 Myddleton Lane	1.6
71 Statham Ave	1.0
150 Poplars Ave	2.0
312 Poplars Ave	2.0
358 Poplars Avenue	2.0

6.4. **Table 6.2** shows that in general, the increase in traffic noise levels are less than 2 dB(A) $L_{A10,18hr}$. A change of less than 3 dB(A) is normally considered to be imperceptible. The greatest change would be observed on Poplars Avenue. **Table 6.3** shows the Noise Impact Magnitude, based on the criteria contained within the 2014 IEMA Guidelines for Environmental Noise Assessment.

6.5. **Table 6.2** shows that at worst, a number of properties close to the road network are likely to experience "Slight" impacts as a consequence of the propose development. It should be noted that the worst affected properties along Mill Lane, where there is a 153% increase in traffic flow predicted, there will be no impact as the noise created by the increased traffic will still be below the level of noise generated by the M62.

Table 6.3: Summary of Traffic Noise Impact Magnitude

Receptor Location	Noise Impact Magnitude
61 Mill Lane	Negligible
2 Mill Lane	Negligible
15 Colstream Close	Slight/Minor
112 St Bridgets Close	Slight/Minor
132 Capesthorne Road	Negligible
2 Birch Avenue	Slight/Minor
36 Cotswold Road	Slight/Minor

Receptor Location	Noise Impact Magnitude
21 Sandy Lane West	Negligible
83 Myddleton Lane	Slight/Minor
71 Statham Ave	Slight/Minor
150 Poplars Ave	Slight/Minor
312 Poplars Ave	Slight/Minor
358 Poplars Avenue	Slight/Minor

Cumulative Impacts for Traffic Noise

6.6. It is understood that there are a number of other committed developments in the area that have been consented that will contribute to increased traffic flow in the area. Whilst the increase in traffic flow direct attributed to the proposed development is unlikely to have a significant impact, the cumulative impact of the other proposed developments combined with the proposed traffic generation from the Peel Hall development has been assessed to determine the cumulative impact from all development.

6.7. The committed developments under consideration are as follows:

- Land at Benson Road, Birchwood (ref: 2015/26220).
- Birchwood Shopping Centre (ref: 2015/25880).
- Birchwood Park (ref: 2015/26044, 2014/23358 and 2008/12744).
- Calver Park (ref: 2015/26685 and 2013/22533).

6.8. In order to assess the impact of the proposed development, previously the changes in noise level as described in **Table 6.2**, and **Table 6.3** have been modelled both with and without the proposed development, including all committed development traffic. However, in **Table 6.4** and **Table 6.5**, the noise level with the proposed development and all other committed development is compared to noise levels without either the proposed development or other committed development, to determine the cumulative impact of all development in the area.

Table 6.4: Summary of the Cumulative Traffic Noise Impacts at Representative Receptor Locations

Receptor Location	Change in $L_{A10, 18hr}$
61 Mill Lane	0.9
2 Mill Lane	0.2
15 Colstream Close	1.4
112 St Bridgets Close	1.6
132 Capesthorne Road	0.7
2 Birch Avenue	1.2
36 Cotswold Road	1.5
21 Sandy Lane West	0.6
83 Myddleton Lane	2.5
71 Statham Ave	1.2
150 Poplars Ave	2.3
312 Poplars Ave	2.3
358 Poplars Avenue	2.3

Table 6.5: Summary of Traffic Noise Impact Magnitude

Receptor Location	Noise Impact Magnitude
61 Mill Lane	No Impact
2 Mill Lane	No Impact
15 Colstream Close	Slight
112 St Bridgets Close	Slight
132 Capesthorne Road	No Impact
2 Birch Avenue	Slight

Receptor Location	Noise Impact Magnitude
36 Cotswold Road	Slight
21 Sandy Lane West	No Impact
83 Myddleton Lane	Slight
71 Statham Ave	Slight
150 Poplars Ave	Slight
312 Poplars Ave	Slight
358 Poplars Avenue	Slight

6.9. The results in **Table 6.4** and **Table 6.5** show that the impact of the increase in traffic flow is still very small at the worst affected sensitive receptors and although the impact is greater when considering all development together, the cumulative impact is still considered to be *"Slight"* or less at all receptor locations.

The Impact of Plant Noise

6.10. The proposed development will see the creation of employment space, a local centre and a new school. All of these land uses could potentially require plant that could make a noise that could cause an impact to new or existing residents of the area. At this stage in design process, the noise output of specific items of plant have yet to be determined and the design, exact location and layout of these building and land uses have yet to be determined; therefore, it is not possible to provide a full and detailed assessment of the likely impact of plant noise.

6.11. Whilst some background noise monitoring has been conducted on the site, it is unlikely to be representative of the potentially worst-affected properties. Consequently, it is seen as premature to set environmental noise limits for plant in accordance with BS 4242: 2014 *'Methods for rating and assessing industrial and commercial sound'*.

6.12. Given the type of land uses proposed that may give rise to plant noise, it is unlikely to be a significant constraint upon the development of the site and it is likely that plant noise could easily be mitigated in the design phase. Therefore, it is recommended that when the sites come forward for detailed applications, plant noise can be addressed at this stage.

The Impact of Construction Noise

6.13. Given the site's location close to a number of existing dwellings, including a small number of dwellings where the development will actually surrounding the existing dwellings, the potential impact of noise and vibration from construction activities will need to be considered. However, given that a detailed program of works, including identification of all plant to be used and the location and duration of the use of this plant, has yet to be prepared, a quantitative construction noise and vibration assessment has not been carried out. Instead a qualitative assessment focussing on best practicable means has been completed. In general the construction works with the greatest potential to generate noise are demolition works and the piling of foundations. Building construction itself generally results in lower noise levels. Only limited demolition is expected to occur and at this stage no details are available on whether piling of foundations will be require. If piling is not required there is no potential for significant vibration impacts.

7.0 EVALUATION OF SIGNIFICANCE

Impacts of the Local Area on the Development

7.1. Noise measurements have indicated that for dwellings up to 185m from the M62 and for gardens up to 110m from the M62, unmitigated noise levels will exceed the recommended maximum internal and external noise levels respectively. However, given that no dwellings are proposed at distances less than 40m from the M62 and only flats are proposed between 40m and 50m from the M62, it is anticipated that through suitable detailed design, taking into account the noise constraints of the site, both suitable internal and external noise levels can be achieved and therefore road noise this is not considered to be a significant constraint upon the development of the site.

Impacts of the Development on the Local Area

7.2. The evaluation of key impacts has shown that providing suitable precautions are made in the planning and execution of the construction phase of the development, significant impacts can be avoided. Similarly, provided the Rating noise level from plant remains below the advised levels, significant impacts from plant noise should not occur to either existing or proposed sensitive receptors.

7.3. The increase in noise levels as a consequence of changes in traffic flow associated with the proposed development can be seen in **Table 6.4** and **Table 6.5**. The results show that the magnitude of the impact would be considered to be *"Slight"* or *"Minor"*. The IEMA Guideline suggest that a *"Slight"* impact is less likely to be considered significant. Given that the greatest impacts are no greater than 2.0 dB(A), which generally is not perceptible to general population, plus the fact that the main impacts are situated away from the M62, where off-site noise measurements have indicated that the $L_{Aeq.16hours}$ noise levels are below the NOEL level of 56 dBA(A) (as a guide, the $L_{Aeq.16hours}$ noise levels is approximately 2 dB(A) lower than the $L_{A10.18hour}$ noise level), it is anticipated that in terms of noise, an increase of up to 2 dB(A) is unlikely to change behaviour or have any consequence in terms of quality of life; therefore the impact is not considered to be significant.

8.0 MITIGATION

Impacts of the Local Area on the Development

8.1. This Environmental Statement accompanies an outline planning application which identifies the number of dwellings that will be constructed within certain areas on the proposed development. Consequently, detailed layouts of how the dwellings will be arranged on the site or how the dwellings will be orientated has not been decided and will not be specified until the detailed application stage, which will follow once planning consent has been gained for the site as a whole. Site layout, dwelling layout and dwelling orientation have a significant impact of the level of mitigation required to ensure suitable internal noise levels. Since these factors have yet to be determined, it will not be possible to assess in detail the level of mitigation required at different areas of the site.

8.2. It has been determined that the closest (and therefore worst-affected) dwellings to the M62 will be apartments with mechanical ventilation situated no closer than 40m from the M62. It has been extrapolated from the onsite noise measurement data that flats at 40m from the M62 will have a daytime $L_{Aeq.16hrs}$ of 64 dB(A) and a night-time $L_{Aeq.8hrs}$ of 59 dB(A). Based on these external noise levels, it is possible to calculate the worse-case level of mitigation using the methodology contained within BS 8233. Section 6.7 of BS 8233 provides a rigorous calculation method for determining the internal noise levels within a proposed development. **Figure 8.1** shows the published calculation procedure.

Figure 8.1: BS 8233:2014 External to Internal Noise Level Calculation Method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3 \quad \text{(G.1)}$$

where:

$L_{eq,ff}$	is the equivalent continuous sound pressure level outside the room elements under consideration;
	NOTE 3 It is the free-field sound level (i.e. in the absence of the facade), measured or estimated at the intended position of the element under consideration. It is related to the level $L_{eq,1}$ measured within a few millimetres of the actual facade by the relation $L_{eq,ff} \approx L_{eq,1} - 6$, and to the level $L_{eq,2m}$ measured 2 m away from the facade by the relation $L_{eq,ff} \approx L_{eq,2m} - 3$.
	NOTE 4 The calculation method assumes the source is traffic noise and a facade shape correction factor is not required. BS EN 12354-3 provides a more detailed calculation method where these assumptions are not valid.
A_0	is a reference absorption area of 10 m² and is independent of frequency;
S_f	is the total facade area in square metres (m²) of the room in question;
S_{wi}	is the area in square metres (m²) of the windows of the room;
S_{ew}	is the area in square metres (m²) of the external wall of the room;
S_{rr}	is the area in square metres (m²) of the ceiling of the room;
S	is the total area in square metres (m²) of elements through which sound enters the room, i.e. $S_f + S_{rr}$;
$D_{n,e}$	is the insulation of the trickle ventilator measured according to BS EN ISO 10140;
	NOTE 5 Where more than one ventilation unit is required to achieve the background ventilation, the $D_{n,e}$ of the combined ventilators should be used in the calculation.
R_{wi}	is the sound reduction index (octave band value) of the window (see Annex C);
R_{ew}	is the sound reduction index (octave band value) of the external wall (see Annex C);
R_{rr}	is the sound reduction index (octave band values) of the roof/ceiling (see Annex C);
A	is the equivalent absorption area of the receiving room being considered (see Annex C);
3	is a correction factor.

8.3. Using the equation in **Figure 8.1**, it is possible to calculate the internal noise levels based on typical construction details and typical room dimensions and therefore calculate the minimum R_w for the windows. It is widely known that a masonry wall will have a R_w of at least 50 dB, sometimes as high as 55 to 60 dB. The R_w of individual glazing solutions will vary considerably. However, typical double glazed window systems will have a R_w of 31 to 33 dB.

8.4. **Table 8.1** shows the results of the calculations based on a daytime $L_{Aeq.16hrs}$ of 64 dB(A) and a night-time $L_{Aeq.8hrs}$ of 59 dB(A) at 40m from the M62. The calculations show that a double

glazed window system with a R_w of 34 dB or more, with a mechanical ventilation system, would achieve noise levels less than the recommended maximum levels contained within BS 8233. Windows with a lower R_w of 30 dB would be suitable for living rooms and all other non-bedrooms. Measurements at 35m from the M62 (i.e. marginally closer than the proposed dwellings) indicate that L_{Amax} noise levels rarely exceed 78 dB at this location. A double glazed window system with a R_w of 34 dB or more in the bedrooms would ensure internal L_{Amax} noise levels would not exceed 45 dB.

8.5. Since the calculations of internal noise levels at dwellings 40m from the M62 have indicated that suitable internal noise levels can be achieved, providing bedroom windows have a minimum R_w of 34 dB and all other rooms have a minimum window R_w of 30, it can be concluded that the rest of the proposed development site would also benefit from suitable internal noise levels providing the glazing meets these minimum criteria. For comparison, a typical double glazed window systems will have a R_w of 31 to 33 dB. It should be noted that dwellings further from the M62 would benefit from lower noise lowers due to both distance and the screening effects of other buildings between those dwellings and the M62, the characteristics of which have yet to be determined. Therefore, it is likely that by the second or third line of houses from the M62, a typical double glazed window systems with a R_w of 31 to 33 dB would be sufficient in all rooms.

Table 8.1: Summary of BS 8233 Calculations and Minimum Window R_w – Flats at 40m from the M62

Room Type	Day L_{Aeq}				Night L_{Aeq}				Minimum Window R_w	Ventilation Required?
	External	Internal			External	Internal				
		BS 8233 Max.	Windows Closed	Windows Open		BS 8233 Max.	Windows Closed	Windows Open		
Living room	64	35	34.3	49	-	-	-	-	30	Yes
Bedroom	64	35	30.4	49	59	30	25.4	44	34	Yes

Outdoor Amenity Space

8.6. Dwelling houses with gardens are proposed at distances from the M62 of 50m or more. At distances of between 50m and 110m, gardens may experience noise levels in excess of the *"upper guideline value of 55 dB $L_{Aeq,T}$"*. However, as with the apartment blocks situated between 40m and 50m from the M62, dwelling houses between 50m and 110m from the M62 could be arranged such that the dwellings themselves act as a noise barrier to the gardens behind the dwellings. Similarly, if the apartment blocks or the first line of dwelling houses are sufficiently tall enough and form a continuous barrier, they may provide significant protection to gardens behind, such that noise levels in all gardens could be below the *"upper guideline value of 55 dB $L_{Aeq,T}$"*. Consequently, it is recommended that at the detailed application stage, detailed calculations are conducted to ensure that noise levels in gardens between 50m and 110m from the M62 do not exceed the *"upper guideline value of 55 dB $L_{Aeq,T}$"* and the design of the site is orientated to facilitate this, or alternative mitigation is put in place to ensure suitable external noise levels.

Changes in Traffic Flow

8.7. Mitigation to control additional traffic noise as a consequence of the proposed development is not required as the impact would be considered *"Slight/Minor"* and not considered to be significant.

The Impact of Plant Noise

8.8. Depending on the location and sound pressure output of the proposed plant, mitigation may also be required to reduce noise levels below the Rating level as described earlier in this chapter. However, mitigation for both plant and construction noise should be routine and could be specified at a later date.

The Impact of Construction Noise

8.9. Mitigating measures are likely to be required to control construction noise. It is proposed that to minimise construction noise impacts, all construction work should take place in standard construction hours, which are:

- Monday – Friday: 08:00 – 18:00
- Saturdays: 08:00 - 13:00; and
- Sundays and Public Holidays: No construction

8.10. It is recommended that the contractor would be required to follow Best Practicable Means to reduce the noise impact upon the local community including the following:

- Operating hours should be adhered to, with local residents being notified of any changes to the operating hours of the site;
- All construction plant and equipment should comply with EU noise emission limits;
- Where practicable, design and use of site hoardings and screens to provide acoustic screening of noise emitting equipment;
- Proper use of plant with respect to minimising noise emissions and regular maintenance. All vehicles and mechanical plant used for the purpose of the works should be fitted with effective exhaust silencers and should be maintained in good efficient working order;
- Selection of inherently quiet plant where appropriate. All major compressors should be 'sound reduced' models fitted with properly lined and sealed acoustic covers which should be kept closed whenever the machines are in use and all ancillary pneumatic percussive tools should be fitted with mufflers or silencers of the type recommended by the manufacturers;
- Machines in intermittent use should be shut down in the intervening periods between work or throttled down to a minimum;
- Plant and equipment such as flat bed lorries, skips and chutes should be lined with noise attenuating materials. Materials should be handled with care and be placed, not dropped. Materials should be delivered during normal working hours;
- All ancillary plant such as generators, compressors and pumps should be position so as to cause minimum noise disturbance, i.e. furthest from receptors or behind close boarded noise barriers. If necessary, acoustic enclosures should be provided and/or acoustic shielding;

- Making positive contact with local residents and providing information on the construction can be the most effective method of reducing the impact of construction noise on sensitive receptors. If appropriate, the above measures can be incorporated into a construction environmental management plan;
- Construction contractors should be obliged to adhere to the codes of practice for construction working given in BS 5228 and the guidance given therein regarding minimising noise emissions from the site; and
- Reference should be made to the Building Research Establishment, BRE ‘Pollution Control’ guidelines, Parts 1-57.Noise Monitoring.

9.0 CONCLUSIONS

9.1. A detailed noise measurements survey and assessment has been carried out in accordance with BS 7445-2: 1991 *'Description and measurement of environmental noise Part 2: Guide to the acquisition of data pertinent to land use'*, with the assessment methodology used to assess noise ingress into the proposed development conducted in accordance with BS 8233: 2014 *'Guidance on sound insulation and noise reduction for buildings'*, and the National Planning Policy Framework.

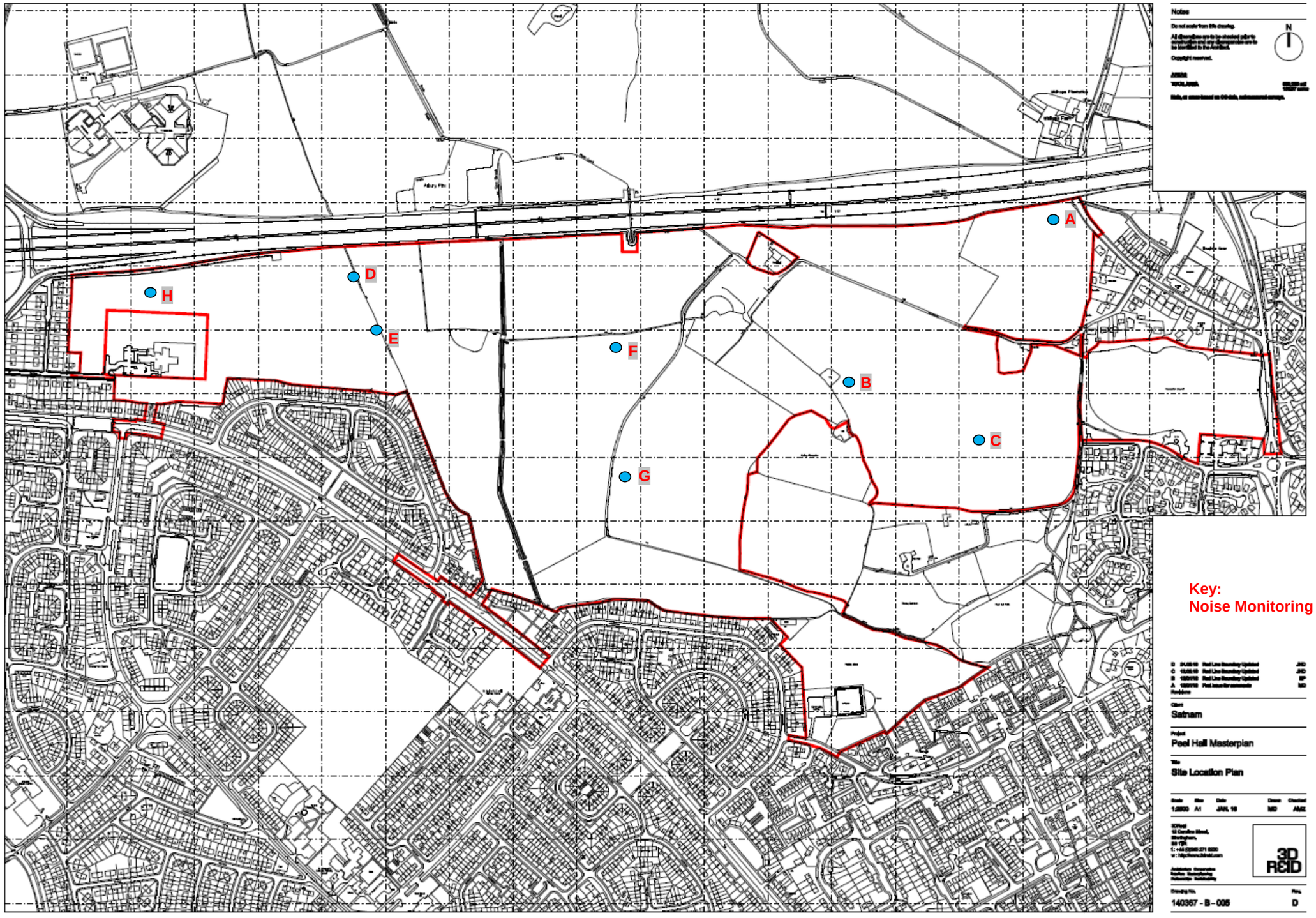
9.2. The assessment shows that proposed development site is characterised mainly by road traffic noise, primarily from the M62 which bounds the proposed development site to the north. To the east, south and west of the site, the noise environment is also characterised by noise from surrounding roads; however generally, the M62 remains the dominant source across the whole site and is ever present.

9.3. The constraints of the proposed development site show that suitable internal noise levels in accordance with BS 8233 can be achieved through the provision of suitable glazing. At distances of between 50m and 110m from the M62, gardens may experience noise levels in excess of the *"upper guideline value of 55 dB* $L_{Aeq,T}$*"*. However, the exact site layout is not yet known, which will have a significant impact on the barrier effects that the proposed buildings may have on their associated gardens. It is recommended that detailed modelling of garden noise is carried out for distances up to 110m from the M62 when detailed planning applications are submitted and appropriate mitigation is implemented accordingly.

9.4. The impacts of the proposed development have been assessed. The impacts of construction noise and vibration will need to be carefully considered and managed and appropriate site specific mitigation implemented. Traffic generation is likely to increase noise levels on surrounding roads. However, the assessment has shown that at worst, the impact of the increase in traffic noise levels will be less than 2 dB(A) $L_{A10,18hr}$. A change of less than 3 dB(A) is normally considered to be imperceptible. According to the criteria contained within the 2014 IEMA Guidelines for Environmental Noise Assessment, this level of impact would be considered to be *"Slight"* (or *"Minor"*) and as such, the impact is considered to be not significant.

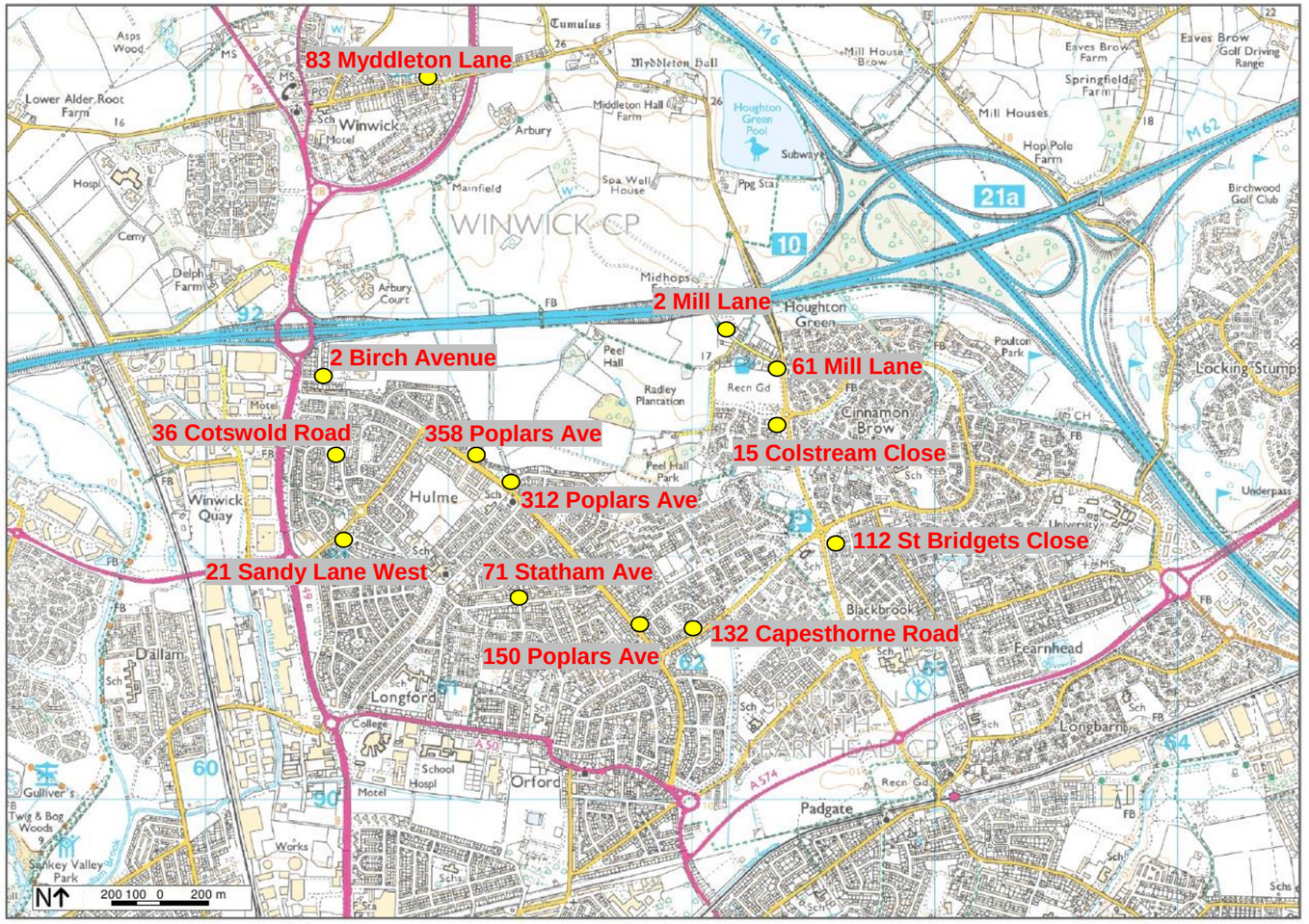
9.5. Since it has been shown that the proposed development meets the guidance contained within the 2014 IEMA Guidelines for Environmental Noise Assessment and BS 8233: 2014 *'Guidance on sound insulation and noise reduction for buildings'*, it is considered that the proposed development adheres to the principles of the National Planning Policy Framework since the new development will not be *"put at risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution"*. Since it has been shown that in terms of noise, the proposals adhere to local and national planning policy, it is considered that noise should not be a constraint on the proposed residential development.

Appendix 1: Site Location Plan



Appendix 2: Receptor Locations

The site plan below shows the locations of the sample sensitive receptor locations used within the modelling:



Map Information

Scale	1:25000
Date:	23/05/16
Reference	H1960
Order No:	1681731

Map data

FIND
PROFESSIONAL MAPPING INTELLIGENCE
Created at findmaps.co.uk