Document 6.2

The West Midlands Rail Freight Interchange Order 201X

ES - Vol 1 - Chapter 13: Noise and Vibration

Regulation 5(2)(a)

Resound Acoustics - July 2018

West Midlands Interchange

Four Ashes Ltd

13 Noise and Vibration

Introduction

13.1 This chapter of the ES sets out an assessment of the likely significant environmental effects of the Proposed Development in respect of noise and vibration. In particular, this chapter describes the relevant legislation and noise and vibration policy context; the methods used for assessment and details of the criteria used to determine significance; the baseline noise and vibration conditions at and surrounding the Site; the potential impacts and effects as a result of the Proposed Development; any mitigation or control measures required to reduce or eliminate adverse effects; and the subsequent residual effects and likely significant effects associated with the Proposed Development.

13.2 This chapter is accompanied by the following technical appendices:

- Technical Appendix 13.1: Glossary of Terminology;
- Technical Appendix 13.2: Standards and Guidelines;
- Technical Appendix 13.3: Full Survey Results;
- Technical Appendix 13.4: Construction Assessment; and
- Technical Appendix 13.5: Operational Noise Assessment Information.

13.3 This chapter is written by Resound Acoustics Limited, a member of the Association of Noise Consultants.

Legislation and Policy Context

National Legislation and Policy

National Policy Statement for National Networks, 2015

13.4 The National Policy Statement for National Networks (NPS)[1], published in December 2014, sets out the overarching policy position for Strategic Rail Freight Interchange (SRFI) schemes. The section titled *Noise and Vibration*, states under the heading *Decision Making*:

"5.193 Developments must be undertaken in accordance with statutory requirements for noise. Due regard must have been given to the relevant sections of the Noise Policy Statement for England, National Planning Policy Framework and the Government's associated planning guidance on noise.

5.194 The project should demonstrate good design through optimisation of scheme layout to minimise noise emissions and, where possible, the use of landscaping, bunds or noise barriers to reduce noise transmission. The project should also consider the need for the mitigation of impacts elsewhere on the road and rail networks that have been identified as arising from the development, according to Government policy.

5.195 The Secretary of State should not grant development consent unless satisfied that the proposals will meet, the following aims, within the context of Government policy on sustainable development:

- *avoid significant adverse impacts on health and quality of life from noise as a result of the new development;*
- *mitigate and minimise other adverse impacts on health and quality of life from noise from the new development; and*
- *contribute to improvements to health and quality of life through the effective management and control of noise, where possible.*

5.196 In determining an application, the Secretary of State should consider whether requirements are needed which specify that the mitigation measures put forward by the applicant are put in place to ensure that the noise levels from the project do not exceed those described in the assessment or any other estimates on which the decision was based."

13.5 Under the heading *Mitigation*, the NPS sets out a hierarchy for considering how to control or reduce noise emissions:

"5.197 The Examining Authority and the Secretary of State should consider whether mitigation measures are needed both for operational and construction noise over and above any which may form part of the project application. The Secretary of State may wish to impose requirements to ensure delivery of all mitigation measures.

5.198 Mitigation measures for the project should be proportionate and reasonable and may include one or more of the following:

- *engineering: containment of noise generated;*
- *materials: use of materials that reduce noise, (for example low □noise road surfacing);*
- *lay-out: adequate distance between source and noise-sensitive receptors; incorporating good design to minimise noise transmission through screening by natural or purpose built barriers; and*
- *administration: specifying acceptable noise limits or times of use (e.g., in the case of railway station PA* systems*)."*

13.6 Importantly, at paragraph 5.199, the NPS states:

"5.199 For most national network projects, the relevant Noise Insulation Regulations will apply. These place a duty on and provide powers to the relevant authority to offer noise mitigation through improved sound insulation to dwellings, with associated ventilation to deal with both construction and operational noise. An indication of the likely eligibility for such compensation should be included in the assessment. In extreme cases, the applicant may consider it appropriate to provide noise mitigation through the compulsory acquisition of affected properties in order to gain consent for what might otherwise be unacceptable development. Where mitigation is proposed to be dealt with through compulsory acquisition, such properties would have to be included within the development consent order land in relation to which compulsory acquisition powers are being sought." □

13.7 For an SRFI, the Noise Insulation Regulations for both roads and railways may be relevant, indicating that the trigger noise levels at which noise insulation might be offered are relevant for a national network project.

Noise Insulation Regulations

13.8 As noted above, the NPS states that:

"5.199 For most national network projects, the relevant Noise Insulation Regulations will apply."

[1] *National Policy Statement for National Networks*, Department of Transport (2014)

13.9 It is therefore appropriate to consider the content of the Noise Insulation Regulations for both roads and railways.

Noise Insulation Regulations 1975 (as amended 1988)

13.10 The Noise Insulation Regulations 1975 (as amended 1988)[2] set out conditions, which if satisfied, require the promoter of a new road to offer affected residents sound insulation or a grant in respect of sound insulation. The Noise Insulation Regulations 1975 (as amended 1988) are referred to in this chapter as 'the NIR 1975'.

13.11 The NIR 1975 indicate that a residential property within 300 metres of a new or modified highway shall be eligible for sound insulation works when:

- road traffic noise levels exceed a façade noise level of 68dB $L_{A10,18hrs}$;
- road traffic noise increases by at least 1dB as a result of the new or modified highway; and
- the contribution from the new or modified highway to the overall road traffic noise level is at least 1dB.

13.12 If all three criteria are met, sound insulation works are carried out, or a grant in respect of sound insulation works is offered. The NIR 1975 provide a specification for doors, windows, blinds and ventilation units to be provided.

13.13 Night-time noise levels are not referred to in the NIR 1975.

13.14 The effect of the amendments to the road network as a result of the Proposed Development have been assessed against the provisions of the NIR 1975.

13.15 The 68dB $L_{A10,18hr}$ value stipulated in the NIR 1975 can be converted to a 16 hour L_{Aeq} value to match the time period and noise index used elsewhere in this assessment, so that noise levels are considered on a consistent basis. This is achieved by subtracting 5dB, which includes -3dB to remove the façade correction, a further -3dB correction to convert the 18 hour L_{A10} noise level to an 18 hour L_{Aeq} noise level, and a +1dB correction to convert the 18 hour L_{Aeq} to a 16 hour L_{Aeq}.

13.16 The equivalent threshold for eligibility for noise insulation, expressed as a free-field 16 hour L_{Aeq} value is, therefore, 63dB $L_{Aeq,16hrs}$.

Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996

13.17 The Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996[3], referred to in this chapter as 'the NIR 1996', adopt a similar approach as the Noise Insulation Regulations 1975 (as amended 1988).

13.18 The NIR 1996 indicate that a residential property within 300 metres of a new or modified railway shall be eligible for sound insulation works when:

- railway noise levels exceed façade noise levels of 68dB $L_{Aeq,18hrs}$ during the daytime, or 63dB $L_{Aeq,6hrs}$ during the night-time;
- railway noise levels increase by at least 1dB as a result of the new or modified railway; and
- the contribution from the new or modified railway to the overall railway noise level is at least 1dB.

13.19 If all three criteria are met, noise insulation works are carried out, or a grant in respect of noise insulation works is offered. The NIR 1996 provide a specification for doors, windows, blinds and ventilation units to be provided.

13.20 The effect of the amendments to the rail network as a result of the Proposed Development have been assessed against the provisions of the NIR 1996.

13.21 The daytime value of 68dB $L_{Aeq,18hrs}$ can be converted to a 16 hour L_{Aeq} value so that a consistent set of values is attained, by subtracting 2dB, which includes a -3dB to remove the façade correction, and a +1dB correction to convert the 18 hour L_{Aeq} to a 16 hour L_{Aeq}. The equivalent daytime threshold for eligibility for noise insulation, expressed as a free-field 16 hour L_{Aeq} value is, therefore, 66dB $L_{Aeq,16hrs}$.

13.22 The night-time value of 63dB $L_{Aeq,6hrs}$ can be converted to a 8 hour L_{Aeq} value to match the time period and noise index used elsewhere in this chapter, by subtracting 4dB, which includes -3dB to remove the façade correction, and a -1dB correction to convert the 6 hour L_{Aeq} to a 8 hour L_{Aeq}. The resultant night-time threshold for eligibility for sound insulation, expressed as a free-field 8 hour L_{Aeq} value is, therefore, 59dB $L_{Aeq,16hrs}$.

National Planning Policy Framework, 2012

13.23 Although of less direct importance than the NPS in terms of applicable planning policy, the *National Planning Policy Framework* (NPPF)[4] is referenced in paragraph 5.193 of the NPS as being of relevance, so it is summarised here.

13.24 The Department for Communities and Local Government published the NPPF on 27th March 2012 and upon its publication, the majority of planning policy statements and guidance notes were withdrawn, including Planning Policy Guidance 24 *Planning and Noise* (PPG24)[5] which until the emergence of the NPPF, set out the Government's position on how noise should be dealt with in the planning system.

13.25 The general guiding principle in the NPPF is contained in Section 11 under the heading *Conserving and enhancing the natural environment*. Paragraph 109 states:

"109 The planning system should contribute to and enhance the natural and local environment by:

- *preventing both new and existing development from contributing to or being put at* unacceptable *risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability;"*

13.26 The guidance set out in PPG24 has been replaced in the NPPF by four aims, which are set out at paragraph 123 in Section 11 of the document, titled *Conserving and enhancing the natural environment*:

"123 Planning policies and decisions should aim to:

- *avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including 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] SI 1975 No. 1763 Building and Buildings, The Noise Insulation Regulations 1975
SI 1988 No. 2000 Building and Buildings, The Noise Insulation (Amendment) Regulations 1988
[3] SI 1996 No. 428 Building and Buildings, The Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996
[4] *National Planning Policy Framework* (2012), DCLG
[5] Department of the Environment, Transport and the Regions (1994) Planning Policy Guidance 24: *Planning and Noise*. HMSO, London

13.27 There are two footnotes to the above guidance. The first footnote refers to the Explanatory Note of the Noise Policy Statement for England, which provides the definition for both:

"significant adverse impacts on health and quality of life" and "adverse impacts on health and quality of life" as described in the first two bullet points.

13.28 The second footnote indicates that the third bullet point is:

"subject to the provisions of the Environmental Protection Act 1990 and other relevant law".

Noise Policy Statement for England, 2010

13.29 The Department for Environment, Food and Rural Affairs published the *Noise Policy Statement for England* (NPSE)[6] in March 2010.

13.30 The NPSE sets out a Noise Policy Vision to promote good health and good quality of life through the effective management of noise *"within the context of Government Policy on sustainable development"*. The meaning of this is explained at paragraph 2.18 of the NPSE as follows:

"2.18 There is a need to integrate consideration of the economic and social benefit of the activity or policy under examination with proper consideration of the adverse environmental effects, including the impact of noise on health and quality of life. This should avoid noise being treated in isolation in any particular situation, i.e. not focusing solely on the noise impact without taking into account other relevant factors."

13.31 It is clear that the NPSE requires noise to be considered in the wider context of sustainable development.

13.32 The explanatory note of NPSE defines the terms used in the NPPF:

"2.20 There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:

- *NOEL – No Observed Effect Level*

This is the level 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 above which adverse effects on health and quality of life can be detected.

2.21 Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

- *SOAEL – Significant Observed Adverse Effect Level*

This is the level above which significant adverse effects on health and quality of life occur."

13.33 This, therefore, is the basis for identifying what is meant by "*adverse impacts on health and quality of life from noise"* at paragraph 5.195 of the NPS.

13.34 The NPSE does not define the SOAEL numerically, stating at paragraph 2.22:

"2.22 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."

13.35 There is no local or national guidance on how the three terms should be defined numerically.

13.36 There are three aims in the NPSE, which match, and expand upon, the first two bullet points in paragraph 123 of the NPPF and add a third aim that relates to a wider improvement in health and quality of life (the bold text is in the NPSE):

"The first aim of the Noise Policy Statement for England

Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

2.23 The first aim of the NPSE states that significant adverse effects on health and quality of life should be avoided while also taking into account the guiding principles of sustainable development (paragraph 1.8).

The second aim of the Noise Policy Statement for England

Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

2.24 The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such adverse effects cannot occur.

The third aim of the Noise Policy Statement for England

Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

2.25 This aim seeks, where possible, positively to improve health and quality of life through the pro-active management of noise while also taking into account the guiding principles of sustainable development (paragraph 1.8), recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim."

13.37 The three aims set out in the NPSE are the same as the three aims set out at paragraph 5.195 of the NPS.

National Planning Practice Guidance, 2014

13.38 In March 2014, the Government released Planning Practice Guidance (PPG)[7] on noise, titled *Noise*. This on-line guidance sets out a number of principles in the form of questions and answers, and reinforces the guidance set out in the NPPF and the NPSE. The PPG on noise was most recently updated in December 2014.

13.39 The Noise PPG notes in paragraph 001 that:

"001 Noise needs to be considered when new development may create additional noise and when new developments would be sensitive to the prevailing acoustic environment."

13.40 It goes on to note in paragraph 003 that:

[6] *Noise Policy Statement for England* (2010), DEFRA

[7] Planning Practice Guidance (2014) *Noise*, DCLG

"003 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."*

13.41 The noise PPG broadly repeats the NPSE definitions of the NOEL, LOAEL and SOAEL and it provides a summary table to explain how the terms relate to each other and to typical human reactions to sound.

13.42 The table is replicated below in Table 13.1.

Table 13.1: Planning Practice Guidance summary of noise exposure hierarchy

Perception	Examples of Outcome	Increasing Effect Level	Action
Not noticeable	No effect	No observed effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No observed adverse effect	No specific measures required
		Lowest observed adverse effect level	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed adverse effect	Mitigate and reduce to a minimum
		Significant observed adverse effect level	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting back to sleep, premature awakening and difficulty getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant observed adverse effect	Avoid
Noticeable and very disruptive	Extensive and regular 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; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable adverse effect	Prevent

13.43 It is noted that the text in paragraph 005 of the PPG for noise reiterates the point illustrated in Table 13.1, that there are degrees of adverse effect above the SOAEL. Table 13.1 defines two degrees of significant adverse effect: a significant observed adverse effect, which is deemed noticeable and disruptive, and an unacceptable adverse effect, which is deemed noticeable and very disruptive.

13.44 The distinction between these two degrees of significant adverse effect is expanded in the text in paragraph 005 of the PPG for noise:

"005 Increasing noise exposure will at some point cause the significant observed adverse effect level boundary to be crossed. Above this level the noise causes a material change in behaviour such as keeping windows closed for most of the time or avoiding certain activities during periods when the noise is present. If the exposure is above this level the planning process should be used to avoid this effect occurring, by use of appropriate mitigation such as by altering the design and layout. Such decisions must be made taking account of the economic and social benefit of the activity causing the noise, but it is undesirable for such exposure to be caused.

At the highest extreme, noise exposure would cause extensive and sustained changes in behaviour without an ability to mitigate the effect of noise. The impacts on health and quality of life are such that regardless of the benefits of the activity causing the noise, this situation should be prevented from occurring."

13.45 The PPG, which is the most recent manifestation of Government advice on how noise should be treated within the planning system, is clear that a significant adverse effect, which lies above the SOAEL but below an unacceptable adverse effect, can be addressed (or 'avoided' in the terms of the PPG) through the provision of mitigation, including noise insulation; it is not until an unacceptable adverse effect is reached that the cause of the effect should be prevented.

13.46 This is exemplified at paragraph 005 of the PPG for noise, which states:

"If the exposure is above this level the planning process should be used to avoid this effect occurring, by use of appropriate mitigation such as by altering the design and layout."

13.47 The types of mitigation that might be considered appropriate are described in paragraph 008 of the PPG for noise, and they include engineering to reduce the noise generated at

source, mitigation achieved through layout, the use of planning conditions/obligations to restrict activities or:

"mitigating the impact on areas likely to be affected by noise including through noise insulation where the impact is on a building". (Paragraph 008 PPG for noise)

13.48 Under the heading *What factors influence whether noise could be a concern?*, the PPG for noise sets out the following advice in paragraph 006:

"006 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; and*
- *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; and*
- *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."*

13.49 The PPG for noise adopts a similar line to that set out in the NPS, which allows for the NIR 1975 and NIR 1996 to be invoked where noise might reach levels that would trigger noise insulation in the cases of new or altered roads or railways.

13.50 The noise PPG provides advice on how to mitigate the effects of noise, noting that there are options to reduce noise at source, to optimise site layouts, to use planning conditions, and providing insulation within affected properties.

Summary of Planning Policy

13.51 The NPS and the PPG for noise both recognise that adverse effects are possible and may be acceptable, but that a balance must be struck, on the basis of the following:

- avoid significant adverse effects on health and quality of life, i.e. where the effects of the Proposed Development exceed the significant observed adverse effect level:
  - the significant adverse effects can be avoided through the implementation of mitigation, including design, layout, embedded mitigation, and/or the provision of noise insulation and ventilation;
  - only once the effect of the Proposed Development reaches an unacceptable level should the scheme be prevented; and
  - the level at which an unacceptable effect is reached must lie above the trigger values set out in the NIR 1975 and NIR 1996, otherwise the NPS would not endorse their use for national infrastructure schemes.
- adverse effects of the Proposed Development should be mitigated and minimised:
  - the provision of mitigation is an appropriate response to adverse effects, and the mitigation can take a number of forms, including engineering methods, modifications to the layout, bunding and noise barriers, DCO Requirements, or insulation.

13.52 The balance that is to be struck must be done in the overarching context of the Government's policy on sustainable development.

Local Policy

South Staffordshire Core Strategy DPD, 2012

13.53 The *South Staffordshire Core Strategy Development Plan Document*[8], which was adopted on 11th December 2012, contains one policy relevant to the Proposed Development, *Policy EQ9: Protecting Residential Amenity*, which states:

"All development proposals should take into account the amenity of any nearby residents, particularly with regard to privacy, security, noise and disturbance, pollution (including light pollution), odours and daylight.

Noise sensitive developments such as housing development will not be permitted in the vicinity of established noise generating uses where potential for harmful noise levels is known to exist unless measures to suppress noise sources can be provided through condition or legal agreement.

Development likely to generate harmful noise levels will be directed to appropriate locations away from known noise sensitive locations and noise sensitive habitats unless measures to suppress noise can be provided for the life of the development through legal agreement."

Development likely to harm the amenity of neighbouring residents will be directed to appropriate locations away from known sensitive locations.

Development must not unacceptably reduce the existing level of amenity space about buildings, particularly dwellings, and not unacceptably affect the amenity of residents or occupants."

13.54 At the time of writing, there were no Supplementary Planning Documents that relate to noise or vibration from the Proposed Development.

Assessment Methodology

Baseline Characterisation

13.55 The study area considered in the noise and vibration assessment extends to a distance of approximately 9km from the Site boundary, although only the effects of off-site road and rail traffic have been considered at this distance. The direct effects of noise and vibration from the construction and operation of the Proposed Development have been considered up to a distance of approximately 300 metres from the Site boundary.

13.56 The baseline noise and vibration climates have been established through direct measurements at a number of locations on and around the Proposed Development.

[8] *Core Strategy Development Plan*, South Staffordshire Council (2012)

13.57 Baseline noise measurements were carried out at eight locations between 17th August 2016 and 23rd August 2016, with the measurements at one of those eight locations being repeated between 13th October 2016 and 20th October 2016. Further noise measurements were carried out between 12th January 2017 and 24th January 2017.

13.58 The noise climate in August and October 2016 was dominated by road traffic noise, with the dominant road depending on the exact location. The M6 motorway dominated the eastern side of the Site and its surroundings, the A5 was a significant source at the northern end of the Site, the A449 was a significant source along the western side, with more local roads such as Vicarage Road and Straight Mile being significant to the south of the Site.

13.59 Trains on the West Coast Mainline Line (WCML) were significant sources of noise at locations within a few hundred metres of the railway line.

13.60 Other sources of sound that were significant included natural sounds such as birdsong, sheep, and rustling trees all at locations less affected by road or rail traffic noise or in lulls between cars or trains. At the northern end of the Site, noise from Calf Heath Quarry was intermittently audible.

13.61 The noise climate in January 2017 was similar to that in August and October 2016, other than traffic noise from the A449 was significantly reduced due to roadworks on that road. The construction works were intermittently audible in close proximity to the road, but were otherwise inaudible.

13.62 Baseline vibration measurements were carried out at two locations, between 17th August 2016 and 23rd August 2016 to quantify existing levels of railway vibration.

Method of Assessment

13.63 There are a number of guidance documents and relevant standards that are relevant to the assessment of noise and vibration, and to which regard has been had in the completion of the assessment. These are:

- BS5228:2009+A1(2014) for determining and assessing the impact of noise and vibration levels likely to be generated during construction[9];
- TRL Report 53[10] for determining levels of construction vibration;
- BS 4142: 2014[11] for assessing the impact of noise from the Proposed Development during operation including from potential fixed plant;
- Design Manual for Roads and Bridges (DMRB) [12] when assessing the potential impact of both construction traffic and development generated road traffic;
- IEMA Guidelines for Environmental Noise Impact Assessment[13] for assessing off-site railway noise;
- ISO9613 - Acoustics – Attenuation of sound during propagation outdoors – Part 2 General method of calculation[14] for calculating operational noise levels;
- British Standard 8233: 2014 Guidance on sound insulation and noise reduction for buildings[15] for assessing the effects of operational noise;
- World Health Organisation's (WHO) Guidelines for Community Noise[16] for assessing the effects of operational noise;
- The Calculation of Road Traffic Noise[17] (CRTN) to calculate road traffic noise levels;
- The Calculation of Railway Noise[18] (CRN) for calculating railway noise levels;
- DEFRA's additional railway noise source terms[19] for calculating railway noise levels; and
- British Standard 6472: 2008 Guide to evaluation of human exposure to vibration in buildings Part 1: Vibration sources other than blasting[20] for assessing railway vibration.

13.64 Summaries of these documents are included within Technical Appendix 13.2.

13.65 The Scoping Opinion provided by the Secretary of State (SoS) set out the requirements shown in Table 13.2, beyond the scope of work set out in the Scoping Report.

Table 13.2: Comments in Scoping Opinion

Consultee	Comments Raised	Response to Comments
SoS	The potential for HGV related vibration to arise for receptors along Croft Lane and the Staffordshire and Worcestershire Canal should be assessed.	Assessed in this chapter
SoS	The assessment should consider traffic related matters identified within the NPS such as number of movements, fleet mix and diurnal patterns.	Assessed in this chapter
SoS	The ES should clearly set out the detailed method of assessment for construction noise, e.g. the ABC method or 5dB change method, and how significance has been assessed.	ABC Method used, as set out in Section A13.2.1 of Appendix 13.2
SoS	The significance criteria for the assessment of peak construction traffic should be set out.	Assessed in this chapter
SoS	Vibration effects arising from the on-site railway movement should be assessed, in particular for the eastern option, if selected.	Assessed in this chapter
SoS	The Secretary of State requires that a worst-case noise assessment is provided for the operational Site. The assessment should account for any diurnal patterns.	Assessed this chapter
SoS	Where construction and operational activities will take place simultaneously, the Applicant should ensure that the worst case combined construction and operational noise scenario is assessed.	Assessed in this chapter
SoS	Where noise mitigation measures such as barriers are proposed, the Applicant should set out the proposed	Assessed in this chapter

[9] British Standard 5228 (2009)+A1 (2014) *Code of practice for noise and vibration control on construction and open sites*, BSi
[10] *TRL Report 53 Ground vibration caused by civil engineering works*, TRL (1986)
[11] British Standard 4142 (2014) *Methods for rating and assessing industrial and commercial sound*, BSi
[12] Design Manual for Roads and Bridges (DMRB), Volume 11 *Environmental Assessment*, Section 3 *Environmental Assessment Techniques*, Part 7 *Noise and Vibration* (2011), The Highways Agency, Transport Scotland, The Welsh Government, The Department for Regional Development Northern Ireland
[13] *Guidelines for Environmental Noise Impact Assessment*, IEMA (2014)
[14] ISO9613 (1996) *Acoustics – Attenuation of sound during propagation outdoors – Part 2 General method of calculation*, ISO
[15] British Standard 8233: 2014 *Guidance on sound insulation and noise reduction for buildings*, BSi
[16] Berglund, B., Lindvall, T., Schwela, D.H., (1999) *Guidelines for Community Noise* World Health Organisation
[17] Department of Transport, Welsh Office (1988) *Calculation of Road Traffic Noise*, HMSO, London
[18] Department of Transport (1995) *Calculation of Railway Noise*, HMSO, London
[19] *Additional railway noise source terms for "Calculation of Railway Noise 1995"*, DEFRA (2007)
[20] British Standard 6472: 2008 *Guide to evaluation of human exposure to vibration in buildings Part 1: Vibration sources other than blasting*, BSi

Table 13.2: Comments in Scoping Opinion		
	phasing of such mitigation and its importance to the reduction of noise impacts on local receptors.	

13.66 The noise and vibration monitoring locations were agreed with SSDC prior to any surveys being undertaken. The appropriateness of the survey period was also discussed, and is detailed in the baseline section of this chapter.

13.67 The assessment methodology was also discussed and agreed with SSDC.

Significance Criteria

13.68 The likelihood of potentially significant effects occurring is assessed against the relevant standards and guidelines for the particular source under consideration, in the following manner:

- the magnitude of impact is determined against the guidelines and standards relevant to the type of noise or vibration being considered;
- the sensitivity of the receptor is determined;
- the duration of the impact is defined; and
- the overall significance of the effect is defined using a matrix that relates impact magnitude to receptor sensitivity.

13.69 These steps are described below.

Magnitude of Impact

13.70 The magnitudes of potential construction impact will be defined according to the descriptions set out in Table 13.3.

Table 13.3: Determination of magnitude of construction impact – subjective responses	
Magnitude of impact	**Definition of magnitude**
High	The noise/vibration causes a material change in behaviour and/or attitude. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.
Moderate	Noise/vibration can be heard/felt and causes small changes in behaviour and/or attitude. Affects the acoustic character of the area such that there is a perceived change in the quality of life.
Low	A minor adverse change from baseline conditions. Noise/vibration can be heard/felt, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.
Negligible	Very little change from baseline conditions. Change barely distinguishable, approximating to a 'no change' situation.

13.71 These descriptions of subjective human response have been translated to construction noise impacts determined in the following way, with reference to the criteria set out in Table A13.2.1 in Technical Appendix 13.2, based on Part 1 of BS5228: 2008+A1: 2014:

- exceeding the adopted criteria by 10dB or more will constitute a high adverse impact, irrespective of the duration;
- exceeding the adopted criteria by less than 10dB for a period of more than one month will constitute a moderate adverse impact;
- exceeding the adopted criteria by less than 10dB for a period of less than one month will constitute a low adverse impact; and
- compliance with the adopted criteria will constitute a negligible impact.

13.72 The time periods stated above are based on experience of other large-scale construction works, and are included to provide an indication as to how degrees of impact may be distinguished in the absence of a firm construction programme.

13.73 The assessment criterion for construction noise in this instance is 65dB L_{Aeq}.

13.74 It is noted that the duration of construction vibration impacts is of less significance since all of the construction works generating vibration are likely to be relatively short in duration. The significance of potential construction vibration impacts are categorised according to the vibration magnitude only, based on Part 2 of BS5228: 2009+A1: 2014, as follows:

- any works causing a vibration level greater than 10mm/s (measured as a peak particle velocity) will constitute a high adverse impact;
- any works causing a vibration level between 1mm/s and 10mm/s will constitute a moderate adverse impact;
- any works causing a vibration level between 0.3mm/s and 1mm/s will constitute a low adverse impact; and
- any works causing a vibration level less than 0.3mm/s will constitute a neutral or negligible impact.

13.75 The initial magnitude of impact of operational noise generated by the Proposed Development will be determined largely in relation to the guidance in BS4142: 2014. It is possible to equate the outcomes in the standard to an impact magnitude, as shown in Table 13.4.

Table 13.4: Determination of BS4142: 2014 impact (Operational Phase)		
Level of magnitude	**Definition of magnitude**	
	BS4142: 2014 assessment level	**Description provided in BS4142: 2014 for likely impact**
High	> +10dB	"A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context."
Moderate	+5dB to +10dB	"A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context." No BS 4142: 2014 description for above +5dB, but the greater the difference, the greater the magnitude of the impact.
Low	+1dB to +4dB	No BS 4142: 2014 description but the lower the

Table 13.4: Determination of BS4142: 2014 impact (Operational Phase)		
		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.
Negligible	≤ 0dB	BS4142: 2014 states that 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.

13.76 It is important to note that the standard clearly states that contextual considerations should be factored into the overall judgment of impact; a direct correlation between the numerical assessment outcomes and the significance of potential impacts should not be assumed, hence the description of the assessment outcomes in Table 13.4 as 'initial' assessment outcomes. The standard itself uses the same language, describing the numerical outcome as 'the initial estimate'.

13.77 It is also important to note that BS4142: 2014 does not describe the thresholds set out in Table 13.4 in definitive terms. The standard refers to outcomes 'around' the values stated, for example:

"A difference of around +5dB is likely to be an indication of an adverse impact, depending on context". (emphasis added).

13.78 The word 'around' is important as it illustrates that there is not a rigid threshold of adverse impact that is reached when the rating level exceeds the background sound level by 5dB, but would disappear when the rating drops by 0.55dB, where the rating level, rounded to a whole number, would exceed the background sound level by 4dB.

13.79 For the purposes of this assessment, the numerical BS4142: 2014 assessment is taken to be indicative of the initial impact significance, as set out in Table 13.4, with contextual factors set out that may modify the stated outcome.

13.80 BS4142: 2014 provides the following guidance in terms of what contextual matters should be considered (only relevant extracts are included here):

"Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following.

1) The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.

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.

Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse."

"3) The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:

- *facade* insulation *treatment;*
- *ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and*
- acoustic *screening."*

13.81 Where appropriate, these factors have been factored into the assessment. The net effect of the contextual matters is that where an initial numerical assessment suggests, for example, a moderate adverse impact, internal sound levels that meet relevant criteria might reduce the impact magnitude to low. Equally, where, for example, a low adverse impact is initially identified, very high sound levels in the area may suggest that the outcome should be a moderate adverse impact as a worsening of an already poor sound climate, may be more impactful than the initial estimate suggests.

13.82 The significance of off-site road traffic noise impacts, during both the construction and operational phases of the Proposed Development, is determined according to the thresholds set out in Table A13.2.4 in Technical Appendix 13.2.

13.83 The significance of off-site road traffic vibration during both the construction and operational phases of the Proposed Development, is considered to be the same as for off-site road traffic noise, as set out in DMRB.

13.84 The significance of off-site rail noise impacts, during the operation of the Proposed Development, is determined according to the thresholds set out in Table A13.2.6 in Technical Appendix 13.2.

13.85 The significance of off-site rail vibration impacts, which will be quantified in terms of vibration dose values (VDVs), during the operational phase of the Proposed Development, will be determined against the thresholds set out in Table A13.2.7, based on BS6472: 2008, as follows:

- VDVs below the 'low probability of adverse comment' category would constitute a negligible impact;
- VDVs that fall into the 'low probability of adverse comment' comment would constitute a low impact;
- VDVs that fall into the 'adverse comment possible' comment would constitute a moderate impact; and
- VDVs that fall into the 'adverse comment probable' comment would constitute a high impact.

Sensitivity of Receptor

13.86 The sensitivity of the various receptors assessed in this chapter will be determined according to the scale set out in Table 13.5.

Table 13.5: Determination of receptor sensitivity	
Receptor Sensitivity	**Type of receptor**
High	Hospitals (e.g. operating theatres or high dependency units), residential accommodation, private gardens, hospital wards, care homes, research facilities.
Medium	Schools, universities, national parks during the day, temporary holiday accommodation at all times including hotels, areas of designated value, e.g. Conservation Areas.
Low	Offices, shops, general outdoor amenity areas, long distance footpaths, doctors surgeries, sports facilities and places of worship.

Table 13.5: Determination of receptor sensitivity	
Negligible	Warehouses, light industry, car parks, agricultural land.

13.87 These receptor sensitivity categories apply to receptors for both the construction and operational phases of the Proposed Development.

Duration of Effect

13.88 The duration of any identified impacts will be considered as short term, medium term or long term, according to Table 13.6.

Table 13.6: Duration of effects	
Timescale	**Definition**
Short term	0 to 1 year
Medium term	1 to 5 years
Long term	5 + years

Assessing Significance of Effect

13.89 The impact magnitude will be related to the receptor sensitivity to determine the overall significance of the effect, in accordance with Table 13.7. An effect of moderate or major significance can be considered to be significant in EIA terms.

Table 13.7: Significance of Effect				
Magnitude of impact	**Sensitivity of receptor**			
	High	**Medium**	**Low**	**Negligible**
High	Major	Moderate	Minor	None
Moderate	Moderate	Minor	Minor	None
Low	Minor	Minor	None	None
Negligible	None	None	None	None

13.90 There is an important distinction to be made between the threshold for identifying significant adverse effects in an Environmental Statement and the specific identification of SOAEL, which has a particular meaning in planning policy. This distinction has been made clear, for instance, in other recent infrastructure-based planning inquiries.

13.91 In reaching a decision on the Thames Tideway Tunnel Order[21], the Secretary of State found that despite the identification of significant adverse effects in the noise assessment:

"…the proposed development meets the first NPS aim of avoiding significant adverse impacts on health and quality of life."[22]

13.92 The Secretary of State made a clear distinction between the identification of significant adverse effects in EIA terms, and complying with the policy aims of avoiding significant adverse impacts of health and quality of life.

13.93 The later decision by the Secretary of State to allow the appeal by Heathrow Airport Limited against the decision by the London Borough of Hillingdon to refuse permission for enabling works that would allow implementation of full runway alternation during easterly operations at Heathrow Airport reached a similar conclusion.

13.94 Paragraph 1064 of the decision letter[23] summarised the findings of the Thames Tideway Tunnel Order letter referenced above:

"I do not equate the 'significant adverse effects' identified in the ES with those that the NPSE seeks to avoid."[24]

13.95 It is clear from these two decisions that the SOAEL, the point at which a significant adverse effect occurs, can lie above the point at which a significant adverse effect occurs in EIA terms.

13.96 Applying the advice in the Noise PPG mitigation in the form of appropriate design and site layout, together with the use of noise insulation at the point where the SOAEL may be reached, is appropriate. The provision of noise insulation in those circumstances mitigates the noise impact and ensures that significant adverse effects on health and the quality of life are avoided. Planning permission can be granted on this basis consistent with the requirements of national policy.

13.97 For this assessment, the LOAEL for operational noise is taken to be the background sound level plus 5dB for each receptor. The SOAEL is taken to be the background sound level plus 10dB or façade levels of 66dB $L_{Aeq,16hrs}$ (daytime) and 62dB $L_{Aeq,8hrs}$ (night-time), whichever is reached first.

13.98 The point at which operational noise from the Proposed Development becomes unacceptable is at the UAEL, which is taken to be façade levels of 75dB $L_{Aeq,16hrs}$ (daytime) and 69dB $L_{Aeq,8hrs}$ (night-time). These values are based on the known insulating performance of the secondary glazing system required by the NIR 1975 and NIR 1996 being in the region of 35dB, and the reasonable internal criteria of 40dB daytime and 35dB night-time in BS8233: 2014.

13.99 At levels above the UAEL, the specified glazing system will no longer be sufficient to achieve the internal criteria, at which point, noise from the Proposed Development could no longer be reduced to acceptable levels.

Assumptions and Limitations

13.100 The following assumptions are relevant to this chapter:

- The construction methods likely to be used to construct the Proposed Development have been estimated, based on experience of other, similar developments and the information in Chapter 5: Demolition and Construction. These are detailed later in this chapter;
- A number of assumptions have been made in terms of the types, locations, and intensity of operational activities at the Proposed Development. These are detailed later in this chapter;
- It is assumed that landscaped bunding that forms part of the Proposed Development will be constructed prior to relevant operations at the Site and will provide noise attenuation for operational activities occurring on the Site. The arrangement of the landscaped bunding is assumed to be as per the Green Infrastructure Plan (Parameters Plans). This

[21] Planning Act 2008: Application for the Proposed Thames Water Utilities Limited (Thames Tideway Tunnel) Order
[22] Para 74, DCLG / DEFRA Thames Tideway Tunnel Order Decision Letter dated 12th September 2014
[23] DCLG/DEFRA Letter dated 2nd February 2017
[24] Para 1064, DCLG/DEFRA Letter dated 2nd February 2017

is considered to be embedded mitigation. The design, location and size of these landscaped bunds was informed by an initial, but significant noise assessment to meet the aspirations of the NPS, PPG for noise, and NPSE; and

- The Applicant has committed to using a cladding material for the proposed buildings that has a much higher sound reduction performance than the types of cladding materials typically used for buildings of this type; the cladding proposed for use at the Proposed Development will offer a sound reduction performance of 39dB Rw for the walls and 28dB Rw for the roofs, which are considerably better than the 25dB Rw performance achieved by typical cladding materials. This better containment of sound generated within the buildings is considered to be embedded mitigation within the Proposed Development. The lower performance for the roofs results from the need to include rooflights, which typically offer a much lower sound reduction.

13.101 The following limitations are relevant to this Chapter:

- The baseline noise and vibration surveys undertaken for this assessment included a number of sample measurements to provide quantitative information concerning the type and degree of noise and/or vibration affecting the Site and surrounding sensitive receptors. The number and duration of noise and/or vibration measurements were chosen to give reasonably representative information on the environment within the agreed time, and the locations of measurements were restricted to the areas unoccupied by buildings that were accessible without undue risk to staff. As with any sampling, the number of sampling points and the methods of sampling and testing cannot preclude the existence of "hotspots" where noise and/or vibration levels may vary from those actually measured due to previously unknown or unrecognised sources. Furthermore, sources may be intermittent or fluctuate in intensity and consequently may not be present or may not be present in full intensity for some or all of the survey duration;
- The baseline noise survey data gathered in August 2016 for this assessment coincided with both school summer holidays and the V Festival. The environmental health officer (EHO) at SSDC was consulted on the timing of the survey and it was agreed that the survey would need to be repeated in due course because of the potential effects of the V Festival. SSDC was less concerned about the potential effects of the school holidays on the baseline noise levels in the area;
- The baseline noise survey was repeated in January 2017, however, the measured noise levels were affected by major roadworks along the A449, resulting in what were considered to be atypically low noise levels;
- It has not been possible to repeat the survey before the submission of the DCO application as the roadworks that affected the January 2017 survey continued throughout 2017, finishing in November 2017. Inclement weather at the start of 2018 and further roadworks on the M54, which diverted traffic along the A449 past the site, have prevented a survey under what could reasonably be considered to be typical conditions;
- The baseline noise data will be resurveyed following the DCO submission; and
- This assessment is based on the lowest representative values taken from the August / October 2016 and January 2017 surveys, even though the January 2017 data was considered to be atypically low. This approach is considered to generate a robust outcome, which may overstate the effects of the Proposed Development.

Baseline Conditions

Current Baseline

13.102 This section summarises the characteristics of the existing noise and vibration conditions of the Site and the surrounding area.

13.103 Baseline noise and vibration surveys were undertaken at the following dates/times:

- between Wednesday 17th August 2016 and Tuesday 23rd August 2016;
- between Thursday 13th October 2016 and Thursday 20th October 2016; and
- between Thursday 12th January 2017 and Tuesday 24th January 2017.

13.104 Measurements at an operational railfreight terminal were undertaken on Thursday 18th August 2016.

Baseline Noise Surveys

13.105 Baseline noise measurements were undertaken at nine locations, as shown in Figure 13.1:

- Position N1: close to the western boundary of the Site, opposite the properties along the A449;
- Position N2: adjacent to Vicarage Road, close to the junction with Straight Mile;
- Position N3: adjacent to Vicarage Road, close to the junction with Stable Lane;
- Position N4: close to the rear of Avenue Cottages to the north of the Site;
- Position N5: at the southern end of Croft Lane;
- Position N6: to the north of the properties on Station Drive;
- Position N7: at the north-western corner of the Site, towards the junction between the A5 and A449;
- Position N8: close to the junction between Stable Lane and Woodlands Lane; and
- Position N9: towards the southern edge of the Site.

13.106 The monitoring locations were agreed with the EHO at SSDC. The EHO at SSDC also noted that the August 2016 survey would need to be repeated in due course due to the influence of the V Festival. The EHO agreed that the positions could be varied if conditions on Site dictated.

13.107 It was not possible to identify a secure location at Position N4 in August 2016, so the position was not surveyed. However, it was possible to measure at Position N4 in January 2017.

13.108 Measurements were undertaken at Position N3 in August 2016, although changes to the Site boundary have rendered the results of little use. Nonetheless, the data has been reported in the chapter. Measurements were not repeated at Position N3 in January 2017.

13.109 The August 2016 measurements at Position N6 were compromised by the sound level meter falling over during the survey, likely due to high winds. The measurements at Position N6 were repeated in October 2016.

13.110 The sound level meter at Position N8 also fell over in August 2016, again, likely to be a result of high winds. However, a local resident, in consultation with Resound Acoustics, picked the meter up again. The calibration of the meter was not found to have drifted so the measurements were considered valid, except for the period when the meter was not vertical.

13.111 Power issues caused the meters at Positions N1, N2 and N8 to fail at various points during the January 2017 survey. The meter at Position N1 missed much of the first week of the survey, with the only parts captured coinciding with a period or poor weather, so the data for that period has not been included in the assessment. The meter at Position N2 stopped at 14:45 on 17th January, and was restarted at 09:34 hours on 18th January 2017, when the batteries were changed. The meter at Position N8 stopped at midnight on 22nd January 2017, missing the last two days of the survey; however the remainder of the data, which covered the majority of the survey period, was considered valid.

13.112 The exact monitoring location at Position N8 was altered for the January 2017 survey, in response to a request by a local resident who felt that the position used in the August 2016 survey was not sufficiently representative of the houses in that area. The location used in

January 2017 was where the resident suggested would be more representative. Resound Acoustics agreed to this alteration, based on the resident's better knowledge of the area.

13.113 The exact monitoring locations at Positions N6 and N9 also differed between the August / October 2016 and January 2017 surveys. Position N6 was moved further south, closer to the properties on Station Drive due to changes in which parcels of land were accessible, and Position N9 was moved away from Position N8 to obtain a wider spread of baseline data. SSDC had indicated that varying the exact locations was acceptable, depending on Site conditions.

13.114 It was known that the August 2016 survey period would fall within the school summer holidays, and would also cover a weekend when V Festival was hosted nearby. Sound from the V Festival was not audible at the Site, however traffic patterns in the area were expected to be altered as a result of the festival.

13.115 Given the timing of the August 2016 survey, it was always the intention to repeat the noise survey. Unfortunately, the repeated January 2017 survey coincided with significant roadworks along the A449, which was reduced in width to a single carriageway in each direction with a speed restriction. The consequence of the roadworks was a significantly altered noise climate, which cannot be considered representative of 'typical' conditions in the area.

13.116 It was therefore planned to repeat the survey once the roadworks had been completed, so that more representative baseline data could be used in the final ES. However, the Highways England works, which were due to be completed by the end of June 2017, were followed by SCC works, which are programmed to run until late 2017, beyond the submission date of the DCO submission.

13.117 While the baseline noise data presented in this chapter is considered to be representative of the noise climate in the area around the Proposed Development during the survey periods, both the August 2016 and January 2017 surveys are considered to have been affected by anomalous activities that compromised the extent to which they can be considered representative of the long-term noise climate in the area.

13.118 To provide a robust assessment, it is considered appropriate to use the lowest representative values from each survey for each monitoring location. In the case of the January 2017 survey data, it was considered that the measured baseline noise levels were lower than would typically be the case, due to the significant reduction in road traffic levels. However, this will lead to a more robust assessment and is therefore considered to be an acceptable approach.

13.119 This approach has been agreed with SSDC, subject to a further baseline noise survey being undertaken post DCO submission.

13.120 The equipment used during the surveys is summarised in Technical Appendix 13.3. All of the sound level meters were calibrated prior to the start of the surveys using the listed acoustic calibrators. The calibrations were checked upon completion of the surveys, and no significant calibration drifts were found to have occurred.

13.121 The measurements at all positions were taken at a height of 1.5 metres above ground level, with the microphone in free-field conditions, i.e. at least 3.5 metres away from any reflecting surfaces other than the ground.

13.122 The weather during the August 2016 baseline noise survey was changeable. The start and end of the survey were suitable for noise measurement, it being mainly dry with light south-easterly winds of less than 5 metres/second. However, the middle part of the survey included rain and high winds, which as noted above, caused two of the sound level meters to fall over.

13.123 Data gathered during the period of poor weather has been excluded from the assessment.

13.124 Information on the weather during the August 2016 baseline noise survey was gathered by Resound Acoustics' staff when on Site at the beginning and end of the survey, and during the survey when in the local area.

13.125 The weather during the October 2016 baseline noise survey (Position N6 only) was broadly acceptable for noise measurement, it being dry with light winds. There were periods during the survey of light rainfall, and data gathered during these periods have been excluded from the assessment.

13.126 For the October 2016 survey, a meteorological monitoring station was installed with the sound level meter, so the weather conditions at the meter are known.

13.127 The weather during the January 2017 baseline noise survey was acceptable after the first three days of the survey, during which there were periods of rain / snow that may have affected the measured levels. There were very short periods of light rain after 15th January 2017, on the morning of 16th January 2017, around 13:30 on 18th January 2017, around 15:15 hours on 19th January 2017, around 20:00 hours on 20th January 2017, around 07:45 hours on 22nd January 2017, and around 10:45 hours and 15:15 hours on 23rd January 2017. It was considered that even after taking account of the periods of inclement weather, there was sufficient data for a representative background sound level to be determined for the survey period.

13.128 There were a range of wind directions during the January 2017 survey, from broadly west, north-westerly or westerly at the start, moving round to an east, north-easterly or easterly on 16th January 2017, then south or south-westerly on 19th January 2017, broadly northerly on 21st January 2017 and finally south-westerly on 22nd January. After the first three days of the survey, the wind speeds were generally low.

13.129 For the January 2017 survey, meteorological monitoring stations were installed at Positions N4 and N6 with the sound level meters, so the weather conditions in the area are known.

13.130 The principal noise sources encountered at each position are listed in Table 13.8.

Table 13.8: Summary of Principal Noise Sources

Monitoring Position	Noise Sources
Position N1	August 2016: Road traffic noise, principally from the A449, although more distant roads were audible when traffic on the A449 'dropped'. Passing trains just audible. Rustling trees audible when traffic on the A449 'dropped'. January 2017: As August 2016, but with less traffic noise due to road-works. Some construction noise was audible at times, which was consid-ered to have emanated from the Bericote Development.
Position N2	August 2016: Road traffic noise from Vicarage Road and more distant roads. Rustling trees. January 2017: As August 2016. Some noise from construction works at the Bericote Development.
Position N3	August 2016: Road traffic noise from Vicarage Road and more distant roads. Rustling trees.

Table 13.8: Summary of Principal Noise Sources

	January 2017: Not used in January 2017.
Position N4	August 2016: Not used in August 2016. January 2017: Road traffic noise on A5 dominant with traffic on M6 audible. Lorries accessing quarry were intermittently audible.
Position N5	August 2016: Distant road traffic noise and passing trains. Rustling trees. January 2017: As August 2016 plus construction noise from Bericote Development intermittently audible, occasional bird scarer/shooting and occasional alarm at 1 Croft Lane.
Position N6	October 2016: Distant road traffic noise from M6, A5 and A449. Construction noise at Bericote Development just audible. Very occasional industrial noise audible. Birdsong. Passing trains. January 2017: As August 2016, plus noise from livestock.
Position N7	August 2016: Road traffic noise from A5. January 2017: As August 2016, plus traffic on A449 audible and activity at council gritting facility east of monitoring position at the start of the survey.
Position N8	August 2016: Distant road traffic noise from M6. Rustling trees. Birdsong. January 2017: As August 2016.
Position N9	August 2016: Distant road traffic noise from M6. Rustling trees. Birdsong. January 2017: As August 2016.

13.131 The noise survey results are summarised in graphical form in Figures A13.3.1 to A13.3.16 in Technical Appendix 13.3 and are summarised in the tables below. In all cases, the daytime is the 16 hour period from 07:00 to 23:00 hours and the night-time the eight hour period from 23:00 to 0700 hours, unless stated otherwise.

13.132 The survey results for Position N1 are summarised in Table 13.9.

Table 13.9: Summary of measured noise levels, Position N1, free-field dB

Date	Period	$L_{Aeq,T}$	L_{A90}[1]	L_{A10}[1]	L_{AFmax}
17th August 2016	Day[2]	63.7	49.0	67.4	73.1 to 80.9
	Night	59.8	42.6	59.7	69.1 to 81.2
18th August 2016	Day	65.2	51.6	68.6	72.5 to 87.4
	Night	59.6	42.9	60.3	64.6 to 78.9
19th August 2016	Day[3]	66.4	55.4	69.8	73.6 to 87.5
	Night[3]	59.7	45.1	62.5	69.4 to 77.4
20th August 2016	Day[3]	65.7	54.3	69.2	73.2 to 88.6
	Night[3]	58.7	37.4	61.4	71.5 to 78.4
21st August 2016	Day[3]	66.0	53.5	69.4	73.6 to 95.1
	Night[3]	62.5	45.9	65.6	69.4 to 86.4
22nd August 2016	Day	67.1	55.1	70.0	69.8 to 86.6
	Night	60.7	38.6	61.2	68.8 to 81.2
23rd August 2016	Day[4]	68.7	59.4	71.9	75.8 to 84.0
18th January 2017	Day[5]	59.1	48.6	61.4	61.2 to 79.2
	Night	55.9	39.3	51.7	54.9 to 74.0
19th January 2017	Day	62.1	52.0	65.2	61.8 to 82.7
	Night	58.5	43.4	58.7	66.8 to 78.3
20th January 2017	Day	59.8	48.2	59.9	60.5 to 85.2
	Night	50.5	39.3	52.6	61.5 to 70.0
21st January 2017	Day	58.8	45.4	60.8	61.2 to 85.3
	Night	48.0	32.4	49.4	55.5 to 68.7
22nd January 2017	Day	52.8	40.3	56.9	61.3 to 72.8
	Night	53.9	35.5	52.7	54.9 to 73.4
23rd January 2017	Day	56.9	45.2	59.7	61.5 to 89.4
	Night	56.1	38.6	56.8	62.9 to 78.7
24th January 2017	Day[6]	60.1	52.6	62.1	64.6 to 70.1

Notes:
[1] The L_{A90} and L_{A10} values presented were calculated from the arithmetic mean of the $L_{A90,15min}$ and $L_{A10,15min}$ measurements for each period.
[2] Daytime period was 4.25 hours in duration
[3] Data excluded from assessment due to weather
[4] Daytime period was 2.75 hours in duration
[5] Daytime period was 11.75 hours in duration
[6] Daytime period was 1.75 hours in duration

13.133 The survey results for Position N2 are summarised in Table 13.10.

Table 13.10: Summary of measured noise levels, Position N2, free-field dB

Date	Period	$L_{Aeq,T}$	L_{A90}[1]	L_{A10}[1]	L_{AFmax}
17th August 2016	Day[2]	61.6	46.2	64.3	71.6 to 89.4
	Night	57.4	45.0	54.2	69.3 to 79.5
18th August 2016	Day	62.1	47.5	65.5	70.7 to 84.4
	Night	56.9	43.5	53.7	49.0 to 83.6
19th August 2016	Day[3]	67.5	50.5	69.5	75.3 to 94.9
	Night[3]	58.6	44.5	54.3	71.9 to 86.4
20th August 2016	Day[3]	63.0	48.1	65.9	71.2 to 95.6
	Night[3]	52.6	38.0	48.4	46.7 to 82.2
21st August 2016	Day[3]	59.6	43.5	62.9	71.8 to 85.1
	Night[3]	58.2	40.4	53.4	44.5 to 79.7
22nd August 2016	Day	63.9	47.2	66.7	71.7 to 90.1
	Night	57.6	38.0	51.3	41.4 to 80.4
23rd August 2016	Day[4]	65.8	51.6	69.8	76.3 to 80.6
12th January 2017	Day[3][5]	67.4	48.2	69.7	78.5 to 92.8
	Night[3]	62.0	44.3	56.5	54.3 to 84.5
13th January 2017	Day[3]	69.1	52.7	72.2	79.1 to 88.9
	Night[3]	59.6	41.6	53.3	70.6 to 84.1
14th January 2017	Day[3]	67.0	48.0	70.7	77.2 to 89.9
	Night[3]	57.3	39.9	48.7	45.1 to 82.3
15th January 2017	Day[3]	65.2	46.8	66.8	76.4 to 93.6
	Night	62.8	42.8	54.1	48.2 to 88.5
16th January 2017	Day	69.0	52.2	72.0	79.1 to 88.1
	Night	63.5	40.6	56.2	45.8 to 85.5
17th January 2017	Day[6]	69.8	52.0	74.1	80.3 to 85.2
	Night	No data recorded			
18th January 2017	Day[7]	69.1	49.3	72.7	79.9 to 87.1
	Night	62.8	39.5	55.4	72.5 to 84.1
19th January 2017	Day	68.9	50.2	72.0	79.1 to 87.1
	Night	63.3	43.2	57.3	74.9 to 85.1
20th January 2017	Day	69.5	54.3	72.8	78.5 to 91.8
	Night	60.9	46.5	56.8	74.8 to 83.5
21st January 2017	Day	67.3	47.8	70.5	78.0 to 94.0
	Night	57.3	35.7	49.2	76.3 to 85.1
22nd January 2017	Day	65.3	42.9	67.8	76.2 to 89.0
	Night	62.9	38.6	53.3	42.8 to 87.7
23rd January 2017	Day	68.9	49.5	72.0	79.1 to 94.9
	Night	63.6	41.5	57.7	75.2 to 85.6
24th January 2017	Day[8]	71.6	59.8	75.3	79.0 to 84.9

Notes:
[1] The L_{A90} and L_{A10} values presented were calculated from the arithmetic mean of the $L_{A90,15min}$ and $L_{A10,15min}$ measurements for each period.
[2] Daytime period was 7.25 hours in duration
[3] Data excluded from assessment due to weather
[4] Daytime period was 2 hours in duration
[5] Daytime period was 6 hours in duration
[6] Daytime period was 7.75 hours in duration
[7] Duration was 13.5 hours in duration
[8] Duration 1.5 hours in duration

13.134 The survey results for Position N3 are summarised in Table 13.11.

Table 13.11: Summary of measured noise levels, Position N3, free-field dB

Date	Period	$L_{Aeq,T}$	L_{A90}[1]	L_{A10}[1]	L_{AFmax}
17th August 2016	Day[2]	63.2	50.9	65.4	75.4 to 93.0
	Night	59.4	48.8	56.5	65.3 to 87.4
18th August 2016	Day	64.1	51.8	67.2	75.3 to 84.2
	Night	58.7	48.5	56.9	57.4 to 79.2
19th August 2016	Day[3]	65.1	48.9	68.1	74.5 to 80.3
	Night[3]	57.0	43.2	50.9	70.8 to 79.5
20th August 2016	Day[3]	62.3	46.2	64.8	73.8 to 91.6
	Night[3]	53.0	37.9	47.1	45.6 to 78.1

Table 13.11: Summary of measured noise levels, Position N3, free-field dB

Date	Period	$L_{Aeq,T}$	L_{A90}[1]	L_{A10}[1]	L_{AFmax}
21st August 2016	Day[3]	60.2	44.3	61.9	74.8 to 85.6
	Night[3]	59.5	40.0	52.8	42.5 to 80.4
22nd August 2016	Day	64.8	45.9	66.8	73.7 to 87.0
	Night	58.5	39.9	50.9	47.6 to 85.7
23rd August 2016	Day[4]	66.5	48.9	70.8	78.7 to 77.6

Notes:
[1] The L_{A90} and L_{A10} values presented were calculated from the arithmetic mean of the $L_{A90,15min}$ and $L_{A10,15min}$ measurements for each period.
[2] Daytime period was 7.5 hours in duration
[3] Data excluded from assessment due to weather
[4] Daytime period was 1 hour in duration

13.135 The survey results for Position N4 are summarised in Table 13.12.

Table 13.12: Summary of measured noise levels, Position N4, free-field dB

Date	Period	$L_{Aeq,T}$	L_{A90}[1]	L_{A10}[1]	L_{AFmax}
12th January 2017	Day[2][3]	55.7	50.6	57.4	61.5 to 81.0
	Night[3]	52.4	47.3	54.2	59.5 to 68.3
13th January 2017	Day[3]	59.2	54.5	60.3	59.2 to 79.1
	Night[3]	48.1	40.7	50.1	55.3 to 71.8
14th January 2017	Day[3]	56.2	51.4	57.7	58.0 to 72.0
	Night[3]	46.8	40.2	47.9	52.8 to 63.3
15th January 2017	Day[3]	57.3	53.2	58.7	57.9 to 73.6
	Night	54.9	49.9	54.8	58.6 to 68.4
16th January 2017	Day	59.8	57.1	61.1	62.3 to 78.2
	Night	54.1	50.1	55.4	59.5 to 69.1
17th January 2017	Day	54.8	51.0	55.8	57.5 to 73.9
	Night	49.6	43.8	50.7	56.7 to 64.3
18th January 2017	Day	54.0	48.3	56.3	59.7 to 74.7
	Night	52.5	44.8	52.2	58.1 to 66.2
19th January 2017	Day	57.9	54.5	59.4	60.9 to 75.0
	Night	57.5	53.6	58.1	60.1 to 68.0

Table 13.12: Summary of measured noise levels, Position N4, free-field dB

Date	Period	$L_{Aeq,T}$	L_{A90}[1]	L_{A10}[1]	L_{AFmax}
20th January 2017	Day	60.8	58.6	62.0	63.7 to 75.4
	Night	55.8	53.1	57.4	62.1 to 70.1
21st January 2017	Day	59.2	56.1	60.1	56.6 to 82.7
	Night	49.0	43.4	51.7	56.5 to 64.2
22nd January 2017	Day	53.7	49.4	55.0	56.4 to 70.6
	Night	51.5	43.3	50.3	55.6 to 74.5
23rd January 2017	Day	54.1	49.4	56.1	57.6 to 74.2
	Night	53.5	47.7	54.1	56.1 to 66.6
24th January 2017	Day[4]	59.1	57.0	60.4	63.3 to 72.4

Notes:
[1] The L_{A90} and L_{A10} values presented were calculated from the arithmetic mean of the $L_{A90,15min}$ and $L_{A10,15min}$ measurements for each period.
[2] Daytime period was 6 hours in duration
[3] Data excluded from assessment due to weather
[4] Daytime period was 1.75 hours in duration

13.136 The survey results for Position N5 are summarised in Table 13.13.

Table 13.13: Summary of measured noise levels, Position N5, free-field dB

Date	Period	$L_{Aeq,T}$	L_{A90}[1]	L_{A10}[1]	L_{AFmax}
17th August 2016	Day[2]	47.2	45.2	48.2	50.2 to 66.2
	Night	46.9	44.7	47.5	48.8 to 64.5
18th August 2016	Day	54.1	45.3	49.1	49.1 to 90.0
	Night	45.8	43.9	46.7	48.5 to 64.5
19th August 2016	Day[3]	64.2	45.6	50.0	51.4 to 113
	Night[3]	45.2	41.6	45.6	47.3 to 67.3
20th August 2016	Day[3]	49.9	45.7	51.1	55.9 to 72.5
	Night[3]	41.6	37.2	43.6	45.6 to 62.7
21st August 2016	Day[3]	47.9	44.1	49.0	50.9 to 71.4
	Night[3]	43.7	39.7	44.7	47.3 to 63.4
22nd August 2016	Day	47.0	42.3	47.4	53.7 to 80.1
	Night	41.5	37.3	42.1	43.9 to 59.9

Table 13.13: Summary of measured noise levels, Position N5, free-field dB

Date	Period	$L_{Aeq,T}$	L_{A90} (1)	L_{A10} (1)	L_{AFmax}
23rd August 2016	Day(4)	45.8	42.8	46.7	51.8 to 67.2
12th January 2017	Day(3)(5)	49.9	46.5	50.9	56.6 to 67.8
	Night(3)	47.1	42.5	48.0	50.3 to 64.0
13th January 2017	Day(3)	53.9	50.3	54.5	57.4 to 80.4
	Night(3)	45.2	39.1	46.1	50.5 to 67.5
14th January 2017	Day(3)	51.2	48.3	52.3	54.0 to 83.5
	Night(3)	45.4	40.9	46.5	49.5 to 64.5
15th January 2017	Day(3)	50.5	47.9	51.4	54.2 to 75.9
	Night	47.5	41.8	47.3	49.4 to 65.9
16th January 2017	Day	52.7	50.4	53.3	53.0 to 82.9
	Night	45.3	42.6	46.3	44.6 to 57.2
17th January 2017	Day	49.0	44.5	49.5	49.8 to 74.5
	Night	41.1	36.8	41.7	44.4 to 65.2
18th January 2017	Day	48.3	44.0	48.8	51.4 to 79.7
	Night	43.6	39.2	44.4	42.8 to 60.5
19th January 2017	Day	49.3	46.5	49.5	48.3 to 72.2
	Night	50.8	46.9	50.1	48.7 to 61.9
20th January 2017	Day	54.6	53.0	55.1	55.7 to 71.1
	Night	51.2	49.4	52.1	53.9 to 62.8
21st January 2017	Day	51.3	48.9	51.5	50.8 to 76.9
	Night	40.2	37.2	41.9	44.9 to 66.0
22nd January 2017	Day	46.7	43.1	47.3	53.1 to 82.4
	Night	43.4	36.7	43.1	43.1 to 64.0
23rd January 2017	Day	48.7	44.9	49.8	53.1 to 73.9
	Night	45.4	41.4	45.9	46.0 to 63.1
24th January 2017	Day(6)	52.0	50.4	52.9	60.1 to 70.6

Notes:
(1) The L_{A90} and L_{A10} values presented were calculated from the arithmetic mean of the $L_{A90,15min}$ and $L_{A10,15min}$ measurements for each period.
(2) Daytime period was 5.5 hours in duration
(3) Data excluded from assessment due to weather
(4) Daytime period was 2.5 hours in duration
(5) Daytime period was 6 hours in duration
(6) Daytime period was 1.75 hours in duration

13.137 The survey results for Position N6 are summarised in Table 13.14.

Table 13.14: Summary of measured noise levels, Position N6, free-field dB

Date	Period	$L_{Aeq,T}$	L_{A90} (1)	L_{A10} (1)	L_{AFmax}
13th October 2016	Day(2)	53.3	47.5	51.7	65.4 to 75.9
	Night	50.6	43.9	46.9	46.9 to 78.6
14th October 2016	Day	53.1	46.8	51.3	66.4 to 76.2
	Night	49.6	41.8	44.9	49.3 to 74.8
15th October 2016	Day	51.4	44.3	50.3	63.8 to 77.7
	Night	42.8	38.9	43.2	47.3 to 73.3
16th October 2016	Day	51.4	45.3	51.3	52.4 to 72.3
	Night	49.0	40.3	46.2	48.8 to 73.2
17th October 2016	Day	53.8	48.5	54.5	61.5 to 79.0
	Night	51.4	43.2	50.7	52.7 to 71.4
18th October 2016	Day	56.8	52.6	58.2	63.8 to 79.0
	Night	49.5	39.6	50.6	57.3 to 71.8
19th October 2016	Day	55.7	50.5	56.1	64.8 to 81.0
	Night	50.6	42.4	50.0	54.4 to 75.4
20th October 2016	Day(3)	56.4	53.1	57.4	67.6 to 74.6
12th January 2017	Day(4)(5)	53.2	47.7	54.7	62.8 to 73.7
	Night(5)	49.8	41.7	50.5	53.7 to 69.6
13th January 2017	Day(5)	56.5	51.0	57.2	61.3 to 87.7
	Night(5)	47.8	38.5	48.6	49.7 to 69.6
14th January 2017	Day(5)	54.0	49.1	55.1	64.4 to 87.0
	Night(5)	44.2	37.6	45.9	46.9 to 62.5
15th January 2017	Day(5)	53.4	47.5	54.4	54.8 to 87.9
	Night	49.5	40.0	48.4	53.1 to 72.2
16th January 2017	Day	54.2	49.0	53.9	65.6 to 86.7
	Night	51.1	36.7	44.9	40.6 to 78.1
17th January 2017	Day	51.3	45.1	50.8	61.9 to 79.5
	Night	47.4	37.9	45.1	45.9 to 71.2
18th January 2017	Day	51.1	45.3	50.0	65.1 to 77.3

Table 13.14: Summary of measured noise levels, Position N6, free-field dB

Date	Period	$L_{Aeq,T}$	L_{A90}[1]	L_{A10}[1]	L_{AFmax}
	Night	47.0	36.7	42.7	40.9 to 71.3
19th January 2017	Day	52.2	45.8	50.8	64.2 to 78.3
	Night	51.0	41.5	47.2	48.0 to 74.6
20th January 2017	Day	54.2	49.3	53.2	64.9 to 84.2
	Night	50.9	45.1	48.0	49.8 to 74.1
21st January 2017	Day	52.2	44.8	49.8	62.0 to 75.3
	Night	41.3	36.0	42.4	45.4 to 67.6
22nd January 2017	Day	49.5	44.0	49.2	54.9 to 76.7
	Night	47.4	36.3	44.2	47.4 to 71.4
23rd January 2017	Day	51.4	45.7	51.1	61.5 to 85.2
	Night	49.8	38.5	47.4	48.9 to 76.2
24th January 2017	Day[6]	54.0	50.1	54.2	67.9 to 73.9

Notes:
[1] The L_{A90} and L_{A10} values presented were calculated from the arithmetic mean of the $L_{A90,15min}$ and $L_{A10,15min}$ measurements for each period.
[2] Daytime period was 11.25 hours in duration
[3] Daytime period was 2 hours in duration
[4] Daytime period was 6 hours in duration
[5] Data excluded from assessment due to weather
[6] Daytime period was 1.75 hours in duration

13.138 The survey results for Position N7 are summarised in Table 13.15.

Table 13.15: Summary of measured noise levels, Position N7, free-field dB

Date	Period	$L_{Aeq,T}$	L_{A90}[1]	L_{A10}[1]	L_{AFmax}
17th August 2016	Day[2]	55.5	45.9	58.2	62.3 to 88.1
	Night	52.8	40.0	54.4	61.0 to 76.1
18th August 2016	Day	56.2	48.8	58.6	62.9 to 82.0
	Night	51.9	40.9	54.2	58.0 to 71.8
19th August 2016	Day[3]	57.5	53.3	59.6	61.2 to 81.5
	Night[3]	52.9	42.9	53.5	58.9 to 101.8
20th August 2016	Day[3]	54.4	50.2	56.4	58.2 to 73.7

Table 13.15: Summary of measured noise levels, Position N7, free-field dB

Date	Period	$L_{Aeq,T}$	L_{A90}[1]	L_{A10}[1]	L_{AFmax}
	Night[3]	48.9	41.2	51.1	55.3 to 67.9
21st August 2016	Day[3]	54.2	50.2	56.0	59.7 to 78.3
	Night[3]	51.9	46.0	54.1	59.1 to 78.3
22nd August 2016	Day	54.3	49.7	56.0	58.8 to 76.2
	Night	48.8	37.5	50.3	58.5 to 75.2
23rd August 2016	Day[4]	54.8	50.8	57.1	64.0 to 71.9
12th January 2017	Day[3][5]	57.6	53.1	59.3	60.4 to 79.6
	Night[3]	54.2	44.5	54.9	56.9 to 75.3
13th January 2017	Day[3]	60.1	56.3	61.4	62.2 to 80.8
	Night[3]	52.1	42.5	54.5	57.4 to 74.6
14th January 2017	Day[3]	57.4	53.2	58.9	57.1 to 82.5
	Night[3]	49.3	39.3	52.0	55.2 to 70.1
15th January 2017	Day[3]	57.1	52.3	58.5	59.7 to 82.1
	Night	51.5	39.0	52.4	53.0 to 70.8
16th January 2017	Day	57.4	52.8	57.3	53.6 to 82.6
	Night	46.4	39.3	48.1	51.5 to 71.8
17th January 2017	Day	54.6	49.0	56.2	53.5 to 83.7
	Night	49.5	38.1	50.6	54.6 to 69.7
18th January 2017	Day	53.8	48.7	54.2	51.2 to 79.8
	Night	48.0	38.0	48.2	53.0 to 72.6
19th January 2017	Day	52.9	47.4	53.4	52.4 to 89.1
	Night	50.0	41.9	50.4	51.6 to 83.2
20th January 2017	Day	53.9	49.9	55.1	56.3 to 83.3
	Night	48.8	44.4	50.3	51.9 to 74.9
21st January 2017	Day	49.9	45.9	51.4	53.9 to 73.8
	Night	48.4	37.6	49.5	52.3 to 78.0
22nd January 2017	Day	52.6	47.0	54.2	57.5 to 79.7
	Night	52.2	41.3	53.3	56.2 to 79.1
23rd January 2017	Day	55.8	51.0	57.1	59.5 to 88.3
	Night	53.6	44.6	55.1	57.0 to 78.1
24th January 2017	Day[6]	58.6	55.2	60.0	62.8 to 71.8

Table 13.15: Summary of measured noise levels, Position N7, free-field dB					
Date	**Period**	**$L_{Aeq,T}$**	**L_{A90}(1)**	**L_{A10}(1)**	**L_{AFmax}**
Notes: (1) The L_{A90} and L_{A10} values presented were calculated from the arithmetic mean of the $L_{A90,15min}$ and $L_{A10,15min}$ measurements for each period. (2) Daytime period was 10.25 hours in duration (3) Data excluded from assessment due to weather (4) Daytime period was 1.25 hours in duration (5) Daytime period was 6 hours in duration (6) Daytime period was 1.75 hours in duration					

13.139 The survey results for Position N8 are summarised in Table 13.16.

Table 13.16: Summary of measured noise levels, Position N8, free-field dB					
Date	**Period**	**$L_{Aeq,T}$**	**L_{A90}(1)**	**L_{A10}(1)**	**L_{AFmax}**
17th August 2016	Day(2)	57.9	55.8	59.1	62.0 to 77.2
	Night	57.0	53.9	58.4	59.4 to 69.1
18th August 2016	Day	58.7	56.5	59.6	60.6 to 91.7
	Night	56.1	53.0	57.8	60.9 to 67.3
19th August 2016	Day(3)	57.4	55.0	58.1	59.3 to 81.3
	Night(3)	54.6	51.7	56.1	58.9 to 72.7
20th August 2016	Day(3)	57.2	51.2	56.0	52.5 to 108.4
	Night(3)	46.5	42.6	48.4	50.0 to 63.3
21st August 2016	Day(3)	51.0	47.8	52.1	52.2 to 69.3
	Night(3)	47.1	43.8	47.7	48.0 to 64.5
22nd August 2016	Day	51.0	47.5	51.1	51.6 to 87.1
	Night	52.1	48.5	52.8	51.5 to 70.3
23rd August 2016	Day(4)	54.3	52.3	55.0	59.5 to 69.5
12th January 2017	Day(3)(5)	56.6	54.2	57.3	55.8 to 69.8
	Night(3)	53.4	50.7	54.7	56.6 to 63.0
13th January 2017	Day(3)	58.9	56.2	59.4	57.2 to 77.1
	Night(3)	49.1	45.3	49.6	48.1 to 63.7
14th January 2017	Day(3)	55.8	53.3	56.5	56.2 to 72.0
	Night(3)	48.1	44.5	48.9	49.9 to 63.8
15th January 2017	Day(3)	57.0	54.4	57.5	54.7 to 76.2
	Night	54.2	50.3	54.6	55.6 to 63.9
16th January 2017	Day	58.2	56.2	59.2	58.7 to 80.9
	Night	51.3	47.9	52.4	51.3 to 64.1
17th January 2017	Day	49.7	46.7	50.0	50.5 to 70.9
	Night	43.7	41.1	44.6	45.7 to 57.1
18th January 2017	Day	49.3	45.7	49.5	50.4 to 82.7
	Night	47.3	42.9	47.5	48.1 to 58.7
19th January 2017	Day	53.2	51.1	53.9	52.1 to 72.4
	Night	54.5	51.0	54.8	52.8 to 63.0
20th January 2017	Day	58.5	56.9	59.3	59.3 to 73.8
	Night	54.2	51.5	55.8	57.1 to 64.2
21st January 2017	Day	57.3	54.6	57.8	52.4 to 72.8
	Night(6)	46.7	44.2	48.3	51.4 to 55.3
Notes: (1) The L_{A90} and L_{A10} values presented were calculated from the arithmetic mean of the $L_{A90,15min}$ and $L_{A10,15min}$ measurements for each period. (2) Daytime period was 7 hours in duration (3) Data excluded from assessment due to weather (4) Daytime period was 1 hour in duration (5) Daytime period was 6 hours in duration (6) Night-time period was 1 hour in duration					

13.140 The survey results for Position N9 are summarised in Table 13.17.

Table 13.17: Summary of measured noise levels, Position N9, free-field dB					
Date	**Period**	**$L_{Aeq,T}$**	**L_{A90}(1)**	**L_{A10}(1)**	**L_{AFmax}**
17th August 2016	Day(2)	54.8	52.8	56.0	57.5 to 87.8
	Night	54.9	52.2	56.2	57.1 to 72.8
18th August 2016	Day	55.9	53.9	57.1	58.3 to 73.7
	Night	53.5	51.0	55.2	57.8 to 62.0
19th August 2016	Day(3)	51.9	49.2	52.2	51.0 to 71.0
	Night(3)	48.2	45.8	49.5	51.8 to 69.3

Table 13.17: Summary of measured noise levels, Position N9, free-field dB

Date	Period	$L_{Aeq,T}$	L_{A90}[1]	L_{A10}[1]	L_{AFmax}
20th August 2016	Day[3]	48.8	45.6	49.8	48.8 to 65.1
	Night[3]	41.3	37.2	42.4	45.2 to 64.1
21st August 2016	Day[3]	46.5	43.6	47.7	49.2 to 68.5
	Night[3]	43.5	39.4	43.2	43.8 to 68.7
22nd August 2016	Day	46.4	42.7	47.4	47.8 to 72.1
	Night	48.0	43.7	48.1	45.0 to 63.9
23rd August 2016	Day[4]	48.4	46.0	48.9	56.6 to 70.9
12th January 2017	Day[3][5]	56.1	53.3	56.9	59.3 to 67.3
	Night[3]	52.5	49.8	53.8	55.6 to 65.0
13th January 2017	Day[3]	58.8	55.3	59.5	59.0 to 81.5
	Night[3]	48.5	44.8	48.9	48.2 to 67.5
14th January 2017	Day[3]	56.0	53.1	57.2	58.8 to 74.3
	Night[3]	48.6	45.0	49.4	54.5 to 67.3
15th January 2017	Day[3]	56.6	54.0	57.4	58.3 to 75.7
	Night	54.1	50.0	54.3	55.4 to 68.6
16th January 2017	Day	58.5	56.1	59.5	61.3 to 90.6
	Night	50.0	46.2	50.6	51.3 to 67.5
17th January 2017	Day	52.8	44.1	54.5	57.2 to 77.7
	Night	44.4	37.6	42.6	46.1 to 72.6
18th January 2017	Day	52.8	43.6	55.2	57.0 to 79.0
	Night	47.6	40.3	45.3	44.9 to 69.8
19th January 2017	Day	54.7	50.3	56.4	62.3 to 75.0
	Night	55.0	51.2	54.8	52.5 to 70.1
20th January 2017	Day	58.9	56.6	60.0	62.1 to 77.5
	Night	54.0	51.8	55.1	57.3 to 71.0
21st January 2017	Day	56.7	53.7	57.2	56.1 to 78.5
	Night	45.0	40.6	46.3	47.5 to 67.1
22nd January 2017	Day	51.2	44.6	52.1	52.4 to 77.7
	Night	46.4	39.3	44.0	40.0 to 69.0
23rd January 2017	Day	55.6	45.1	55.3	59.5 to 76.9
	Night	49.4	43.6	48.1	45.3 to 68.9
24th January 2017	Day[6]	57.6	52.7	60.6	66.7 to 74.7

Notes:
[1] The L_{A90} and L_{A10} values presented were calculated from the arithmetic mean of the $L_{A90,15min}$ and $L_{A10,15min}$ measurements for each period.
[2] Daytime period was 6.75 hours in duration
[3] Data excluded from assessment due to weather
[4] Daytime period was 2 hours in duration
[5] Daytime period was 6 hours in duration
[6] Daytime period was 1.75 hours in duration

13.141 British Standard 4142: 2014 indicates that a representative background sound level should be adopted for use in an assessment, which should not automatically be assumed to be the lowest or most common value. For this assessment, the distribution of L_{A90} values in the measurement data has been analysed and representative values determined.

13.142 To aid the determination of the representative values, the cumulative percentage of each dataset set has also been analysed, and the 25% point has been determined, i.e. the value above which 75% of the data lies. This is considered a reasonable starting point in identifying the representative level, although not necessarily directly equivalent to it.

13.143 Representative L_{A90} values have been separately determined for the August / October 2016 and January 2017 surveys, as shown in Table 13.18. The representative values have been rounded to the nearest whole number as required by BS4142: 2014. The distribution analysis of the daytime and night-time background sound levels are contained in Technical Appendix 13.3. Representative values have not been defined for Position N3, as it is not used in the assessment.

13.144 The values highlighted blue are the lowest for each position for each period, and these are the values that have been used in the assessment of operational noise.

Table 13.18: Representative background sound levels used in assessment, free-field dB

Position	Period	August / October 2016		January 2017	
		Range	Representative Values	Range	Representative Values
N1	Day	35 to 64	45	33 to 61	41
	Night	30 to 59	39	30 to 58	31
N2	Day	37 to 56	44	36 to 64	44
	Night	34 to 51	35	33 to 58	35
N4	Day	NA	NA	39 to 62	49
	Night	NA	NA	36 to 60	42
N5	Day	33 to 48	42	36 to 56	43

Table 13.18: Representative background sound levels used in assessment, free-field dB

Position	Period	August / October 2016		January 2017	
		Range	Representative Values	Range	Representative Values
	Night	32 to 50	36	31 to 55	35
N6	Day	40 to 57	44	37 to 54	46
	Night	34 to 55	37	30 to 54	34
N7	Day	42 to 56	48	38 to 60	46
	Night	35 to 54	38	29 to 58	32
N8	Day	44 to 60	53	40 to 60	46
	Night	43 to 59	50	38 to 58	39
N9	Day	36 to 56	43	37 to 60	42
	Night	36 to 57	37	33 to 58	36
Note: No value stated for Position N3 as it is not used in the assessment					

13.145 It should be noted that by using the lowest representative background sound level data from the two surveys, the assessment will be robust and give a worst-case indication of the likely impacts, beyond the reasonable worst-case assessment required of an EIA. As well assessing the reasonable worst-case sound emissions from the Proposed Development, the use of the lowest representative background sound level data from the two surveys will result in assessment outcomes that are likely to be considerably more stringent than would be the case had it been possible to measure the baseline noise climate under typical conditions.

13.146 It is considered unlikely that background sound levels in the area when the road network is fully operating will be as low as was the case in January 2017. However, in the absence of the opportunity to undertake further background sound level measurements, it is considered appropriate to adopt the most robust approach to the assessment.

13.147 It is anticipated that these values will be revised or confirmed when a future baseline noise survey is undertaken, after the road works are complete.

13.148 Although BS4142: 2014 does not require representative L_{Aeq} values to be established, they have been included here as they have been used to assist in determining the likely audibility of acoustic characteristics in the subsequent assessment of operational noise. The representative L_{Aeq} values are set out in Table 13.19.

13.149 As for the background sound levels, separate representative values have been determined for the August / October 2016 and January 2017 surveys. The values highlighted blue are the lowest for each position, and these are the values that have been used in the assessment of operational noise.

Table 13.19: Representative ambient sound levels used in assessment, free-field dB

Position	Period	August / October 2016		January 2017	
		Range	Representative Values	Range	Representative Values
N1	Day	57 to 71	63	48 to 69	53
	Night	48 to 69	53	37 to 66	47
N2	Day	53 to 68	58	56 to 73	63
	Night	36 to 53	49	37 to 71	52
N4	Day	NA	NA	46 to 63	52
	Night	NA	NA	42 to 62	46
N5	Day	40 to 62	45	40 to 58	45
	Night	36 to 52	38	35 to 56	39
N6	Day	46 to 60	50	44 to 58	50
	Night	38 to 58	42	34 to 57	38
N7	Day	52 to 61	55	43 to 62	50
	Night	41 to 60	47	39 to 60	44
N8	Day	47 to 62	54	42 to 61	48
	Night	46 to 61	53	40 to 60	42
N9	Day	39 to 59	46	39 to 67	48
	Night	38 to 59	47	34 to 60	40
Note: No value stated for Position N3 as it is not used in the assessment					

13.150 As for the representative background sound level data, using the lowest representative ambient sound level data from the two surveys is considered robust and likely to give a worst-case indication of the likely impacts. It is considered unlikely that ambient sound levels in the area will be as low as was the case in January 2017 when the road network is fully operating. However, in the absence of the opportunity to undertake further measurements, it is considered appropriate to adopt the most robust approach to the assessment.

13.151 It is anticipated that these values will be revised or confirmed when a future baseline noise survey is undertaken, after the road works are complete.

Baseline Vibration Surveys

13.152 Vibration measurements were carried out at the Site between 12:00 hours on Wednesday 17th August 2016 and 09:30 hours on Tuesday 23rd August 2016, to measure vibration levels due to existing train pass-bys.

13.153 The equipment used during the survey is summarised in Table A13.3.4 in Technical Appendix 13.3. The meters were laboratory-calibrated in the year preceding the survey.

13.154 The vibration measurements were carried out at the following positions:

- Position V1: 0.75 metres from the boundary of the Site with Network Rail land. The meter was located close to the abutment of a footbridge over the railway, at the top of an embankment, above the railway.
- Position V2: 0.5 metres from the boundary of the Site with Network Rail land. The meter was located close to the fence line, with the railway line beyond, at grade with the meter location.

13.155 The measurement positions are shown in Figure 13.1. The accelerometers at both positions were dug into the ground at a depth of approximately 30cm, with the soil back-filled above and compacted.

13.156 The measured vibration levels are set out below in the form of vibration dose values. In all cases, the daytime is the 16 hour period from 07:00 to 23:00 hours and the night-time the eight hour period from 23:00 to 0700 hours, unless stated otherwise.

13.157 The vibration levels measured at Position V1 are summarised in Table 13.20. The full results are set out in graphical form in Figures A13.3.81 to A7.3.83.

Table 13.20: Measured Vibration Dose Values, Position V1, $ms^{-1.75}$

Day	Period	X-axis VDVd,T	Y-axis VDVd,T	Z-axis VDVb,T
17th August 2016	Day(1)	0.013	0.017	0.048
	Night	0.012	0.026	0.043
18th August 2016	Day	0.017	0.019	0.055
	Night	0.008	0.008	0.029
19th August 2016	Day	0.019	0.032	0.056
	Night	0.013	0.016	0.038
20th August 2016	Day	0.022	0.022	0.061
	Night	0.005	0.005	0.021
21st August 2016	Day	0.018	0.013	0.054
	Night	0.012	0.008	0.031
22nd August 2016	Day	0.020	0.015	0.061
	Night	0.010	0.007	0.028
23rd August 2016	Day(2)	0.014	0.010	0.035

Notes:
(1) Daytime period was 5 hours in duration
(2) Daytime period was 2.5 hours in duration

13.158 The vibration levels measured at Position V2 are summarised in Table 13.21. The full results are set out in graphical form in Figures A13.3.84 to A13.3.86.

13.159 It was noted that there was one particular spike in the vibration level at Position V2, which was considerably higher than any other part of the measurement. It is considered likely that the spike was anomalous, most likely to have been caused by livestock kept in the field in which the vibration meter was located. The spike has been removed from the numerical analysis of the data, but retained in the graphical survey results.

Table 13.21: Measured Vibration Dose Values, Position V2, $ms^{-1.75}$

Day	Period	X-axis VDVd,T	Y-axis VDVd,T	Z-axis VDVb,T
17th August 2016	Day(1)	0.020	0.025	0.129
	Night	0.015	0.018	0.090
18th August 2016	Day	0.021	0.024	0.130
	Night	0.016	0.019	0.096
19th August 2016	Day	0.063	0.070	0.170
	Night	0.021	0.041	0.145
20th August 2016	Day	0.029	0.044	0.219
	Night	0.009	0.008	0.062
21st August 2016	Day	0.028	0.062	0.199
	Night	0.020	0.039	0.157
22nd August 2016	Day	0.083	0.112	0.227
	Night	0.015	0.017	0.117
23rd August 2016	Day(2)	0.023	0.051	0.123

Notes:
(1) Daytime period was 11 hours in duration
(2) Daytime period was 1.5 hours in duration

Operational Noise Survey

13.160 A noise survey was undertaken at the railfreight terminal at Widnes, to gather source data that could be considered representative of the activities likely to occur at the Proposed Development. It is understood that the activities undertaken at Widnes, in terms of both the intensity of activity, and the technology being used, would be similar to that at the Proposed Development. Data gathered at Widnes was therefore considered representative of the likely activities at the Proposed Development.

13.161 The measurements were carried out on Thursday 18th August 2016 using the equipment listed in Table A13.3.5 in Technical Appendix 13.3. The sound level meter was calibrated before the survey using the listed acoustic calibrator, and the calibration checked upon completion of the survey. No significant calibration drifts were found to have occurred.

13.162 The survey results have been converted into SEL and SWL values, as summarised in Table 13.22 together with the measured L_{Amax} values. A full set of survey data is set out in Table A13.3.6 in Technical Appendix 13.3.

Table 13.22: Measured Noise Levels at Widnes Railfreight Terminal, dB

Source	SEL at 10m	L_{AFmax} at 10m	SWL
Train backing into siding (wagons only)	74	64	93
HGV passing	80	68	99
HGV idling	77	68	93
HGV pull away	81	70	101
Crane lowering container on to HGV in Bay	85	75	98
Container down on to HGV trailer	92	94	109
Crane disconnect and grabber backup	83	79	100
Crane moving	80	74	96
HGV starting up	69	70	95
HGV pulling up	79	72	98
HGV air brakes	71	73	99
Grab lower and connect to trailer	86	87	106
Crane lifting container from trailer	80	79	101
Reach Stacker drive past	95	82	114
Train pull away (wagons only)	112	101	131
Crane lift container from train	77	80	101
Crane drop and disconnect container onto train	85	87	106
Reach stacker revving up	95	93	114
Reach stacker drive by no container	92	88	111
Reach stacker connecting to container	96	98	119
Reach stacker reversing with container	93	90	112
Reach stacker moving forward with container	94	89	113
Reach stacker putting down container	91	92	115
Reach stack reversing and accelerating without container	92	87	111

Sensitive Receptors

Existing Sensitive Receptors

13.163 The baseline section confirms the following sensitive receptors that may be affected by the Proposed Development include:

- Existing local residents:
  - Along the A5 to the north of the Site;
  - On and around Croft Lane to the north of the Site;
  - To the west of the A449, to the west of the Site;
  - On Station Drive, to the south of the Site; and
  - In Calf Heath, to the south-east of the Site.
- Canal users that moor along the Staffordshire and Worcestershire Canal, close to the Croft Lane; and
- Transient users of the canal towpath.

New Sensitive Receptors

13.164 No noise-sensitive receptors will be introduced as a result of the Proposed Development, so these have not been considered.

Potential Effects

Demolition and Construction

Construction Noise

13.165 The demolition and construction stage of the Proposed Development is expected to generate some potential significant direct and indirect noise and vibration impacts, with temporary effects.

13.166 An assessment of the likely construction noise emissions has been undertaken.

13.167 Detailed information is not available at this stage on the proposed construction methods. Notwithstanding this, the works are anticipated to involve the following elements:

- site preparation works, including demolition, earthworks, involving excavators, dump trucks, loaders and lorries;
- foundation works, involving concreting plant, trucks and lorries;
- piling works at bridge abutments;
- building erection works, involving lorries, tracked cranes, manual tasks such as hammering, nail guns and erection of scaffolding, generators and compressors;

- road surfacing, including asphalt paving equipment and lorries; and
- landscaping works, involving dump trucks, lorries, compaction plant, excavators and asphalting plant.

13.168 It is understood that piling will only be required for the bridge abutments.

13.169 The items of plant assumed to be used during each phase of works are set out in Technical Appendix 13.4.

13.170 The calculations have been undertaken for two situations; an 'average' case where the construction plant are assumed to be at the approximate centre of the Site, and a 'worst-case' where the construction plant are assumed to be at the part of the Site closest to the receptor under consideration. This gives a range of values representing the average and worst-case noise levels likely to be generated during the works.

13.171 Construction noise has been predicted at the receptor locations listed in Table 13.23, and shown in Figure 13.2. The listed receptors are a representative sample of those receptors that may be affected by the construction of the Proposed Development.

Table 13.23: Receptors for construction noise assessment

Receptor	Distance to Site boundary (metres)	Distance to closest proposed building (metres)	Distance to centre of site (metres)	Distance to bridge abutment (metres)
1 Kings Road	70	500	1,455	2,025
181 Station Drive	230	430	1,410	1,285
182 Station Drive	125	370	1,275	1,230
4 Croft Lane	25	260	700	620
Allspan	200	465	1,520	2,140
Avenue Cottages	5	80	860	1,175
Avery Bungalow	170	470	1,510	2,100
Chase View	50	285	1,335	990
Cobweb Cottage	110	315	1,430	2,030
Craigmore	125	385	1,175	1,205
Denson House	5	165	1,180	390
Elmhurst	150	380	1,475	2,075
Evergreen	70	180	1,110	400
Gailey House	15	115	775	590
Hamerton House	30	230	1,020	890
High Clere	10	250	1,185	1,750
Hollybyre	55	165	1,110	410
Homestead	70	180	1,090	400
Longacre	50	200	990	1,270
Longfield	35	210	1,110	930
Marsh Farm	140	225	1,260	600
Meadow View	35	240	1,150	1,700
Oak View	30	255	770	730
Roundabout Cottages	20	320	1,420	1,000
School House	30	340	1,395	1,015
Silverthorne	115	370	1,230	1,220
St Clare	115	370	1,205	1,215
Straight Mile Farm	25	130	1,020	1,570
Sylvestris	25	435	1,340	1,950
The Cottage	25	240	810	785
The Villa	35	155	925	1,080
Wharf Cottage	60	245	940	925
Wharf House	35	250	895	860
Wood View	20	90	845	1,125
Woodland Farm	50	215	1,365	1,965
Calf Heath Reservoir West	25	80	825	1,210
Calf Heath Reservoir East	30	100	975	1,460
Canal Moorings North	60	220	840	820
Canal Moorings South	45	210	545	530
Canal Towpath Gravelly Way	30	215	420	245

13.172 It is understood that Straight Mile Farm will be purchased by the Applicant, with a view to incorporating parts of it into the Proposed Development for landscaping works. However, the property is to remain as a residential receptor, at least in the short-term, with it potentially being returned to residential use in the long-term. For the purposes of this assessment, it is assumed that Straight Mile Farm will remain as a residential receptor throughout the construction works.

13.173 Furthermore, it is understood that there are properties within the Order Limits, Heath Farm, Woodside Farm and residential properties at the intersection of Vicarage Road / Straight Mile, that are likely to remain occupied during some part of the construction works. Since the duration of the occupation of each property is not known, it is not possible to reasonably quantify their potential proximity to the construction works and the

consequential impacts. For the purposes of this assessment, it is assumed that these properties could be as adversely affected as the worst-affected receptors set out in Table 13.23.

13.174 The assessment criteria for each of the receptor groups are as determined in accordance with Table A13.2.1 in Technical Appendix 13.2, whereby the existing ambient noise level, rounded to the nearest 5dB, defines the assessment criteria. The existing noise levels at each of these assessment positions are taken to be as measured during the daytime noise measurements, as the construction works will be limited to this period. To provide a robust assessment, the lowest representative ambient sound level measured at each position has been used, as listed and highlighted blue in Table 13.19.

13.175 In this instance, the existing ambient daytime noise levels were all below 65dB(A) when rounded to the nearest 5dB, except at Position N1 in August 2016, which at 63dB(A), would be equal to 65dB(A) when rounded to the nearest 5dB. For the sake of robustness, the lower ambient sound level of 53dB(A) measured at Position N1 in January 2017 is taken as the basis of the construction noise assessment criterion.

13.176 In accordance with the guidance in BS5228: 2009+A1: 2014, where the existing ambient noise level is below 65dB(A), a daytime criterion of 65dB(A) applies. This is considered to be the case at all receptors.

13.177 Table 13.24 sets out the predicted construction noise levels for each assessment location. Where the construction noise levels are predicted to exceed the 65dB criterion, the cells are highlighted blue.

Table 13.24: Predicted construction noise levels, free-field dB

Receptor	Phase of Construction Works[1]					
	1	2	3	4	5	6
1 Kings Road	47 to 73	45 to 55	30	42 to 51	41 to 47	47 to 73
181 Station Drive	47 to 63	46 to 56	34	42 to 53	41 to 43	47 to 63
182 Station Drive	48 to 68	47 to 57	34	43 to 54	42 to 43	48 to 68
4 Croft Lane	53 to 82	52 to 60	40	48 to 57	47 to 62	53 to 82
Allspan	47 to 64	45 to 55	29	42 to 52	41 to 47	46 to 64
Avenue Cottages	52 to 96	50 to 71	35	47 to 67	46 to 53	51 to 96
Avery Bungalow	47 to 66	45 to 55	30	42 to 52	41 to 47	46 to 65
Chase View	48 to 76	46 to 60	36	43 to 56	42 to 46	47 to 76
Cobweb Cottage	47 to 70	46 to 59	30	42 to 55	41 to 50	47 to 69
Craigmore	49 to 68	47 to 57	34	44 to 53	43 to 43	49 to 68
Denson House	49 to 96	47 to 64	44	44 to 61	43 to 48	49 to 96
Elmhurst	47 to 67	45 to 57	30	42 to 54	41 to 49	47 to 66
Evergreen	49 to 73	48 to 64	44	44 to 60	43 to 58	49 to 73
Gailey House	53 to 87	51 to 67	41	47 to 64	46 to 55	52 to 86
Hamerton House	50 to 81	49 to 61	37	45 to 58	44 to 53	50 to 80
High Clere	49 to 90	47 to 61	31	44 to 57	43 to 57	49 to 90
Hollybyre	49 to 76	48 to 64	44	44 to 61	43 to 57	49 to 75
Homestead	50 to 73	48 to 64	44	44 to 60	43 to 62	49 to 73
Longacre	50 to 76	49 to 63	34	45 to 59	44 to 52	50 to 76
Longfield	49 to 80	48 to 62	37	44 to 59	43 to 51	49 to 79
Marsh Farm	48 to 67	47 to 62	40	43 to 58	42 to 50	48 to 67
Meadow View	49 to 80	47 to 61	31	44 to 58	43 to 51	49 to 79
Oak View	53 to 81	51 to 61	39	47 to 57	46 to 60	52 to 80
Roundabout Cottages	47 to 84	46 to 59	36	42 to 55	41 to 45	47 to 84
School House	48 to 81	46 to 58	36	42 to 55	41 to 45	47 to 80
Silverthorne	49 to 69	47 to 57	34	43 to 54	42 to 43	48 to 69
St Clare	49 to 69	47 to 57	34	44 to 54	43 to 43	48 to 69
Straight Mile Farm	50 to 82	49 to 66	32	45 to 63	44 to 63	50 to 82
Sylvestris	48 to 82	46 to 56	30	43 to 52	42 to 52	47 to 82
The Cottage	52 to 82	51 to 61	38	47 to 58	46 to 61	52 to 82
The Villa	51 to 80	49 to 65	35	46 to 61	45 to 60	51 to 79
Wharf Cottage	51 to 75	49 to 61	37	46 to 57	45 to 60	51 to 74
Wharf House	51 to 80	50 to 61	37	46 to 57	45 to 59	51 to 79
Wood View	52 to 84	50 to 70	35	47 to 66	46 to 51	51 to 84
Woodland Farm	48 to 76	46 to 62	30	42 to 59	41 to 50	47 to 76
Calf Heath Reservoir West	52 to 82	50 to 71	34	47 to 67	46 to 51	52 to 82
Calf Heath Reservoir East	51 to 81	49 to 69	33	45 to 65	44 to 49	50 to 80
Canal Moorings North	52 to 75	50 to 62	38	47 to 58	46 to 61	52 to 74
Canal Moorings South	56 to 77	54 to 62	42	50 to 59	49 to 66	55 to 77
Canal Towpath Gravelly Way	58 to 81	45 to 55	48	53 to 59	52 to 66	58 to 80

Note:
Cells shaded blue show where predicted levels exceed the 65dB criterion.
[1] Phases of work as follows: Phase 1 = Site preparation works; Phase 2 = Foundation

Table 13.24: Predicted construction noise levels, free-field dB

works; Phase 3 = Piling; Phase 4 = Building erection works; Phase 5 = Road construction works; and Phase 6 = Landscaping works

13.178 It can be seen from Table 13.24 that the 65dB criterion is likely to be exceeded at a number of locations when works are close to the receptors closest to the Site boundary. At the worst-affected locations, Avenue Cottages, Denson House, Gailey House, and High Clere, the noisiest phase of works is predicted to lead to noise levels 31dB, 31dB, 22dB and 25dB above the 65dB criterion respectively.

13.179 A number of locations are predicted to have high adverse impacts, with construction noise levels 10dB or more above the adopted 65dB criterion. The locations where this is considered likely to be the case are highlighted blue in Table 13.24.

13.180 For these properties, the high adverse impacts, when combined with the high sensitivity of each receptor, are likely to lead to major adverse effects, which are considered significant in EIA terms.

13.181 In addition to the listed properties, the properties within the Order Limits that are likely to remain occupied during the some part of the construction works (Heath Farm, Woodside Farm and residential properties at the intersection of Vicarage Road / Straight Mile) could be as adversely affected as the worst-affected properties. It is not possible to quantify the likely impact at these properties, as their proximity to any particular element of the construction works is not known due to the uncertainty as to the duration of their occupancy. However, for the purposes of this assessment, it is assumed that these properties may also be subject to high adverse impacts in the worst-case, which would be considered as major adverse effects, which are considered significant in EIA terms.

13.182 A high adverse impact is predicted at the northern and southern canal mooring receptors for two phases of work, which when combined their medium sensitivity, results in moderate adverse effects, which are considered significant in EIA terms.

13.183 High adverse impacts are predicted along the canal towpath for three phases of work, which when combined with its medium sensitivity as part of the Staffordshire and Worcestershire Canal Conservation Area, results in a moderate adverse effect, which is significant in EIA terms.

13.184 High adverse impacts are predicted at Calf Heath Reservoir, which when combined with its low sensitivity as an outdoor amenity space, results in a minor adverse effect, which is not significant in EIA terms.

13.185 A number of properties are predicted to be subject to low to moderate adverse impacts, where the construction noise levels exceed the 65dB criterion by between 0dB and 10dB. The distinction between low and moderate impacts will depend on the duration of the works causing the criterion to be exceeded.

13.186 These properties include: 1 Kings Road, 182 Station Drive, Avery Bungalow, Cobweb Cottage, Craigmore, Elmhurst, Evergreen, Homestead, Marsh Farm, Silverthorne, and St Clare.

13.187 Low to moderate adverse impacts at these locations, when combined with their high sensitivity, are likely to lead to minor or moderate adverse effects. Minor adverse effects are not considered significant in EIA terms, but moderate adverse effects are considered significant in EIA terms.

13.188 The upper end of the ranges of predicted noise levels will only occur where the works are at the closest possible distance to each receptor. The exact duration of works at these minimum distances is not known in detail, however, it is expected to be relatively short. For example, site preparation works or landscaping works at the closest distances might last approximately one to two days, before they move further from the receptors. The duration of the worst impacts is therefore likely to be limited.

13.189 Furthermore, the early construction of the landscaped bunds will provide acoustic screening to subsequent phases of work, where those subsequent phases of work occur within the Site.

13.190 It is noted that the relatively high levels predicted for Phase 6 Landscaping Works are predicted on some of the activities occurring receptor-side of the landscaped bunds, thereby negating any potential benefits from those bunds.

13.191 Where the construction works are away from the receptors, towards the centre of the Site, which is considered to be more representative of the majority of the construction works, the construction noise levels are predicted to be below the 65dB criterion, which would constitute a negligible impact, which even with high sensitivity receptors, would be considered to have no effect.

13.192 Details for mitigating construction noise are set out in the ODCEMP, which will be updated as further detail on the construction works emerges (as part of the DCEMP to be secured as a DCO Requirement). No phase of construction will commence until the DCEMP is approved, nor until the earthworks strategy has been approved.

13.193 The Applicant will include construction noise in the bespoke noise insulation scheme that is to be a committed measure to address adverse effects of the Proposed Development. Table A13.2.2 in Technical Appendix 13.2 sets out thresholds that, when equalled or exceeded for the following periods, will result in eligibility for noise insulation:

- for a period of 10 or more days of working in any 15 consecutive days; or
- for a total number of days exceeding 40 in any 6 consecutive months.

13.194 The commitment to provide insulation when the thresholds are equalled, and not just when they are exceeded as is set out in BS5228: 2009+A1:2014, is a material betterment over the approach set out in that standard, and ties the provisions of the bespoke noise insulation scheme in with the 'high adverse impact' threshold. If the trigger for noise insulation were left as stated in BS5228: 2009+A1:2014, there would be a 1dB gap where a high adverse impact were identified, but where eligibility for noise insulation under the bespoke noise insulation scheme would not apply.

13.195 The assessment of eligibility will be undertaken with enough time prior to the start of any construction works such that any identified sound insulation measures can be installed at the appropriate time. The Applicant has committed to repeating the baseline ambient sound level survey as part of the bespoke noise insulation scheme, should it be required by the local planning authority.

13.196 Since the precise durations of the various specific construction works are not known at this stage, it is not possible to identify those properties that are likely to be eligible. Based on the initial assessment contained in this chapter, which is based on a series of worst-case assumptions regarding the proximity and type of construction work to be undertaken, the following properties exceed the noise insulation thresholds, and depending on the duration of the works, may be eligible:

- 4 Croft Lane;
- Avenue Cottages;
- Chase View;
- Denson House;
- Gailey House;
- Hamerton House;
- High Clere;
- Hollybyre;

- Longacre;
- Longfield;
- Meadow View;
- Oak View;
- Roundabout Cottages;
- School House;
- Straight Mile Farm;
- Sylvestris;
- The Cottage;
- The Villa;
- Wharf Cottage;
- Wharf House;
- Woodland Farm; and
- Wood View.

13.197 The list of properties that may be eligible for noise insulation, as set out above, is based on the representative sample of properties at which the construction noise levels have been assessed. When the final assessment is undertaken prior to the start of the construction works, all eligible properties will need to be considered.

13.198 Based on the assessed locations, and the proximity of sensitive receptors around them, it is considered likely that a further 30 properties may be eligible for insulation during the construction works.

13.199 Since the analysis set out here has been undertaken without the benefit of a detailed programme of construction works, it is likely that the final list of eligible properties will be smaller than is listed here; the actual period of time where the construction noise levels exceed the qualifying criteria may be of limited duration. The analysis set out above is therefore considered to be an initial assessment, based on worst-case assessment and propagation parameters.

13.200 Consideration has been given as to whether there may be any properties that could be so adversely affected by construction noise that the occupants may require temporary rehousing. Table A13.2.2 in Technical Appendix 13.2 identifies threshold values at which such an action may be necessary; the temporary rehousing thresholds being 10dB greater than the noise insulation thresholds for each time period.

13.201 The Applicant is committed to avoiding this situation, and will commit to managing the works so that the higher thresholds shown in Table A13.2.2 in Technical Appendix 13.2 are not reached, or where they are reached, the period of exposure is kept below the exposure periods set out in the text under Table A13.2.2 in Technical Appendix 13.2. This commitment is set out in the draft DCO Requirements.

13.202 On the basis of this commitment, temporary rehousing will not be required to protect residents from construction noise.

Construction Vibration

13.203 Part 2 of BS5228: 2009+A1: 2014 contains a number of formulae that may be used to estimate vibration levels for specific types of activity, such as the use of a vibratory roller or a rotary piling rig. The standard also contains historic vibration data measured at various sites around the UK for a range of piling operations.

13.204 TRL Report 53 contains historic data for a number of ground engineering works, such as heavy lorries on poor road surfaces, or bulldozers.

13.205 In general terms, general engineering works undertaken at least 25 metres from a sensitive receptor are unlikely to generate vibration levels of 1mm/s or more, and would therefore be unlikely to adversely impact a sensitive receptor.

13.206 Some elements of the construction works may generate perceptible levels of vibration at off-site receptors, for example heavy ground works or vibratory compaction, when they occur close to boundaries of the Site.

13.207 The likely vibration levels from vibratory compaction activities have been calculated using the formulae in Part 2 of BS5228: 2009+A1: 2014. The calculation suggests that vibration levels of approximately 2mm/s are possible inside properties within 20 metres of such activities.

13.208 Similarly, the level of vibration from ground works has been estimated from Figure A13.2.1 in Technical Appendix A13.2, which suggests that vibration levels of more than 1mm/s are possible where ground works are undertaken within approximately 8 to 10 metres of a receptor.

13.209 The receptors Avenue Cottages, Denson House, Gailey House, High Clere, Roundabout Cottages, and Wood View are the only receptors likely to be within 10 to 20 metres of heavy ground works, and it is possible that where the works are very close to them, vibration levels may be in the region of 1 to 3mm/s. This would be regarded as a moderate adverse impact, which, when combined with the high sensitivity of these receptors, would result in a moderate adverse effect, which is significant in EIA terms.

13.210 As with the assessment of construction noise, the properties within the Order Limits that are likely to remain occupied during some part of the construction works (Heath Farm, Woodside Farm and residential properties at the intersection of Vicarage Road / Straight Mile) could be as adversely affected as the worst-affected properties. It is not possible to quantify the likely impact, as their proximity to any particular element of the construction works is not known due to the uncertainty as to the duration of their occupancy. However, for the purposes of this assessment, it is assumed that the properties may also be subject to moderate adverse impacts in the worst-case, which would be considered as moderate adverse effects, which are considered significant in EIA terms.

13.211 Mitigation for construction vibration is considered later in this chapter.

Construction Traffic

13.212 An assessment of potential noise and vibration effects from construction traffic has been undertaken, based on construction traffic data provided by WSP. Traffic data has been provided for the existing situation (2016) and for the construction period. The data is shown in Table A13.4.7 in Technical Appendix 13.4.

13.213 Traffic noise predictions have been carried out at a notional receptor location 10 metres from the edge of the carriageway and 1.5 metres above ground level. A notional receptor has been used because it is the change in traffic noise level that is of interest, not the absolute noise levels at any given receptor. The predicted changes in noise level will occur at noise-sensitive receptors along the road considered.

13.214 The vehicle speeds have been modelled in accordance with the guidance in CRTN, according to the class of road. Low flow corrections have been applied to all routes with a flow less than 4,000 as required in CRTN. Roads with a daytime flow of less than 1,000 vehicles are not valid.

13.215 The calculated road traffic noise levels are contained in Technical Appendix 13.4 in Table A13.4.8.

13.216 It can be seen from Table A13.4.8 that the changes in daytime road traffic noise as a result of construction traffic (third column in Table A13.4.8) are predicted to be less than 1dB along all of the roads considered.

13.217 Increases in road traffic noise of less than 1dB would be classed as negligible or low adverse impacts, which when combined with the high sensitivity of the residential receptors along these roads, would be regarded as no adverse effect, or minor adverse effect, which is not significant in EIA terms. Consequently, mitigation is not considered necessary.

13.218 As described in the DMRB, the effect of changes in road traffic vibration mirror those from changes in road traffic noise, albeit at lower levels of annoyance at all levels.

13.219 It is therefore considered likely that for traffic on all roads there is likely to be no adverse noise or vibration effect as a result of construction traffic, which is not significant in EIA terms.

Operational Development

13.220 The Proposed Development is expected to generate a range of potential significant direct and indirect noise and vibration impacts, with likely permanent effects.

Operational Noise Emissions

13.221 Rail terminals and warehouse buildings are, to a large degree, predictable in terms of their likely noise emissions. Noise from handling of containers, and the movement of heavy goods vehicles, tugs and trains is generally similar. Providing traffic volumes are known, the overall noise emissions can be calculated and assessed.

13.222 The operation of the Proposed Development is likely to involve heavy goods vehicle movements in the service yards and on the various roads serving the Site, movement of tugs between the rail terminal and the units, loading and unloading of trains, and loading and unloading activities at each unit. Tugs, in the context of the Proposed Development, are similar to HGV tractor units, in that they move trailers around service yards at sites similar to the Proposed Development, but they contain less bodywork, and fewer comforts typically found in road-going, long-distance HGV tractor units. They are designed to quickly and economically move trailers around yards. They are often referred to as yard shunters, although the word 'shunter' is avoided in this chapter so as not be confused with small railway freight locomotives also called shunters.

13.223 A database of typical noise emission levels is shown in Table 13.25. These values have been taken from similar but unrelated developments and from the survey at Widnes.

Table 13.25: Typical source noise levels for activities at industrial sites, free-field dB

Source	Distance (metres)	LAE	L_{AFmax}
HGV air brakes	10	71(1)	73(1)
HGV start up and pull away	10	69(1)	70
HGV reversing alarm	10	82	73
HGV dropping off trailer	10	79	85
HGV picking up trailer	10	84	86
HGV pass-by	10	80(1)	68(1)
Tug pass-by with trailer	10	83	81
Tug pass-by without trailer	10	79	77
Tug dropping off trailer	10	75	77
Tug picking up trailer	10	87	92
Car door slam	10	65	72
Car engine starting	10	62	66
Car pulling away	10	67	64
Car pass-by	10	70	-
Forklift pass-by	10	79	-
Forklift moving pallet (inc rev alarm)	10	85	76
Reach-stacker revving up	10	95(1)	93(1)
Reach-stacker drive by no container	10	92(1)	88(1)
Reach-stacker connecting to container	10	96(1)	98(1)
Reach-stacker reversing with container	10	93(1)	90(1)
Reach-stacker moving forward with container	10	94(1)	89(1)
Reach-stacker putting down container	10	91(1)	92(1)
Reach-stacker reversing and accelerating without container	10	92(1)	87(1)
Reach-stacker drive past	10	95(1)	82(1)
Crane lift container from train	10	77(1)	80(1)
Crane drop and disconnect container onto train	10	85(1)	87(1)
Idling Class 66 locomotive	-	106(2)	-

Notes:
(1) – Values measured at Widnes Terminal
(2) – Data for idling Class 66 locomotive based on information presented in Adrian Morgan's Noise and Vibration Proof of Evidence, submitted on behalf of Network Rail for the Network Rail (Hope Valley Capacity) Order, dated 12 April 2016

13.224 The likely operational traffic movements for the Site have been confirmed by the traffic consultant for the project, WSP. The peak traffic values in each of the daytime and night-time periods are shown in Table 13.26.

Table 13.26: Peak Hourly Vehicle Movements

Vehicle Type	Period	Main Site	Rail Terminal
HGV	Day	416	43

	Night	295	31
Car	Day	1139	-
	Night	1156	-
Tug	Day	26	20
	Night	21	14

13.225 The traffic data shown in Table 13.26 relate to the whole of the Proposed Development; individual building units will have lower values, and the above values have been split across the Site according to floor area.

13.226 Each of the vehicle movements in Table 13.26 is assumed to give rise to each of the relevant noise generating events set out in Table 13.25, to derive the overall vehicle noise emissions for the Proposed Development.

13.227 The assessment periods are taken as one hour for the daytime and evening periods and fifteen minutes for the night-time period, consistent with the approach recommended in BS4142: 2014. Since the vehicle movements into and out of the Site had been derived in terms of hourly totals, it has been assumed that the night-time fifteen minute period includes one quarter of the peak hour car and heavy goods vehicle (HGV) movements. By assessing operational activities at the Proposed Development based on the highest daytime and night-time one hour vehicle flows against representative background sound levels that are towards the lower end of the range of measured values, the assessment is considered to represent the worst-case scenario.

13.228 It is assumed that the tugs will operate at the Site to move trailers between the rail terminal and each unit.

13.229 Forklifts are likely to operate at the Proposed Development, principally within buildings. However, it is also likely that they will operate outside buildings loading or unloading HGVs at level access doors. It has been assumed that 20 forklift loads are required per HGV at a level access door to either load it or unload it, based on observations at other sites. This equates to 40 forklift movements per HGV at a level access door.

13.230 It is assumed that there will be two level access doors per operational side of a building, and the number of HGVs serving those level access doors is proportional to the number of level access doors and dock levellers.

13.231 Each forklift movement is assumed to give rise to each of the relevant noise-generating events set out in Table 13.25, to derive the overall forklift noise emissions for the Site. The source noise levels for forklifts set out in Table 13.25 are based on measurements of diesel-powered forklifts.

13.232 In addition to the vehicle movements, it has been assumed that activities within the buildings generate reverberant noise levels of 75dB(A), which is typical for warehouse buildings.

13.233 Buildings such as those at the Proposed Development are generally constructed using a composite cladding panel, which typically offers a sound reduction of 25dB Rw. However, in this instance the Applicant has committed to using a cladding material with a much higher sound reduction performance, thereby better containing sound generated within the buildings. The external building fabric of the walls of all buildings is assumed to provide a sound reduction of 39dB Rw, which is considered to be typical for a built-up system such as that proposed here. Roofs will have a composite sound reduction of 28dB Rw; the lower value resulting from the inclusion of rooflights, which typically offer a much lower sound reduction. The commitment to utilise buildings with a higher level of sound reduction is considered to be mitigation that is embedded in the Proposed Development.

13.234 The effect of opening doors in the proposed warehouse buildings has also been considered, to test the sensitivity of the assessment outcome to the status of the doors. The doors that are modelled as open are the level access doors on each building, as the doors on the dock levellers will only open when a trailer is docked. Open level access doors are assumed to have a sound reduction of 0dB.

13.235 It is assumed that gantry cranes load or unload all of the trains in the rail terminal south of Gravelly Way, and reach stackers undertake the same operations north of Gravelly Way. Each train is assumed to contain 41 containers, which would typically take 4 hours to load or unload, at the rate of ten containers per hour. It is assumed that two trains are likely to be at the Site at any one time.

13.236 The noise levels generated by the activities have been calculated using the prediction framework set out in ISO9613 as implemented by the noise modelling software CADNA/A.

13.237 The vehicle activities in and around the Site have been modelled as acoustic point or line sources. Noise breaking out from the building has been modelled using acoustic area sources, with the dimensions set to match the highest allowed under the Parameters Plans.

13.238 The self-screening that would occur in service yards as a result of the occupation by large vehicles has been ignored to present a worst-case. The acoustic screening effects of garden fences have also been ignored.

13.239 The topography on and around the Site has been modelled using OS mapping information and on-site observations. The acoustic absorbency of the ground around the Site is assumed to be acoustically soft, including all landscaping and landscaped bunds, while the ground absorbency at the Site itself is assumed to be acoustically hard. All buildings have been modelled as approximately 70% acoustically reflective.

13.240 The landscaped bunding, which is effectively embedded mitigation, was designed through an iterative process of assessing various potential site layouts. The bunds have been optimised to balance the greatest level of noise reduction, while providing an appropriate, natural landscaped effect.

13.241 One hour and fifteen minute L_{Aeq} values have been calculated as appropriate for the assessment period for each noise-generating event. The predicted noise levels from each event have been logarithmically summed to derive the overall noise levels from the Proposed Development.

13.242 The assessment of noise and vibration is based on the Parameters Plans.

13.243 Where appropriate, recommendations are presented that will be factored into DCO Requirements which relate to detailed layout of development zones.

13.244 For the Site to operate, there will be elements that make noise, such as lorries, fork-lift trucks, tugs, reach stackers etc, and elements that screen noise, such as buildings. An absolute worst-case, whereby all of the noise-generating activities are located in all of the worst-case locations for the surrounding receptors, which will generally be close to the Site perimeters, would not function in practice. The placement of the buildings, relative to the noise-generating activities, must be based on a practical arrangement of the Site whereby it makes operational sense and could conceivably function.

13.245 Therefore, to enable predictions of the noise emissions to be undertaken, the initial calculations have been undertaken on the basis of the Illustrative Masterplan (Document 2.8, which accompanies a suite of DCO submission documents) to provide a reasonable starting point. Where the layout could be made worse within the declared site parameters, in terms of noise emissions, the layout has been adjusted to arrive at a reasonable worst-case scenario, specifically, the following adjustments have been made:

- Units 4010 and 4020 rotated clockwise through 90 degrees so that the service yard of Unit 4010 is parallel to the A5;
- Unit 5020 rotated through 180 degrees so that the service yard faces south-east;
- The service yard of Unit 1030 moved south to replace the car parking; and
- Unit 4030 modelled as a two-sided, cross-dock unit.

13.246 This approach results in an assessment of the worst case implementation of the Parameters Plans that could work from an operational point of view.

13.247 The assessment of operational noise levels has been undertaken at the following locations, as shown in Figure 13.2, which is a representative sample of the properties potentially affected by operational noise from the Proposed Development:

- 1 Kings Road;
- 181 Station Drive;
- 182 Station Drive;
- 4 Croft Lane;
- Allspan;
- Avenue Cottages;
- Avery Bungalow;
- Chase View;
- Cobweb Cottage;
- Craigmore;
- Denson House;
- Elmhurst;
- Evergreen;
- Gailey House;
- Hamerton House;
- High Clere;
- Hollybyre;
- Homestead;
- Longacre;
- Longfield;
- Marsh Farm;
- Meadow View;
- Oak View;
- Roundabout Cottages;
- School House;
- Silverthorne;
- St Clare;
- Straight Mile Farm;
- Sylvestris;
- The Cottage;
- The Villa;
- Wharf Cottage;
- Wharf House;
- Wood View;
- Woodland Farm;
- Calf Heath Reservoir West;
- Calf Heath Reservoir East;
- Canal Moorings North;
- Canal Moorings South; and
- Canal Towpath Gravelly Way.

13.248 As noted in the construction noise assessment, it is understood that Straight Mile Farm will be purchased by the Applicant, with a view to incorporating parts of it into the Proposed Development for landscaping works. However, the property is to remain as a residential receptor, at least in the short-term, with it potentially being returned to residential use in the long-term. For the purposes of this assessment, it is assumed that Straight Mile Farm will remain as a residential receptor throughout the operational use of the Proposed Development.

13.249 Similarly, there are known to be properties within the Order Limits that are likely to be occupied during part of the construction works (Heath Farm, Woodside Farm and residential properties at the intersection of Vicarage Road / Straight Mile). It is understood that it is possible that the properties may also be occupied during the parts of the operational use of the Proposed Development, although the exact duration of their occupation is not known. For the purposes of this assessment, it is assumed that these properties may be as adversely affected by operational noise from the Proposed Development, as the worst-affected properties.

13.250 To allow a direct comparison with the measured noise levels, the noise predictions are free-field values at the position of the property façade closest to, and facing, the Site. The predictions for the majority of receptors have been undertaken at 4 metres above ground level to represent the noise level at either the bedroom windows or simply an upper storey. The exceptions are at the following receptors, where a calculation height of 1.5 metres has been adopted to reflect the lower height of the building / receptor:

- Avery Bungalow;
- Chase View;
- Craigmore;
- St Clare;
- Woodland Farm;
- All Calf Heath Reservoir receptors; and
- All canal receptors.

13.251 The noise levels predicted at the above receptors are shown in Table 13.27. The predictions have been rounded to the nearest whole number to obtain specific sound levels.

Table 13.27: Predicted specific sound levels, free-field $L_{Aeq,T}$ dB

Receptor	Period	Specific Sound Level, $L_{Aeq,T}$ dB
1 Kings Road	Day	36
	Night	35
181 Station Drive	Day	40
	Night	40
182 Station Drive	Day	42
	Night	41

Table 13.27: Predicted specific sound levels, free-field $L_{Aeq,T}$ dB

Receptor	Period	Specific Sound Level, $L_{Aeq,T}$ dB
4 Croft Lane	Day	43
	Night	42
Allspan	Day	35
	Night	34
Avenue Cottages	Day	45
	Night	44
Avery Bungalow	Day	34
	Night	33
Chase View	Day	44
	Night	43
Cobweb Cottage	Day	36
	Night	35
Craigmore	Day	42
	Night	42
Denson House	Day	41
	Night	40
Elmhurst	Day	35
	Night	34
Evergreen	Day	44
	Night	43
Gailey House	Day	42
	Night	41
Hamerton House	Day	41
	Night	40
High Clere	Day	38
	Night	37
Hollybyre	Day	44
	Night	43
Homestead	Day	44
	Night	43
Longacre	Day	40

Table 13.27: Predicted specific sound levels, free-field $L_{Aeq,T}$ dB

Receptor	Period	Specific Sound Level, $L_{Aeq,T}$ dB
	Night	38
Longfield	Day	42
	Night	41
Marsh Farm	Day	41
	Night	40
Meadow View	Day	39
	Night	38
Oak View	Day	43
	Night	42
Roundabout Cottages	Day	43
	Night	42
School House	Day	43
	Night	42
Silverthorne	Day	43
	Night	42
St Clare	Day	43
	Night	43
Straight Mile Farm	Day	39
	Night	39
Sylvestris	Day	36
	Night	34
The Cottage	Day	40
	Night	39
The Villa	Day	41
	Night	40
Wharf Cottage	Day	40
	Night	39
Wharf House	Day	42
	Night	41
Wood View	Day	44
	Night	42

Table 13.27: Predicted specific sound levels, free-field $L_{Aeq,T}$ dB		
Receptor	**Period**	**Specific Sound Level, $L_{Aeq,T}$ dB**
Woodland Farm	Day	37
	Night	37
Calf Heath Reservoir West	Day	40
	Night	39
Calf Heath Reservoir East	Day	43
	Night	42
Canal Moorings North	Day	41
	Night	40
Canal Moorings South	Day	44
	Night	44
Canal Towpath Gravelly Way	Day	47
	Night	47

13.252 It can be seen from Table 13.27 that the predicted specific sound levels are all well below 63dB L_{Aeq} (free-field) during the daytime and 59dB L_{Aeq} (free-field) during the night-time, which are the lowest equivalent eligibility thresholds from the NIR 1975 and NIR 1996, when adjusted to match the noise indices.

13.253 This comparison is offered solely to illustrate that the noise emissions from the scheme are below the equivalent thresholds at which noise insulation would be offered under the NIR 1975 and NIR 1996, demonstrating that the Proposed Development is expected to give rise to noise levels comfortably below the threshold of acceptability implied in the NPS. This comparison is set out notwithstanding the fact that the noise levels from the Proposed Development include contributions from all operational activities at the site, irrespective of whether they would be valid for consideration under the NIR 1975 and NIR 1996.

13.254 To determine whether an impact is nevertheless likely, the predicted specific sound levels from the Site have been assessed using the method set out in BS4142: 2014. The specific sound levels shown in Table 13.27 have been converted to rating levels by the addition of appropriate corrections, determined in accordance with BS4142: 2014.

13.255 BS4142: 2014 allows for two methods of determining appropriate corrections, a subjective method, based on the assessor's judgement, and an objective method based on measurements. In this instance, the Proposed Development does not yet exist, so only the subjective methods are possible.

13.256 The level of correction has been determined in the following manner:

- Calculating the overall L_{Aeq} and L_{AFmax} sound levels from the Site due to all elements likely to exhibit a tonal character, including reversing alarms and crane alarms, and comparing the resultant values with the representative L_{Aeq} level measured during the baseline noise survey.
- This process will test both the average tonal and impulsive sound levels and the peaks of tonal or impulsive sound against the existing acoustic climate at each receptor.
- For all receptors, the total L_{Aeq} value for tonal sources was considerably below the existing measured L_{Aeq} values, suggesting that the average measure of the tonal elements would not be audible.
- This process was repeated for all impulsive operations, including, cranes and reach stackers picking up/putting down containers, and tugs and HGVs picking up trailers. Again the total L_{Aeq} value for impulsive sources was considerably below the existing measured L_{Aeq} values, suggesting that the average measure of the impulsive elements would not be audible.
- The likely maximum noise levels from tonal and impulsive activities was calculated for each receptor, and compared with the existing baseline L_{Aeq} levels. The aim of this test was to determine whether peaks of sound would be distinctive or distinguishable from the general sounds at each receptor.
- Since the L_{AFmax} maximum sound levels were not all below the existing L_{Aeq} sound levels at the various receptors, scales were adopted to provide a consistent, quantified approach to determining the likelihood of each characteristic being audible.
- Depending on the receptor/source type and location, the maximum noise levels ranged from considerably below the baseline L_{Aeq} values, and therefore likely to be inaudible, to being 10dB or more above them, and therefore likely to be audible.
- The corrections were applied on the following basis for tonal elements:
    - L_{Amax} values below L_{Aeq} values by more than 5dB: 0dB
    - L_{Amax} values between 5dB below and equal to the L_{Aeq} values: +2dB
    - L_{Amax} values between equal to and 10dB above L_{Aeq} values: +4dB
    - L_{Amax} values 10dB or more above L_{Aeq} values: +6dB
- A similar process was applied to the impulsive elements:
    - L_{Amax} values below L_{Aeq} values by more than 5dB: 0dB
    - L_{Amax} values between 5dB below and equal to the L_{Aeq} values: +3dB
    - L_{Amax} values equal to and 10dB above L_{Aeq} values: +3dB
    - L_{Amax} values 10dB or more above L_{Aeq} values: +9dB
- The corrections are cumulative, i.e. for the most tonal, impulsive sources, a total correction of +15dB is possible.

13.257 The Proposed Development is unlikely to be noticeably intermittent at off-site receptors. The operations will, on an individual basis, be intermittent, but there will be a large number of overlapping operations so that, when judged in the context of the existing noise climate which has a significant amount of road traffic noise, the Site is likely to appear to be operating consistently.

13.258 The total corrections applied to the calculated specific sound levels for each receptor are shown in Table 13.28.

Table 13.28: Derived Acoustic Character Corrections, dB		
Receptor	**Period**	**Correction**
1 Kings Road	Day	6
	Night	6
181 Station Drive	Day	6
	Night	9
182 Station Drive	Day	6
	Night	9

Table 13.28: Derived Acoustic Character Corrections, dB

Receptor	Period	Correction
4 Croft Lane	Day	9
	Night	11
Allspan	Day	6
	Night	6
Avenue Cottages	Day	9
	Night	11
Avery Bungalow	Day	6
	Night	6
Chase View	Day	6
	Night	9
Cobweb Cottage	Day	6
	Night	9
Craigmore	Day	6
	Night	11
Denson House	Day	9
	Night	9
Elmhurst	Day	6
	Night	6
Evergreen	Day	6
	Night	9
Gailey House	Day	11
	Night	13
Hamerton House	Day	9
	Night	11
High Clere	Day	6
	Night	9
Hollybyre	Day	6
	Night	9
Homestead	Day	6
	Night	9
Longacre	Day	6

Table 13.28: Derived Acoustic Character Corrections, dB

Receptor	Period	Correction
	Night	9
Longfield	Day	9
	Night	11
Marsh Farm	Day	6
	Night	6
Meadow View	Day	6
	Night	9
Oak View	Day	9
	Night	11
Roundabout Cottages	Day	6
	Night	9
School House	Day	6
	Night	9
Silverthorne	Day	6
	Night	11
St Clare	Day	6
	Night	11
Straight Mile Farm	Day	9
	Night	11
Sylvestris	Day	6
	Night	6
The Cottage	Day	9
	Night	11
The Villa	Day	6
	Night	9
Wharf Cottage	Day	9
	Night	11
Wharf House	Day	9
	Night	11
Wood View	Day	6
	Night	11

Table 13.28: Derived Acoustic Character Corrections, dB		
Receptor	**Period**	**Correction**
Woodland Farm	Day	9
	Night	11
Calf Heath Reservoir West	Day	9
	Night	13
Calf Heath Reservoir East	Day	11
	Night	13
Canal Moorings North	Day	9
	Night	13
Canal Moorings South	Day	9
	Night	11
Canal Towpath Gravelly Way	Day	9
	Night	11

13.259 The background sound data for each assessment location has been determined by reference to the monitoring location located closest to each location. The correlations between measurement positions and assessment locations are shown in Table 13.29.

Table 13.29: Representative background sound survey position		
Receptor	**Period**	**Representative Position**
1 Kings Road	Day	N9
181 Station Drive	Day	N6
182 Station Drive	Day	N6
4 Croft Lane	Day	N5
Allspan	Day	N8
Avenue Cottages	Day	N4
Avery Bungalow	Day	N8
Chase View	Day	N7
Cobweb Cottage	Day	N8
Craigmore	Day	N6
Denson House	Day	N7
Elmhurst	Day	N8
Evergreen	Day	N1

Table 13.29: Representative background sound survey position		
Receptor	**Period**	**Representative Position**
Gailey House	Day	N5
Hamerton House	Day	N5
High Clere	Day	N9
Hollybyre	Day	N1
Homestead	Day	N1
Longacre	Day	N4
Longfield	Day	N5
Marsh Farm	Day	N1
Meadow View	Day	N9
Oak View	Day	N5
Roundabout Cottages	Day	N7
School House	Day	N7
Silverthorne	Day	N6
St Clare	Day	N6
Straight Mile Farm	Day	N9
Sylvestris	Day	N9
The Cottage	Day	N5
The Villa	Day	N4
Wharf Cottage	Day	N5
Wharf House	Day	N5
Wood View	Day	N2
Woodland Farm	Day	N8
Calf Heath Reservoir West	Day	N4
Calf Heath Reservoir East	Day	N4
Canal Moorings North	Day	N5
Canal Moorings South	Day	N5
Canal Towpath Gravelly Way	Day	N5

13.260 The predicted rating levels, which combine the calculated specific sound levels with the derived acoustic character corrections, have been compared with the background sound levels, as shown in Table 13.30. The background sound levels are the lowest representative values for each position, as were highlighted blue in Table 13.18.

13.261 The calculations are based on what is considered to be a worst-case interpretation of the Parameters Plans.

Table 13.30: BS4142 Assessment

Receptor	Period	Background Sound Level, L_{A90}	Rating Level, $L_{Ar,T}$	Difference
1 Kings Road	Day	42	42	0
	Night	36	41	+5
181 Station Drive	Day	44	46	+2
	Night	34	49	+15
182 Station Drive	Day	44	48	+4
	Night	34	50	+16
4 Croft Lane	Day	42	52	+10
	Night	35	53	+18
Allspan	Day	46	41	-5
	Night	39	40	+1
Avenue Cottages	Day	49	54	+5
	Night	42	55	+13
Avery Bungalow	Day	46	40	-6
	Night	39	39	0
Chase View	Day	46	50	+4
	Night	32	52	+20
Cobweb Cottage	Day	46	42	-4
	Night	39	44	+5
Craigmore	Day	44	48	+4
	Night	34	53	+19
Denson House	Day	46	50	+4
	Night	32	49	+17
Elmhurst	Day	46	41	-5
	Night	39	40	+1
Evergreen	Day	41	50	+9
	Night	31	52	+21
Gailey House	Day	42	53	+11
	Night	35	54	+19
Hamerton House	Day	42	50	+8
	Night	35	51	+16
High Clere	Day	42	44	+2
	Night	36	46	+10
Hollybyre	Day	41	50	+9
	Night	31	52	+21
Homestead	Day	41	50	+9
	Night	31	52	+21
Longacre	Day	49	46	-3
	Night	42	47	+5
Longfield	Day	42	51	+9
	Night	35	52	+17
Marsh Farm	Day	41	47	+6
	Night	31	46	+15
Meadow View	Day	42	45	+3
	Night	36	47	+11
Oak View	Day	42	52	+10
	Night	35	53	+18
Roundabout Cottages	Day	46	49	+3
	Night	32	51	+19
School House	Day	46	49	+3
	Night	32	51	+19
Silverthorne	Day	44	49	+5
	Night	34	53	+19
St Clare	Day	44	49	+5
	Night	34	54	+20
Straight Mile Farm	Day	42	48	+6
	Night	36	50	+14
Sylvestris	Day	42	42	0
	Night	36	40	+4

Table 13.30: BS4142 Assessment

Receptor	Period	Background Sound Level, L_{A90}	Rating Level, $L_{Ar,T}$	Difference
The Cottage	Day	42	49	+7
	Night	35	50	+15
The Villa	Day	49	47	-2
	Night	42	49	+7
Wharf Cottage	Day	42	49	+7
	Night	35	50	+15
Wharf House	Day	42	51	+9
	Night	35	52	+17
Wood View	Day	44	50	+6
	Night	35	53	+18
Woodland Farm	Day	46	46	0
	Night	39	48	+9
Calf Heath Reservoir West	Day	49	49	0
	Night	42	52	+10
Calf Heath Reservoir East	Day	49	54	+5
	Night	42	55	+13
Canal Moorings North	Day	42	50	+8
	Night	35	53	+18
Canal Moorings South	Day	42	53	+11
	Night	35	55	+20
Canal Towpath Gravelly Way	Day	42	56	+14
	Night	35	58	+23

13.262 It can be seen from Table 13.30 that a range of outcomes is predicted. In a number of cases, the rating levels are below the background sound levels, which would be regarded as negligible impacts.

13.263 At the other end of the scale, rating levels up to 18dB above the background sound levels are predicted, which would be regarded as high adverse impacts. Locations where the rating levels are between 5dB and 10dB above the background sound levels would be regarded as having moderate adverse impacts.

13.264 However, BS4142: 2014 is clear that contextual matters should be taken into account when determining the overall magnitude of potential impacts, and that the numerical analysis should not alone dictate the outcome.

13.265 BS4142: 2014 notes that some of the relevant contextual factors that should be taken into account include:

"The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:

- *facade insulation treatment;* ☐
- *ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and* ☐
- *acoustic screening."*

13.266 Consideration has been given to protecting the internal environment of the affected properties through the provision of a bespoke noise insulation scheme, as described below.

Bespoke Noise Insulation Scheme

13.267 The Applicant has committed to a bespoke noise insulation scheme that will address potential noise impacts at a lower threshold than would be the case for the NIR 1975 and NIR 1996, and that will include consideration of noise sources that are not covered by these two pieces of legislation. An assessment of eligible properties under the NIR 1975 and NIR 1996 is set out later in the chapter, and one property, The Villa, is considered to qualify for noise insulation under the NIR 1975.

13.268 The NIR 1975 and NIR 1996 for roads and railways may apply in the case of national infrastructure projects as described in the NPS, and specific assessments of the roads and railways altered as part of the Proposed Development against the NIR 1975 and NIR 1996 are set out later in this chapter.

13.269 However, these pieces of legislation limit eligibility to residential properties within 300 metres of the new or modified road or railway, and only consider road and rail traffic on public roads/railways, thereby excluding vehicular noise and other sources operating on privately-owned roads and service yards.

13.270 The Proposed Development contains new or modified railways in the western part of the scheme, and new or modified highways threaded through the spine of the scheme, resulting in properties more than 300 metres of either that may still be affected by the Proposed Development. There will also be a number of noise sources which do not fall within the remit of the NIR 1975 and NIR 1996, thereby limiting the current legislative tools in this instance.

13.271 The Applicant is committed to provide a bespoke sound insulation scheme for the Proposed Development, to be enacted under the provisions of the DCO, to better represent the potential impacts of the Proposed Development. This bespoke noise insulation scheme will broaden the number and types of noise source that will be considered, and will broaden the geographical extent of the area considered. The bespoke noise insulation scheme will also cover the construction phase of the Proposed Development, as noted earlier in this chapter.

13.272 Although the bespoke noise insulation scheme may be considered as mitigation that seeks to address identified impacts of the Proposed Development, the way in which BS4142: 2014 requires all relevant contextual information to be taken into account before determining the final level of impact, necessitates its inclusion as part of the main impact assessment rather than setting it aside until mitigation is assessed. It is not possible to reach an indication of potential impact using BS4142: 2014 without considering this relevant contextual matter.

13.273 The key principles of the NIR 1975 and NIR 1996 will be retained, i.e. that to be considered, properties must be residential in use, but they should be within 300 metres of the Order Limits for the scheme, rather than within 300 metres of roads or railways.

13.274 It should be noted that the language used in the bespoke noise insulation scheme is simpler than that used in the NIR 1975 and NIR 1996. These legislative mechanisms consider eligible properties to be all residential properties within 300 metres of a particular scheme.

If the eligible properties meet the assessment criteria, then they are deemed to be qualifying properties. The bespoke noise insulation considers eligible properties to be those residential properties within 300 metres of the Order Limits that qualify under the terms of the scheme, i.e. under the bespoke noise insulation scheme, eligible properties are equivalent to qualifying properties under the NIR 1975 and NIR 1996. This is noted here so the status of properties is clear when discussing the various schemes.

13.275 The Applicant proposes to retain the lower of the absolute thresholds for daytime and night-time from the two sets of Noise Insulation Regulations will be retained, adjusted so that they are in the form of 16 hour and 8 hour façade L_{Aeq} values.

13.276 In addition, the Applicant proposes to include relative thresholds that are likely to reached at much lower noise levels than the equivalent NIR 1975 and NIR 1996 values, and internal noise criteria based on British Standard guidance on suitable sound levels for residential properties, but making allowance for distinctive acoustic character. These relative criteria and internal criteria represent a material betterment over the statutory schemes, i.e. the relative and internal criteria contained in the bespoke noise insulation will trigger noise insulation at much lower noise levels than would be the case if the only qualifying criteria were the absolute thresholds transposed from the NIR 1975 and NIR 1996.

13.277 The detail of the bespoke noise insulation scheme is set out in the s106 obligations, but in summary, the qualifying criteria will be:

- in terms of absolute external criteria (all three criteria are required to be met):
    - noise levels from the scheme exceed façade noise levels of 66dB $L_{Aeq,16hrs}$ during the daytime, or 62dB $L_{Aeq,8hrs}$ during the night-time;
    - noise levels increase by at least 1dB as a result of the scheme; and
    - the contribution from the scheme to the overall noise level is at least 1dB.
- or, in terms of relative criteria:
    - where the rating level at an eligible façade, including any appropriate character corrections, exceeds the background sound level in the absence of any sound from the scheme, by 10dB or more, during either the daytime and/or the night-time, calculated in accordance with BS4142: 2014.
- or, in terms of internal criteria in habitable rooms:
    - where the internal rating level within a habitable room exceeds 40dB $L_{Aeq,16hrs}$ during the daytime, or 35dB $L_{Aeq,8hrs}$ during the night-time.

13.278 Daytime is taken to be 07:00 hours to 23:00 hours, and night-time 23:00 hours to 07:00 hours.

13.279 Failing to meet any of the three sets of criteria, the absolute external criteria, the relative criteria or the internal criteria, would result in a property being eligible for noise insulation.

13.280 The internal criteria are based on the guidance set out in BS8233: 2014 and the WHO Guidelines, both of which set out criteria for suitable internal sound levels for residential properties. It is acknowledged that neither document explicitly cover the situation being assessed here, i.e. a new source of industrial or commercial sound affecting existing residential properties, however, they provide the only guidance on absolute sound levels.

13.281 In the case of BS8233: 2014, the guideline values apply to steady sound sources of noise without character, but the standard does note:

"Noise has a specific character if it contains features such as a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content, in which case lower noise limits might be appropriate."

13.282 BS8233: 2014 does not identify what those lower limits should be; however, including the BS4142: 2014 acoustic character corrections in the calculations does, in effect, lower the thresholds by an amount equal to the value of the correction at each receptor. It is considered that although not an application of BS8233: 2014 in strict accordance with the terms of that standard, it does meet with the broader aims of the standard.

13.283 There will be four windows for assessing which properties are eligible under the bespoke noise insulation scheme, as set out in the s106 obligations. For each assessment window, the assessment will need to consider all properties within 300 metres of the Order Limits to determine which are eligible under the bespoke noise insulation scheme. The analysis presented in this chapter considers a large, representative sample of the properties, to provide an indication as which are likely to be eligible. However, the results of the analysis set out in this ES chapter should not be taken as definitive, as they are based on background sound level data that is considered to have been compromised by the atypical traffic conditions during the survey. The definitive assessment should be undertaken once typical background sound level data has been established.

13.284 For each assessment, the calculations will include an estimate of the noise contribution from the remainder of the Proposed Development so that the overall effect of the Proposed Development is not underestimated by only considering the specific parcel of land under consideration.

13.285 The provision of a bespoke noise insulation scheme, and the use of enhanced insulation and ventilation in response to noise impacts is considered a valid response to potential noise impacts. As noted in this chapter, the PPG for noise states closing windows is a valid form of mitigation for reducing noise impacts where an alternative form of ventilation is provided, and the NPS itself allows for the Noise Insulation Regulations to be invoked in the case of national infrastructure schemes, where noise mitigation has already been designed into the scheme.

13.286 Under the bespoke noise insulation scheme any property that is anticipated to have a rating level that exceeds the background sound level by 10dB or more, or whose internal sound levels exceed the internal criteria, would be offered a scheme of noise insulation that would include an alternative means of ventilation. In such instances, the occupants would have the option of keeping their windows closed and retaining access to rapid ventilation.

13.287 Based on the calculations at the representative sample of receptors assessed in this chapter, as set out in Table 13.30, the following properties would be eligible for noise insulation, either as a result of a rating level exceeding the background sound level by 10dB or more, or as a result of the internal sound levels exceeding the internal criteria: 181 Station Drive, 182 Station Drive, 4 Croft Lane, Avenue Cottages, Chase View, Cobweb Cottage, Craigmore, Denson House, Evergreen, Gailey House, Hamerton House, High Clere, Hollybyre, Homestead, Longacre, Longfield, Marsh Farm, Meadow View, Oak View, Roundabout Cottages, School House, Silverthorne, St Clare, Straight Mile Farm, The Cottage, The Villa, Wharf Cottage, Wharf House, Wood View, and Woodland Farm.

13.288 In addition, a further 39 properties may also be eligible for sound insulation, based on their proximity to the assessed properties and likely exposure to noise from the Proposed Development.

13.289 Taking account of the bespoke noise insulation scheme, the internal noise criteria will be met at all residential properties, even if the acoustic character corrections are included.

13.290 The properties within the Order Limits that might remain occupied during some part of the operation of the Proposed Development (Heath Farm, Woodside Farm and residential properties at the intersection of Vicarage Road / Straight Mile) could be as adversely affected as the worst-affected properties. It is not possible to quantify the likely impact as their proximity to any particular element of the operational site is not known due to the uncertainty as to the duration of their occupancy. However, for the purposes of this assessment, it is assumed that the three properties may also be eligible for noise insulation under the bespoke noise insulation scheme.

13.291 As well as achieving the internal criteria, the daytime external noise levels, even including the penalties for acoustic character, would meet the upper 55dB threshold set out in BS8233: 2014 and the WHO Guidelines at all of the residential locations assessed as a result of noise from the Proposed Development. The daytime sound levels along the towpath may marginally exceed the 55dB criterion, with the receptor at Canal Towpath Gravelly Way predicted to have a rating level of 56dB as a result of noise from the Proposed Development.

13.292 It should be noted that the properties identified above have been considered as part of the initial assessment presented in the ES, taking account of background sound level data that is considered unrepresentatively low, and calculation and operational parameters that generate worst-case noise levels from the Proposed Development. Further assessments will be required as part of the bespoke noise insulation scheme.

13.293 It is noted that the two canal mooring assessment locations are predicted to have rating levels at least 10dB above the background sound levels at night.

13.294 While the canal mooring locations are considered as quasi-residential receptors, i.e. people will be sleeping there albeit individuals will not be staying for prolonged periods, there is no simple method of extending the bespoke noise insulation scheme to cover the affected boats.

13.295 The benefit of the bespoke noise insulation scheme may be difficult to implement at the canal mooring locations. Other schemes, such as Thames Tideway Tunnel, included provision to assess implementing a similar noise insulation package for canal boats on a case-by-case basis, taking account of the practicalities of installing the package on any given boat. The Thames Tideway Tunnel scheme also allowed for relocating the affected boats during construction works, which was the phase of that project anticipated to lead to the impacts.

13.296 Investigating the installation of an insulation package for a limited and known number of boats, or temporarily relocating permanently moored residential barges during a time-limited construction period, was an appropriate response to the identified impact for the Thames Tideway Tunnel scheme. However, it may be less practical to implement a similar approach for the Proposed Development where the moorings are let on a temporary basis for a potentially large number of boats, and the potential impact is from the long-term operation of the Site.

13.297 It is similarly considered impractical to review the practicality of installing the noise insulation package on a case-by-case basis for the Proposed Development, as the time taken to install the package, where it can be installed, is likely to take longer than the maximum allowed mooring duration, which is understood to be one week.

13.298 It is therefore likely that the identified impacts on the moorings will not be reduced through the bespoke noise insulation package.

13.299 The overall assessment outcomes according to BS4142: 2014 should take into account relevant contextual matters, which the standard states may include absolute sound levels, and internal sound levels. These contextual matters may be used to alter the initial assessment outcomes based on the numerical analysis alone. On the basis of the internal noise levels within residential properties meeting the only available guidelines on acceptable acoustic environments for residential occupation, it is suggested that the BS4142: 2014 outcomes are less adverse than the numerical analysis set out in Table 13.30 alone suggests.

Summary of Operational BS4142 Noise Assessment

13.300 It is considered that operational noise from the Proposed Development is likely to result in high adverse impacts at the worst-affected locations, but that these locations will benefit from the bespoke noise insulation scheme, thereby reducing the significance of the impacts.

13.301 Overall, the impacts at these properties are considered to be moderate adverse, which when combined with high sensitivity receptors, results in moderate adverse effects, which are significant in EIA terms.

13.302 As noted above, the bespoke noise insulation scheme cannot practically be applied to the canal moorings, so the identified high impacts will remain. While moored canal boats are quasi-residential receptors, they are by their very nature transient, so their sensitivity is medium rather than high. A high adverse impact combined with a medium sensitivity would result in a moderate adverse effect, which is significant in EIA terms.

13.303 For the canal towpaths and Calf Heath Reservoir, the assessment suggests high adverse impacts. The canal towpaths, as part of the Staffordshire and Worcestershire Canal Conservation Area, are considered to be of medium sensitivity, resulting in moderate adverse effects, which are significant in EIA terms.

13.304 The high adverse impacts at Calf Heath Reservoir results in minor adverse effects, which are not significant in EIA terms, when taking account of its low sensitivity.

13.305 All of the identified impacts and effects from operational noise are anticipated to be long-term, permanent effects.

13.306 The scope for additional mitigation to address these potential impacts is set out later in this chapter.

13.307 BS4142: 2014 requires any uncertainties that are inherent in the measurement, calculation and assessment process to be considered. In this instance, the uncertainty has been reduced as far as considered practicable through the implementation of high quality source data and a robust calculation process.

13.308 Uncertainty has also been reduced by undertaking the baseline sound measurements in accordance with recommended good practice, for example, measuring in suitable weather conditions and using laboratory-calibrated measurement equipment.

13.309 The measurements covered both a weekday and weekend, and include measurements made over the typically quietest periods i.e. in the middle of the night-time. This should result in measurements that capture the lowest typical background sound levels in the areas, enabling a more robust assessment.

13.310 However, it is noted that the baseline noise survey is to be repeated due to external factors that may have reduced the extent to which the noise climate in August 2016 and January 2017 could be deemed typical. It is therefore noted that the assessment set out above will need to be repeated when more representative background noise data is available.

13.311 Any uncertainties inherent in the BS4142: 2014 assessment are likely to be small compared with the magnitude of impacts set out in this chapter, and are therefore unlikely to affect the stated outcomes.

13.312 The assessment set out above only considered the representative sample of receptor locations shown in Figure 13.2. When the assessment is repeated with the final background sound survey data, it will be necessary to include all eligible receptors within 300 metres of the Proposed Development boundary.

Assessment of Operational Maximum Noise Levels

13.313 The maximum noise levels associated with the use of the Proposed Development, in the form of L_{AFmax} values, are likely to relate to a HGV tractor unit or tug picking up a trailer, reach stackers or cranes picking up or putting down containers, or slamming car doors.

13.314 The highest maximum noise levels associated with these events are likely to be in the region of 92dB L_{AFmax} for a tug picking up a trailer, 86dB L_{AFmax} for an HGV tractor unit picking up a trailer, 98dB L_{AFmax} for a reach stacker connecting to a container, 82dB L_{AFmax} for a crane dropping a container onto a train, and 72dB L_{AFmax} for a car door slam, all at a distance of 10 metres.

13.315 Taking account of the distance between the development zones shown on the Parameters Plans and the surrounding receptors, maximum noise levels from the Proposed Development are likely to exceed the external façade level 60dB L_{AFmax} WHO criterion identified in Section A13.2.5 in Technical Appendix 13.2 at Avenue Cottages, Chase View, Denson House, Evergreen, Gailey House, Homestead, School House, The Villa and Wood View only, in terms of residential receptors. A level of 69dB is predicted at Wood View, with 65dB or less predicted at the other receptors.

13.316 As is noted in Section A13.2.5 WHO Guidelines in Technical Appendix 13.2, the external 60dB L_{AFmax} criterion has been derived to represent an internal threshold of 45dB, which is the actual value that the WHO research is based on. All of the properties predicted to have maximum noise levels in excess of 60dB L_{AFmax} externally will be eligible for noise insulation under the bespoke noise insulation scheme and their internal maximum L_{AFmax} sound levels would be comfortably below the 45dB L_{AFmax} internal threshold that the 60dB L_{AFmax} external threshold is designed to achieve. No adverse effects are likely to result.

13.317 Maximum noise level in excess of the 60dB L_{AFmax} criterion are also predicted at Calf Heath Reservoir, however, the criterion relates to sleep disturbance, which is not a requirement at the reservoir.

13.318 Mitigation therefore may be required to control maximum noise events for Wood View, which is considered later in this chapter.

Implications of Phased Construction/Operations

13.319 The operational use of the first phases of the Proposed Development while later phases are being constructed has the potential to lead to increased noise levels at receptors around the Site.

13.320 Where the construction works are close to the Site boundary near a receptor, there will be no additive effect for the closest receptors; the construction works will dominate and the effects will be as set out in this chapter for the construction works alone.

13.321 The potential for combined effects is greater where the construction works are further from any given receptor, when the construction noise levels are predicted to drop towards the level of noise generated by the operations.

13.322 The noise levels generated by each phase of operational development has been compared with the 'average' construction noise levels, and it has been found that the greatest increase in construction noise levels is likely to be around 2dB, even allowing for the use of reach stackers at the rail terminal in Phase 1, before gantry cranes are installed in Phase 2.

13.323 In many instances, localised effects will reduce even this small increase. For instance, at properties on Croft Lane, the development is likely to acoustically screen any construction works, thereby reducing the construction noise to a level that is unlikely to significantly add to the operational noise levels.

13.324 Overall, the effect of cumulative construction and operational noise levels is unlikely to be significantly greater than construction on its own.

13.325 The key difference will be at night, where construction works stop, and the early phases of the operational development continue. In these instances, the impacts set out in the operational noise assessment will occur with no added effect from construction noise.

Operational Vibration Emissions

13.326 Vibration from HGVs on roads, or operational activities in the service yards of the development zones across the Site are unlikely to generate significant levels of vibration providing the road and yard surfaces are maintained in good condition, free from potholes or discontinuities.

13.327 Operations at the rail terminal are likely to involve the largest, heaviest machinery, such as the gantry crane and reach stackers moving fully laden containers, but even these are unlikely to generate perceptible levels of vibration at off-site receptors. The receptors closest to these operations are in excess of 200 metres away, and the likelihood of significant vibration propagating off-site over a distance of more than 200 metres is very low.

13.328 Overall, vibration from operations at the Site is likely to be negligible, which would be regarded as no effect, which is not significant in EIA terms.

Off-Site Road Traffic Noise Impacts

13.329 Road traffic data for roads around the Site have been supplied by WSP (the traffic consultant for the project). The data has been supplied with and without traffic generated by the Proposed Development so that its effect on existing road traffic noise levels can be determined.

13.330 Traffic noise predictions have been carried out at a notional receptor location 10 metres from the edge of the carriageway and 1.5 metres above ground level. A notional receptor has been used because it is the change in traffic noise level that is of interest, not the absolute noise levels at any given receptor. The predicted changes in noise level will occur at noise-sensitive receptors along the road considered.

13.331 The supplied daytime traffic flows are set out in Table A13.5.1 for the year 2021 and Table A13.5.2 for the year 2036 in Technical Appendix 13.5. Traffic flows for the night-time are set out in Table A13.5.3 for the year 2021 and Table A13.5.4 for the year 2036, also in Technical Appendix 13.5. The night-time flows are for the period 23:00 hours to 07:00 hours.

13.332 It is understood that the traffic flows for the years 2021 and 2036 include traffic from other committed developments in the area (Technical Appendix 2.7).

13.333 The vehicle speeds have been modelled in accordance with the guidance in CRTN, according to the class of road. Low flow corrections have been applied to all routes with a flow less than 4,000 as required in CRTN.

13.334 CRTN only allows for the calculation of either 18 hour or 1 hour noise levels, there is no calculation for an 8 hour night-time flow. It has therefore been assumed that the traffic flows during the 8 hour night-time period are spread equally across eight 1 hour periods, and the resultant eight values averaged logarithmically to obtain the 8 hour value. Since the traffic will not, in practice, be spread into eight exactly equal one hour periods, this method may over-estimate the 1 hour noise levels for the periods of least traffic, and under-estimate the 1 hour noise levels for periods for greatest flow. However, it will generate the correct overall noise levels for the overall night-time period.

13.335 CRTN states that roads with a daytime flow of less than 1,000 vehicles are not valid, and roads with a night-time 1 hour flow of less than 50 vehicles are not valid.

13.336 Due to the large number of roads considered in the assessment, and the multiple assessment years and time periods, the calculated road traffic noise levels are contained in Technical Appendix 13.5.

13.337 The predicted changes in daytime road traffic noise levels as a result of the use of the Proposed Development for the year 2021 are shown in Table A13.5.5 in Technical Appendix 13.5.

13.338 It can be seen from Table A13.5.5 that the changes in daytime road traffic noise as a result of the Proposed Development in 2021 (fourth column in Table A13.5.5) are predicted to be less than 3dB along all roads except the A5 between junction 12 of the M6 and the site access, and Vicarage Road between the site access and the A5. In these two instances, the change in road traffic noise is predicted to be just above +3dB.

13.339 A similar outcome is predicted for daytime road traffic noise in 2036, as shown in Table A13.5.6, where increases of +3 and +3.1dB are predicted along the same two stretches of road, with the increases elsewhere all being less than +3dB.

13.340 Increases in road traffic noise of just over 3dB would be classed as moderate adverse impacts, which when combined with the high sensitivity of the residential receptors along these roads, would be regarded as moderate adverse effects, which are significant in EIA terms. Increases in road traffic noise of less than 3dB would be considered as low adverse impacts, which when combined with the high sensitivity of the receptors, results in a minor adverse effect, which is not significant in EIA terms.

13.341 The potential changes in night-time road traffic noise are set out in Tables A13.5.7 and A13.5.8 for the years 2021 and 2036 respectively.

13.342 It can be seen from Table A13.5.7 that, in 2021, the night-time road traffic noise levels are likely to increase by less than 3dB along all of the roads considered, except:

- A5 between M6 Junction 12 and proposed Site access (increase of +3.8dB);
- A449 between Gravelly Way and Station Drive (northbound and southbound – increases of +4.1dB and +3.3dB respectively); and
- Vicarage Road between proposed Site access and A5 (increase of +7.8dB).

13.343 The same roads are the only examples where increases are predicted to be greater than +3dB for the year 2036.

13.344 Increases in road traffic noise of just 3 to 5dB would be classed as moderate adverse impacts, which when combined with the high sensitivity of the residential receptors along these roads, would be regarded as moderate adverse effects, which are significant in EIA terms.

13.345 An increase of 7 to 8dB, as is predicted for Vicarage Road between the proposed site access and the A5, would be classed as a high adverse impact, which when combined with the high sensitivity of residential receptors along the road, would be considered a major adverse effect, which is significant in EIA Terms.

13.346 The key limitation of the method used to assess the potential impact of off-site road traffic noise is that by ascribing the calculated change in road traffic noise to every receptor along a particular road, it ignores both the proximity of the receptor to the source and the influence of traffic on other roads that may contribute to the overall road traffic noise levels at a particular location.

13.347 For the roads where significant adverse effects have been identified, the A5 between M6 Junction 12 and the Site access, the A449 between Gravelly Way and Station Drive, and Vicarage Road between proposed Site access and the A5, further, more detailed calculations have been undertaken, taking account of both the actual proximity of the potentially affected properties to the road network, and the influence of other roads in the area.

13.348 It is noted that there are no residential properties along the A449 between Gravelly Way and Station Drive, so this link road is not considered further. Although moderate increases in road traffic noise are predicted, the absence of receptors result in no adverse effects.

13.349 Detailed calculations for the receptors along the A5 between M6 Junction 12 and the proposed Site access have indicated that the increases in road traffic noise set out above are likely to occur in practice, i.e. traffic on the A5 is sufficiently dominant at the properties along the road, that the calculated increases on that stretch of road are likely to occur at the properties. Other roads in the area, which are predicted to have a smaller increase in road traffic noise, do not affect the outcome.

13.350 There are noted to be three properties close to Vicarage Road between the proposed Site access and the A5, two of which are adjacent to the road, The Old Vicarage, and White Farm, with a third located alongside the A5, opposite the junction with Vicarage Road, Pool House. These properties are shown in Figure 13.3.

13.351 Detailed calculations of the road traffic noise levels at each of these three properties have been undertaken, using the calculation methods set out in CRTN. The traffic data used in the calculations is as set out in Tables A13.5.3 and A13.5.4 in Technical Appendix 13.5. All of the roads in the area have been included in the calculations.

13.352 The calculated daytime road traffic noise levels at each of the three properties is shown in Table 13.31 and the night-time values are shown in Table 13.32. In each instance, values for both 2021 and 2036 are shown.

Table 13.31: Change in daytime road traffic noise levels, free-field $L_{A10,T}$ dB

Receptor[1]	2021			2036		
	No Dev	W/Dev	Change	No Dev	W/Dev	Change
White Farm (NW)	64.8	66.4	+1.6	65.3	66.8	+1.5
White Farm (SW)	66.5	67.3	+0.8	67.0	67.7	+0.7
Old Vicarage (N)	66.5	67.5	+1.0	66.9	67.8	+0.9
Old Vicarage (W)	65.5	66.9	+1.4	65.9	67.2	+1.3
Old Vicarage (S)	62.0	63.4	+1.4	62.5	63.8	+1.3
Pool House (S)	71.5	72.5	+1.0	71.9	72.8	+0.9

Note: [1] Receptor name followed by façade under consideration in brackets, stated as N for northern façade, E for eastern façade, S for southern façade, W for western façade etc

13.353 It can be seen from Table 13.31 that all of the daytime changes in road traffic noise are predicted to be less than+2dB, and would be considered as low adverse impacts. When combined with the high sensitivity of the receptors, would result in minor adverse effects, which are not significant in EIA terms. It can be seen that while Vicarage Road itself is predicted to have a moderate increase in road traffic noise level, traffic on other roads in the area will reduce the overall effect of that change.

13.354 The changes in night-time road traffic noise are shown in Table 13.32.

Table 13.32: Change in night-time road traffic noise levels, free-field $L_{A10,T}$ dB

Receptor[1]	2021			2036		
	No Dev	W/Dev	Change	No Dev	W/Dev	Change
White Farm (NW)	61.0	64.1	+3.1	61.6	64.3	+2.7
White Farm (SW)	63.3	64.7	+1.4	63.8	65.1	+1.3
Old Vicarage (N)	63.8	65.0	+1.2	64.2	65.4	+1.2
Old Vicarage (W)	62.4	64.7	+2.3	62.9	64.9	+2.0
Old Vicarage (S)	58.4	60.9	+2.5	58.9	61.2	+2.3
Pool House (S)	68.9	70.1	+1.2	69.3	70.5	+1.2

Note: [1] Receptor name followed by façade under consideration in brackets, stated as N for northern façade, E for eastern façade, S for southern façade, W for western façade etc

13.355 It can be seen from Table 13.32 that the greatest impact is at the north-western façade of White Farm, where an increase of +3.1dB is predicted for 2021, reducing in the long-term to +2.7dB in 2036. The higher of these values would be regarded as a moderate adverse impact, which when combined with the high sensitivity of the receptor, would result in a moderate adverse effect, which is significant in EIA terms. Again, traffic on the other roads in the area offsets what had been a major increase in traffic noise on Vicarage Road so that the actual change in noise level at each property is markedly reduced.

13.356 At the other locations, and in 2036 for the north-western façade of White Farm, the changes in road traffic noise would be considered as low adverse impacts, which when combined with the high sensitivity of the receptor, would result in a minor adverse effect, which is not significant in EIA terms.

13.357 It is understood that there may be a period where the Proposed Development is in its early stages of operation, before the A449/A5 link road is constructed. Traffic data has been provided by WSP to illustrate how the operational traffic movements may differ from those already assessed.

13.358 The off-site road traffic noise levels likely to be generated by these alternative traffic flows have been calculated and the outcomes were broadly in line with those described above. Moderate adverse impacts are likely along the A5 between M6 Junction 12 and the proposed Site access during both the daytime and night-time, and a moderate night-time adverse impact at White Farm, adjacent to Vicarage Road. These moderate impacts, when combined with the high sensitivity of the receptors, would result in moderate adverse effects, which are significant in EIA terms.

13.359 Mitigation to address the identified moderate adverse effects resulting from off-site road traffic is considered later in this chapter.

Off-Site Road Traffic Vibration

13.360 As described in the DMRB, the effect of changes in road traffic vibration mirror those from changes in road traffic noise, albeit at lower levels of annoyance at all levels. In recognition of this, the impact categories are taken to be one category lower than was the case for off-site road traffic noise.

13.361 It is therefore considered likely that for traffic on all roads there is likely to be a negligible impact at the majority of receptors along the assessed road, with minor adverse effects at the roads identified has having changes in road traffic noise of more than 3dB.

13.362 , i.e. the A5 between M6 Junction 12 and the proposed Site access, and Vicarage Road between the proposed Site access and the A5. These are not considered to be significant in EIA terms.

Noise Insulation Regulations for Roads

13.363 An assessment has been undertaken of the eligibility of all properties within 300 metres of any new or altered road for noise insulation, under the NIR 1975.

13.364 The receptors considered are identified in Figure 13.4.

13.365 The assessment uses the baseline 2016 flows and future with development flows for 2036, as shown in Table A13.5.2, and the calculations use the methods set out in CRTN.

13.366 The pre-development traffic noise levels, termed the Prevailing Noise Level in NIR 1975, have been calculated based on the 2016 traffic flows and existing road layout. The traffic noise levels that result from the Proposed Development, including the effect of both additional traffic and the amended /new road layouts for the year of highest traffic flow within 15 years of the year of opening, termed the Relevant Noise Level, have been calculated based on the 2036 traffic flows.

13.367 The contribution to the Relevant Noise Level from unaltered and altered / new parts of the road network have also been determined separately to enable the contribution of the altered / new roads to be identified.

13.368 The calculated noise levels, and the three tests set out in the NIR 1975, are show in Table A13.5.9 in Technical Appendix 13.5.

13.369 It can be seen from Table A13.5.9 that one property, The Villa, is considered to qualify for noise insulation under the NIR 1975.

Off-site Railway Noise

13.370 The likely change in railway noise levels at locations away from the Site have been calculated, based on the existing and proposed train movements.

13.371 The existing train movements along the line that serves the Site are shown in Table 13.33, broken down by train type.

Table 13.33: Summary of Existing Train Movements

Train Type	Northbound		Southbound	
	Day	Night	Day	Night
Passenger				
Pendolino	12	0	13	1
Voyager	38	1	41	0
Class 350	31	2	34	1
Class 150	1	0	0	1
Freight				
Intermodal / Conventional	5	11	11	11
Metal	1	1	0	1
Nuclear	2	0	0	2
Timber	1	1	0	0
Coal	1	0	0	0
Cement	1	0	0	1
Loco Only	2	0	2	1

13.372 The noise levels likely to be generated by these train movements have been calculated using the algorithms set out in CRN.

13.373 CRN was written in 1995 and does not cover many of the modern train types serving the WCML. Reference has therefore been made to the DEFRA document *Additional railway noise source terms for "Calculation of Railway Noise 1995"*, which contains source terms for the trains listed in Table 13.33.

13.374 The composition of these trains is set out in Table 13.34.

Table 13.34: Composition of trains		
Train Type	**Assumed Speed**	**Composition**
Pendolino	200 kph	6 motor wagons, 3 carriages
Voyager	200 kph	5 motor wagons
Class 350	120 kph	3 motor wagons, 3 carriages
Class 150	120 kph	6 motor wagons
All freight (except nuclear)	120 kph	1 Class 66 loco, 25 wagons
Nuclear freight	120 kph	1 Class 66 loco, 2 wagons

13.375 It is understood that, at full capacity, the Proposed Development will be served by two trains to/from the north, one during the daytime and one during the night-time, and eight to/from the south, with six during the daytime and two during the night-time.

13.376 It is assumed that these trains would comprise a Class 66 locomotive and 25 wagons.

13.377 The change in noise level has been calculated for a notional track-side receptor, set 25 metres back from the nearside rail. A notional receptor has been used to determine the overall change in railway noise levels that will occur at all receptors along the line. The changes in noise level are shown in Table 13.35.

Table 13.35: Change in rail traffic noise levels, free-field $L_{Aeq,T}$ dB			
Period	**Calculated Noise Level, $L_{Aeq,T}$ dB**		**Change**
	Existing	**Future**	
16 hour daytime	66.7	66.9	+0.2
8 hour night-time	66.2	66.6	+0.4

13.378 It can be seen from Table 13.35 that the largest change in rail noise would be +0.4dB, which would be a negligible impact. Even if combined with high sensitivity receptors, overall there is anticipated to be no adverse effect, which is not considered significant in EIA terms.

Off-Site Railway Vibration

13.379 The likely future levels of off-site railway vibration have been determined. The existing level of railway vibration was measured at two locations, Positions V1 and V2. Position V1 was located at the top of an embankment above the railway, and Position V2 was at grade with the line.

13.380 The existing vibration dose values were set out in Table 13.20 for Position V1 and Table 13.21 for Position V2. The measured Vibration Dose Values (VDVs) were at a level that BS6472: 2008 would suggest that there is less than a low probability of adverse comment at Position V1 and a low probability of adverse comment at Position V2.

13.381 The effect of adding the seven daytime and three night-time trains has been determined by identifying the highest individual one minute measured VDV, which is considered likely to have been due to a passing freight train, and adding a further ten occurrences of it over the course of the 24 hour period. For Position V2, the highest individual one minute VDV has been ignored as it is likely to have been caused by livestock.

13.382 The calculation is considered to represent the worst-case as ten additional trains are allowed for, rather than the maximum eight travelling to/from the south.

13.383 The resultant future VDVs are shown in Table 13.36.

Table 13.36: Calculated Future Vibration Dose Values, $ms^{-1.75}$				
Position	**Period**	**X-Axis VDVd,T**	**Y-Axis VDVd,T**	**Z-Axis VDVb,T**
V1	Day	0.028	0.052	0.069
	Night	0.021	0.043	0.051
V2	Day	0.137	0.142	0.246
	Night	0.107	0.102	0.180

13.384 The value set out in Table 13.36 would, at worst, fall into the 'low probability of adverse comment' category of BS6472: 2008, and would therefore be classed as low adverse impacts.

13.385 Any high sensitivity receptors along the route that receive the low adverse impacts would be subject to minor adverse effects, which are not significant in EIA terms.

Noise Insulation Regulations for Railways

13.386 An assessment has been undertaken of the eligibility of all properties within 300 metres of any new or altered railway line for noise insulation, under the NIR 1996.

13.387 The receptors considered are identified in Figure 13.5.

13.388 The pre-development railway noise levels, termed the Prevailing Noise Level in NIR 1996, have been calculated based on the 2016 railway movements, as set out in Table 13.33 and Table 13.34.

13.389 The railway noise levels that result from the Proposed Development, including the effect of both additional trains and the amended /new rail layouts for the future with development scenario, termed the Relevant Noise Level, have been calculated based on the level of additional train movements set out above.

13.390 The contribution to the Relevant Noise Level from unaltered and altered / new parts of the rail network have also been determined separately to enable the contribution of the altered / new rail lines to be identified.

13.391 The calculated noise levels, and the three tests set out in the NIR 1996, are shown in Table A13.5.10 for the daytime and Table A13.5.11 for the night-time, both in Technical Appendix 13.5.

13.392 It can be seen from Tables A13.5.10 and A13.5.11 that no properties are considered eligible for noise insulation under the NIR 1996.

Fixed Plant Noise

13.393 The Proposed Development may include plant to control the climate within the building, although at this stage no details are available as to what plant is to be included, if any. The DCO Requirements requires the details of all mechanical and ventilation plant to be submitted to and approved by the local planning authority.

13.394 Suggested plant noise limits are shown in Table 13.37. It is suggested that, where possible, the plant be designed to a lower limit to ensure that there is 'headroom' for the other noise sources at the Site. The background sound levels are the representative values for each position, as set out in Table 13.18.

Table 13.37: Suggested noise limits for fixed plant, free-field dB			
Receptors Close to Position:	**Period**	**Background Sound Level, L_{A90}**	**Recommended Limit, $L_{Ar,T}$ (1)**
N1	Day	41	41
	Night	31	31
N2	Day	44	44
	Night	35	35
N4	Day	49	49
	Night	42	42
N5	Day	42	42
	Night	35	35
N6	Day	44	44
	Night	34	34
N7	Day	46	46
	Night	32	32
N8	Day	46	46
	Night	39	39
N9	Day	42	42
	Night	36	36
Note: (1) The proposed noise limits are applicable at a point close to, but at least 4 metres in front of, the relevant façade			

13.395 Note that the limits suggested above are rating levels and as such any design should take into account the acoustic characteristics of the plant. The limits are deemed to apply to the total fixed plant noise emission level from the whole Site, so individual plant items may need to be designed to a lower limit to take into account the cumulative effects of noise.

13.396 Designing fixed plant at the Site to comply with the stated limits is considered likely to result in a minor to no adverse effect, which for receptors for high sensitivity would be classed as a minor effect. These effects are anticipated to be long term. This is not considered significant in EIA terms.

13.397 The limits suggested in Table 13.37 should be updated as and when the background sound survey is repeated.

Mitigation and Residual Effects

13.398 This section sets out the mitigation measures that are considered necessary to address identified significant adverse effects.

Construction

13.399 Mitigation, in terms of Best Practicable Means (BPM), as defined in the Control of Pollution Act 1974, are included in the ODCEMP, and have been factored into the assessment of construction noise and vibration presented earlier in this chapter, although no specific reductions have been applied to the calculated values. Construction noise will be considered as part of the bespoke noise insulation scheme, with noise insulation offered to the worst-affected properties that meet the qualifying criteria.

13.400 Notwithstanding these measures, it has been identified that the noisiest works are likely to give rise to major adverse effects where the works are close to the off-site receptors. It has also been identified that construction vibration is likely to give rise to moderate adverse effects, where vibratory works are carried out close to two particular off-site receptors. These effects are likely to be short-term in duration, and therefore temporary.

13.401 Further mitigation measures will be identified and included in the DCEMP as the detail of the construction methods evolves, which may include:

- the use of quiet plant;
- selection of quieter methods where there are equivalent choices; and
- maximising the benefits of acoustic bunds by erecting them as early as is practicable.

13.402 Notwithstanding these future mitigation measures, it is likely that where the construction works are close to the off-site receptors, moderate, possibly major, adverse effects may still occur, but they are likely to be short-term in duration.

13.403 Details for mitigating construction noise are set out in the ODCEMP, which will be updated as further detail on the construction works emerges (as part of the DCEMP to be secured as a DCO Requirement). No phase of construction will commence until the DCEMP is approved, nor until the earthworks strategy has been approved.

13.404 Adverse effects as a result of noise and vibration from construction traffic are unlikely, and mitigation is not considered necessary.

Operational Development

13.405 The operation of the Site has been assessed in terms of on-site operational noise and vibration, off-site road and railway noise and vibration, and fixed plant noise. Each is considered below.

On-Site Operational Noise

13.406 The assessment of on-site operational noise suggests that moderate adverse effects are likely at a number of receptors. A number of the receptors likely to be affected by the Proposed Development are likely to be eligible for noise insulation under the bespoke noise insulation scheme to be offered through the DCO process, even though the noise levels forecast fall well below those that would trigger the need for insulation under the NIR 1975 or NIR 1996. The provision of a bespoke noise insulation scheme is considered to be a key mitigation measure that has already been taken into account in this assessment, and was a determining factor in arriving at the moderate adverse outcome.

13.407 The provision of noise insulation, and importantly ventilation, should result in internal noise levels that meet the target noise levels set out in BS8233: 2014 and the WHO Guidelines, thereby providing a suitable internal noise climate for affected residents.

13.408 It is acknowledged that the guideline values set out in BS8233: 2014 and the WHO Guidelines do not strictly apply to the types of noise likely to be present at the Proposed Development. However, by including acoustic character corrections in the calculation of internal noise levels, it is considered that allowance has been made for the acoustic features that BS8233: 2014 and the WHO Guidelines seek to exclude from their guidance.

13.409 The moderate adverse effects identified at the canal moorings, and along the canal towpath, would not be ameliorated by the bespoke noise insulation scheme, as it is not possible to implement the scheme for transient boat-based receptors, nor for transiently-used outdoor receptors.

13.410 The landscaping proposals for the Site include significant mounding to provide acoustic screening, which has been accounted for in the assessment. This built-in (embedded) mitigation has been designed specifically to limit noise impacts.

13.411 It is important to note that because the DCO application is outline in nature with defined parameters, the final form of development will be defined through detailed design of the development zones. It is at that stage, when specific details are known of the likely operators and their specific activities, that mitigation can be designed in detail.

13.412 Further noise assessments at that stage will offer the opportunity to further protect the surrounding receptors through the provision of detailed mitigation specific to the proposed operators.

13.413 Acoustic barriers of varying heights have been tested at various locations around the Site, and found not to significantly alter the outcomes already identified. This is due to the acoustic screening already included in the assessment from the landscaped mounding.

13.414 In addition, the detailed design of the Proposed Development is covered by the draft DCO Requirements, and good acoustic design may be secured as part of that commitment.

13.415 Subject to the detailed design of the Site, it is likely that some degree of further noise reduction should be possible to reduce the operational sound levels below those assessed here, although for the purposes of this assessment, the moderate adverse effects should be regarded as possible residual effects.

On-Site Operational Vibration

13.416 The assessment of on-site operational vibration suggested that no adverse effects were likely, so mitigation is not considered necessary. No adverse residual effects are considered likely.

Off-Site Road Traffic Noise and Vibration

13.417 The assessment of off-site road traffic noise and vibration suggests that only minor adverse effects are likely as a result of the Proposed Development along the majority of roads, with moderate adverse effects along the A5 between M6 Junction 12 and the proposed Site access, and Vicarage Road between the proposed Site access and the A5.

13.418 Mitigating off-site road traffic noise is not generally possible as the land is not within the control of the Applicant; the erection of roadside noise barriers could require the purchase of land considerably beyond the Order limits. The use of low noise road surfaces can be effective for free-flowing traffic conditions, however, the traffic movements that lead to the moderate adverse effect are close to junctions, where traffic is unlikely to be free-flowing. Low noise road surfaces are unlikely to provide a material benefit.

13.419 Maintaining the roads in good condition will reduce the likelihood of ground-borne vibration from road vehicles.

13.420 In the worst-case, the identified moderate adverse effects will remain.

13.421 One property, The Villa, is considered to qualify for noise insulation under the NIR 1975.

Off-Site Railway Noise and Vibration

13.422 The assessment of off-site railway noise suggests that no significant adverse effects are likely as a result of the Proposed Development.

13.423 The identified minor adverse effect from off-site railway vibration is likely to remain.

13.424 Mitigation is not considered necessary for either off-site railway noise or vibration.

13.425 No properties are considered to qualify for noise insulation under the NIR 1996.

Fixed Plant Noise

13.426 Designing fixed plant items to meet the suggested noise limits is the key mitigation to prevent adverse effects from this element of the Proposed Development. Specific mitigation measures, in the form of silencers, attenuated louvres or enhanced plant room structures, can only be identified one the building services plant design is known.

13.427 Providing the building services design adheres to the recommended limits, no adverse effects are considered likely.

Summary of Mitigation Measures

Table 13.38: Summary of Proposed Mitigation and Enhancement Measures

Potential Effects Identified	Proposed Mitigation/Control & Enhancement Measures
Construction	
Moderate to major adverse effects from construction noise	Best Practice as set out in ODCEMP. Provision of bespoke noise insulation scheme in the most severe cases.
Moderate adverse effects from construction vibration	Best Practice as set out in ODCEMP.
Completed Development	
Moderate adverse effects from on-site operational noise	Incorporation of significant landscaped mounding. Provision of bespoke noise insulation scheme.

Summary of Residual Effects

13.428 Table 13.39 provides a tabulated summary of the outcomes of the noise and vibration of the Proposed Development.

Table 13.39: Summary of Residual Effects

Receptor	Description of Residual Effect	Nature of Residual Effect*					
		Significance**	+ -	D I	P T	R IR	St Mt Lt
Construction							
Residential receptors around the Site	Construction noise	Moderate to Major	-	D	T	R	St
Avenue Cottages, Denson House,	Construction	Moderate	-	D	T	R	St

Table 13.39: Summary of Residual Effects

Gailey House, High Clere, Roundabout Cottages, and Wood View, plus Heath Farm, Woodside Farm and residential properties at the intersection of Vicarage Road / Straight Mile, that are likely to remain occupied during some part of the construction works	vibration						
Canal moorings and canal towpath	Construction noise	Moderate	-	D	T	R	St
Completed Development							
Residential receptors around the Site	On-site operational noise	Moderate	-	D	P	R	Lt
Canal moorings and canal towpath	On-site operational noise	Moderate	-	D	P	R	Lt
One property along Vicarage Road between site and A5	Increase in road traffic noise	Moderate	-	D	P	R	Lt
Receptors along A5 between site access and M6	Increase in road traffic noise	Moderate	-	D	P	R	Lt

Notes:
* - = Adverse/ + = Beneficial; D = Direct/ I = Indirect; P = Permanent/ T = Temporary; R=Reversible/ IR= Irreversible; St- Short term/ Mt –Medium term/ Lt –Long term.
**Negligible/Minor/Moderate/Major

Likely Significant Environmental Effects

13.429 Noise from the construction of the Proposed Development is likely to give rise to short-term moderate to major adverse effects at the receptors closest to the Site, where the construction works are close to the Site boundaries.

13.430 Vibration from the construction of the Proposed Development may give rise to moderate adverse effects at two receptors, when heavy ground works are carried out close to them.

13.431 Noise from on-site operational activities is likely to give rise to moderate adverse effects at a number of receptors around the Site. The provision of a bespoke noise insulation scheme should result in internal noise levels that meet the available guidelines for residential properties.

13.432 Increases in noise from road traffic on roads around the site, particularly on Vicarage Road between the Site access and the A5, the A5 between the Site access and the M6, the A449 between Gravelly Way and Brewood Road are predicted to lead to moderate to major adverse effects.

13.433 The provision of a bespoke noise insulation scheme for operational and construction noise, which builds on the statutory requirement set out in the NPS to apply the Noise Insulation Regulations, results in a scheme that meets the policy requirements of the NPS, in particular:

- significant adverse effects on health and quality of life from noise are avoided;
- a range of measures are proposed, particularly through careful layout of the Proposed Development to mitigate and minimise other adverse effects on health and quality of life; and
- mitigation measures are proposed in the form of a noise insulation scheme to ensure that satisfactory residential environments continue to be provided for the properties in closest proximity to the development.

13.434 The NPS does aspire to an aim for development to improve health and quality of life through the effective management and control of noise "where possible" but this is not considered to be a requirement of the policy and not something which the provision of substantial development such as a SRFI is likely to be able to achieve.

13.435 For the reasons set out above, the noise and vibration policy requirements of the NPS are met.

Decommissioning

13.436 The Proposed Development is expected to be operational indefinitely, as long as it is viable and fit for purpose.

13.437 In the long term, it may likely be re-developed or adapted on a piecemeal basis as operator requirements change and new occupiers move to the Site. Any such piecemeal redevelopment would be expected to be undertaken in accordance with current and future legislation and guidance in relation to noise and vibration and would be subject to separate planning applications and planning requirements and conditions.

13.438 On this basis the potential effects on noise and vibration for decommissioning are considered to be negligible.

Cumulative Effects

13.439 The following schemes have been considered in terms of direct noise and vibration effects:

- the Bericote Development; and
- Calf Heath Quarry.

13.440 In addition, schemes further afield have been included in the traffic data, and therefore are included in the assessment of off-site road traffic noise and vibration.

13.441 The potential for cumulative effects between the operation of the first phases of development and later stages of construction has also been considered.

Construction

13.442 The construction of the scheme on the Bericote Development will be complete before the Proposed Development commences construction, so no cumulative effects are likely.

13.443 Calf Heath Quarry is currently operational, however should DCO consent be granted, no further minerals will be excavated within the Site including the new minerals allocation. The existing minerals infrastructure will be removed. As the quarry is regulated under an Environmental Permit removal of the existing minerals infrastructure at Calf Heath Quarry

would be expected to employ stringent mitigation measures similar to those that would be implemented during construction of the Proposed Development. It is anticipated that the current quarry workings would be left open, thereby minimising the need to rework materials during the earthworks stage of the Proposed Development, and this has been taken into account in the cut/fill models for the Proposed Development and in the baseline established for this ES. As such, it is not anticipated that there will be any cumulative effects.

Completed Development

13.444 Operational noise from the scheme on the Bericote Development has the potential to occur simultaneously with the Proposed Development, thereby increasing noise levels in the area. However, the way in which sound from industrial or commercial activities is assessed would result in the scheme on the Bericote Development increasing the background sound levels against which sound from the Proposed Development would be assessed, rather than being considered cumulatively.

13.445 Notwithstanding this, the noise assessment submitted with the application for the scheme on the Bericote Development[25] suggests that noise from that scheme will generally be much lower than the existing background sound levels, so no cumulative effect is likely.

13.446 Calf Heath Quarry will no longer be in operation once the Proposed Development is complete, so there will be no cumulative effects.

[25] *Proposed Development – Four Ashes – Noise & Vibration Assessment*, White Young Green on behalf of Bericote Properties Limited (May 2016)