Norwich Western Link Environmental Statement: Chapter 7 Noise and Vibration

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Glossary of Abbreviations and Defined Terms

The definition of key terms used in this report are provided below. These definitions have been developed by reference to the definitions used in EU and UK legislation and guidance relevant to Noise and Vibration as well as professional judgement based on knowledge and experience of similar schemes in the context of the Proposed Scheme.

Term	Definition
AAWT	Average Annual Weekday Traffic Flow
A-weighting dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Construction Noise Study Area	The area within which significant construction noise effects could occur. As set out within relevant guidance, the Construction Noise Study Area is set at a distance of 300m from construction working areas.
Construction Traffic Noise Study Area	The area within which significant construction traffic noise effects could occur. As set out within relevant guidance, the Construction Traffic Noise Study Area is set at a distance of 50m from the kerb of routes used by vehicles associated with the construction of the Proposed Scheme.
Construction Vibration Study Area	The area within which significant construction vibration effects could occur. As set out within relevant guidance, the Construction Vibration Study Area is set at a distance of 100m from any vibration generating construction activity.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power.
DM2029	Do-minimum scenario for the opening year 2029 which does not include the Proposed Scheme.
DM2044	Do-minimum scenario for the design year 2044 which does not include the Proposed Scheme.
DS2029	Do-something scenario for the opening year 2029 which includes the Proposed Scheme.

Term	Definition
DS2044	Do-something scenario for the design year 2044 which includes the Proposed Scheme.
Façade Level	At a distance of 1 metre in front of a large sound reflecting object such as a building façade.
Free-field Level	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5 metres away.
LAeq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
LA10,T	A noise level index. The noise level exceeded for 10 % of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise
LA90,T	A noise level index. The noise level exceeded for 90 % of the time over the period T. L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background noise.
LOAEL	Lowest Observed Adverse Effect Level as introduced within the Noise Policy Statement for England.
NOEL	No Observed Effect Level as introduced within the Noise Policy Statement for England.
Operational Noise Study Area	The area within which significant operational road traffic noise effects could occur. As set out within relevant guidance, the operational noise Study Area is set at a distance of 600m from the kerb of all road links physically altered by the Proposed Scheme, and 50m from the kerb of wider network road links anticipated to experience a noise level change as a result of the Proposed Scheme that could cause a significant effect to arise.
Peak Particle Velocity (PPV)	Descriptor for the magnitude of vibration.

Term	Definition
Section 61 consent	As set out in the Control of Pollution Act 1974, Section 61 provides for a process by which prior consent is sought from the Local Planning Authority to agree construction working hours, programmes and working methods in advance of construction works starting.
SOAEL	Significant Observed Adverse Effect Level as introduced by the Noise Policy Statement for England.
Sound Pressure Level	The sound level is the sound pressure relative to a standard reference pressure of 20 Pa ($20x10^{-6}$ Pascals) on a decibel scale.
Sound Power Level	Sound power measured on a decibel scale, relative to a reference value of 10^{-12} W.

7 Noise and Vibration

7.1 Introduction

7.1.1 This chapter reports the outcome of the assessment of likely significant effects arising from noise and vibration associated with the Proposed Scheme. It describes the assessment methodology and the baseline conditions relevant to the assessment, which have been used to reach these conclusions, as well as a summary of the likely significant effects leading to the additional mitigation measures required to avoid, prevent, reduce or, if possible, offset any likely significant adverse effects, and the likely residual effects and any required monitoring after these measures have been employed.

7.1.2 This chapter (and its associated figures and appendices) is intended to be read as part of the wider ES. This chapter focusses on human receptors and their response to noise and vibration. For noise and vibration impacts on ecological receptors refer to **Chapter 10: Biodiversity** (Document Reference: 3.10.00) and **Chapter 11: Bats** (Document Reference: 3.11.00).

7.2 Legislative framework, policy and guidance

Legislative framework

7.2.1 The applicable legislative framework to the noise and vibration assessment is summarised as follows:

- Directive 2002/49/EC of the European Parliament, 2002 – Assessment and Management of environmental noise (better known as the Environmental Noise Directive) (**Ref 7.1**);
- Directive 2014/52/EU of the European Parliament, 2014 - Assessment of the effects of certain public and private projects on the environment (**Ref 7.2**);
- The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations) (**Ref 7.3)**;

- Noise Insulation Regulations 1975 (as amended) (NIR) (**Ref 7.4**); and
- The Control of Pollution Act 1974 **(Ref 7.5)**.

7.2.2 The relevant sections of the above documents are summarised in **Appendix 7.1: Legislation policy and guidance** (Document Reference 3.07.01).

Policy

7.2.3 Planning policy applicable to the noise and vibration assessment includes the following:

- National Planning Policy Framework (NPPF), 2023 (**Ref 7.6**);
- Noise Policy Statement for England (NPSE), 2010 (**Ref 7.7**);
- National Policy Statement for National Networks (NPS NN), 2014 (**Ref 7.8)**; and
- Broadland District Council Local Plan, Development Management Development Planning Document (DPD) (2015) (**Ref 7.9**).

National noise policy

7.2.4 The NPSE provides more detail than the NPPF in relation to noise and sets out the long-term vision of the Government's noise policy which applies to all forms of external noise. The NPSE refers to the management and control of noise within the context of Government Policy on sustainable development and stresses that noise impact should not be treated in isolation from other related factors.

7.2.5 The NPSE introduces and describes three categories, or levels of noise. It describes the presence or absence of noise effects but does not quantify those categories, stating that the corresponding objective levels are likely to be different for different noise sources, receptors and times of the day or night. These categories are:

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

7.2.6 Much of the guidance relating to noise within the NPS NN is similar to that within the NPSE and NPPF. The NPS NN specifically reiterates the aims of the NPSE as follows in paragraph 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."*

Local noise policy

Broadland District Council Local Plan

7.2.7 The Development Management DPD (2015) sets out policies which should be applied within the Broadland planning authority area. Relevant to noise is Policy EN4 – Pollution which states:

"Development proposals will be expected to include an assessment of the extent of potential pollution. Where pollution may be an issue, adequate

mitigation measures will be required. Development will only be permitted where there will be no significant adverse impact upon amenity, human health or the natural environment"

Summary of response to policy

7.2.8 Table 7-1 sets out how the assessment in this chapter of the ES has considered the key components of the NPPF, NPSE and Broadland District Council Local Plan.

Table 7-1 Description of policy and how this has been considered in the assessment

Policy	Comment
NPPF	This chapter conforms with the NPPF by identifying the likely effects from noise and vibration that would occur as a result of the Proposed Scheme during construction and operation. Health effects are considered by the application of LOAEL and SOAEL thresholds for noise and vibration.
NPSE	Health effects are considered in line with the LOAEL and SOAEL categories as defined in the NPSE. In addition, this chapter promotes the management of noise and vibration impacts through effective mitigation during construction and operation.
NPS NN	In accordance with paragraph 5.193 of the NPS NN, due regard has been given to the NPSE and NPPF as well as associated guidance within Planning Practice Guidance: Noise. The Proposed Scheme has been designed as far as practicable to avoid giving rise to significant adverse noise and vibration effects. Health effects are considered by the application of LOAEL and SOAEL thresholds for noise and vibration. In addition, this chapter promotes the management of noise and vibration impacts through effective mitigation during construction and operation.

Policy	Comment
Broadland DPD	An assessment of construction and operational noise has been undertaken for the Proposed Scheme and mitigation measures are proposed to limit adverse noise impacts on human receptors.

Guidance

7.2.9 The following guidance documents have been used during the preparation of this chapter, a summary of which are presented within **7.1: Legislation, policy and guidance** (Document Reference 3.07.01).

- National Highways, Design Manual for Roads and Bridges, Sustainability & Environment Appraisal, LA 111 Noise and Vibration, Revision 2, May 2020 (**Ref 7.10**);
- Calculation of Road Traffic Noise (CRTN). Department of Transport and Welsh Office. 1988 (**Ref 7.11**);
- Converting the UK traffic noise index $L_{A10,18h}$ to EU noise indices for noise mapping. P G Abbott and P M Nelson (TRL Limited). Project Report PR/SE/451/02 (**Ref 7.12);**
- British Standard (BS) 5228 Code of practice for noise and vibration control on construction and open sites. Part 1: Noise. BS 5228:2009+A1:2014 (referred to in this chapter as BS 5228-1) (**Ref 7.13**); and
- British Standard (BS) 5228 Code of practice for noise and vibration control on construction and open sites. Part 2: Vibration. BS 5228:2009+A1:2014 (referred to in this chapter as BS 5228-2) (**Ref 7.14).**

7.2.10 In addition, this chapter has been prepared in accordance with the Government's National Planning Practice Guidance: Noise (**Ref 7.15**).

7.3 Consultation, scope, methodology and significance criteria

Consultation undertaken to date

7.3.1 Table 7-2 provides a summary of the consultation activities undertaken to date with Broadland District Council and Breckland District Council. Whilst the Proposed Scheme lies within Broadland District Council area, as Breckland District Councils area is nearby, consultation was also undertaken with Breckland District Council in order to be robust.

Table 7-2 Summary of consultation undertaken

Organisation	Individual	Form of consultation	Summary of outcome of discussions
Broadland District Council	Environmental Health Officer (EHO)	Email and telephone discussions following receipt of the Scoping Opinion	Emails have been exchanged between the project team and the EHO regarding three aspects of the noise and vibration assessment following receipt of the Scoping Opinion. 1 – Operational noise assessment speeds It was agreed that the predicted traffic speeds would not be subject to the speed pivoting process as outlined in the DMRB LA 111. This is a process to ensure that modelled speeds from the traffic model are consistent with observed speeds. It is considered that the traffic speeds from the transport model are appropriate for use for the operational noise assessment. 2 – Receptors currently experiencing low baseline noise levels The potential operational noise impacts on receptors in more remote locations (but still within the detailed calculation area which is defined below) away from significant existing and future noise sources were discussed given the particularly low baseline noise levels in this area. It was agreed that the consideration of significance would be (as recommended by DMRB LA 111) based on the noise level changes, absolute noise level predictions and other relevant acoustic contextual factors. 3 – Baseline noise survey The baseline survey locations and methodology were discussed and agreed. 4 – Noise model background correction The approach to the noise model background correction was clarified with the EHO.
Breckland District Council	Environmental Health Officer (EHO)	Email and telephone discussions following receipt of the Scoping Opinion	Emails have been exchanged between the project team and the EHO regarding three aspects of the noise and vibration assessment following receipt of the Scoping Opinion. 1 – Operational noise assessment speeds It was agreed that the predicted traffic speeds would not be subject to the pivoting process as outlined in the DMRB LA 111. It is considered that the traffic speeds from the transport model are appropriate for use for the operational noise assessment. 2 – Baseline noise survey The baseline survey locations were discussed and agreed. 3 – Noise model background correction The approach to the noise model background correction was clarified with the EHO.

Scope of the assessment

7.3.2 This section provides an update to the scope of the assessment and re-iterates the evidence base for scoping out elements following further iterative assessment. Further information on the scoping process is contained in **Chapter 5: Approach to EIA** (Document Reference: 3.05.00).

7.3.3 The noise and vibration chapter of the Scoping Report set out the approach described within DMRB LA 111 for the derivation of the Operational Noise Study Area. The Scoping Report noted that ultimately the Operational Noise Study Area would be informed by traffic flows which were not available at that time. Subsequent to the publication of the Scoping Report, following review of the traffic flows as part of this assessment, a modified approach from that presented within DMRB LA 111 for the Operational Noise Study Area has been adopted in order for the assessment to be proportionate. This approach, and the extent of the Operational Noise Study Area is set out in detail under the 'Extent of the Study Area' heading at paragraph 7.3.8 below.

7.3.4 Further, the Scoping Report noted that for each construction activity, distances would be provided within which receptors were considered likely to experience a significant adverse effect rather than undertake receptor specific predictions. However, given the limited number of receptors within the Construction Noise Study Area (which is defined from paragraph 7.3.9 onwards), the construction noise assessment is based on predictions at ten sample receptors which are representative of those around them. This is considered to be a more robust and detailed approach than that set out in the Scoping Report. The construction noise assessment methodology is set out further in Section 7.3.

Elements scoped out of the assessment

7.3.5 The elements shown in Table 7-3 are not considered to give rise to likely significant effects as a result of the Proposed Scheme and have therefore not been considered within this assessment. This is consistent with the elements scoped-out within the Scoping Report.

Table 7-3 Elements scoped out of the assessment

Element scoped out	Justification
Permanent traffic ground-borne and airborne vibration effects	Operational vibration is scoped out of the assessment methodology as a maintained road surface would be free of irregularities as part of project design and under general maintenance, so operational vibration is likely to be negligible and therefore would not have the potential to lead to significant adverse effects.
Temporary diversion route traffic noise	It is unlikely that any major highways would need to be closed for multiple days / nights in a row. Whilst it is anticipated that brief closures would be required on both the A1067 and A47 in order for the Proposed Scheme to tie-in with the new junctions on these roads, it is assumed that these closures would be of short duration (only a few days / nights) that would not warrant an assessment of potential noise impacts. In addition, the local roads crossing the Proposed Scheme which may require more extended closures and associated diversion routes generally carry low numbers of vehicles, meaning that moving these vehicles to another local route would be unlikely to lead to significant noise impacts at nearby receptors. Therefore, an assessment of temporary diversion route traffic noise is scoped out of this assessment. Further details of the proposed diversion routes are set out in the '**Transport Assessment'** (Document Reference: 4.01.00) (Section 10.10).
Noise and vibration during highway maintenance works	The Proposed Scheme would require some maintenance once open to the public. It is assumed that the noise and vibration levels during maintenance would be less than those anticipated during the construction phase. Further, it is likely that maintenance would be infrequent and short in duration (likely to be only a few days per year). On this basis, it is considered unlikely that significant effects would arise from noise or vibration during highway maintenance works.

Elements scoped into the assessment

Construction phase

7.3.6 The following elements are considered to have the potential to give rise to likely significant effects during construction of the Proposed Scheme and have therefore been considered within this assessment:

- Temporary construction noise effects;
- Temporary construction vibration effects; and
- Temporary construction traffic noise effects.

Operational phase

7.3.7 Permanent traffic noise effects are considered to have the potential to give rise to likely significant effects during operation of the Proposed Scheme and have therefore been considered within this assessment.

Extent of the Study Area

7.3.8 The Study Areas for both the construction noise and vibration and operational noise assessments have been defined based on DMRB LA 111 guidance.

Construction noise and vibration

7.3.9 DMRB LA 111 states that the construction Study Area should include all noise and vibration sensitive receptors that are potentially affected by construction noise and vibration. DMRB LA 111 also notes that "*A study area of 300m from the closest construction activity is normally sufficient to encompass noise sensitive receptors*". For construction vibration, DMRB LA 111 notes that "*A study area of 100m from the closest construction activity with the potential to generate vibration is normally sufficient to encompass vibration sensitive receptors".*

7.3.10 With regard to construction traffic noise, DMRB LA 111 determines the Study Area as including a 50m width from the kerb line of public roads with the potential for an increase in baseline noise level of 1dB or more as a result of the addition of construction traffic to existing traffic levels.

7.3.11 Based on the above, the following Study Areas have been adopted for the construction phase:

- Construction Noise Study Area – 300m from the main on-site construction works (although a wider area is considered for the night-time assessment on account of the potential for impacts beyond 300m);
- Construction Vibration Study Area – 100m from any vibration generating construction activity; and
- Construction Traffic Noise Study Areas – 50m from the kerb line of public roads with the potential to experience at least a 1dB change in noise level.

7.3.12 The construction noise and vibration Study Areas are shown in **Appendix 7.8: Noise and Vibration Figures - Figure 7.1: Construction Study Area** (Document Reference: 3.07.08).

Operational noise

7.3.13 For operational noise, DMRB LA 111 advises in NOTE 1 that:

"An operational study area defined as the following can be sufficient for most projects, but it can be reduced or extended to ensure it is proportionate to the risk of likely significant effects:

1) The area within 600m of new road links or road links physically changed or bypassed by the project;

2) The area within 50m of other road links with the potential to experience a short term BNL change of more than 1.0dB(A) as a result of the project."

7.3.14 The Basic Noise Level (BNL) is described in the CRTN. It does not relate to any specific receptor, but rather is a measure of source noise, at a reference distance of 10m from the nearside carriageway edge of a specific length of highway. It is determined by obtaining the estimated noise level from the 18-

hour traffic flow and then applying corrections for vehicle speed, percentage of heavy vehicles, gradient and road surface as described in CRTN. DMRB LA 111 does not require that the gradient and road surface aspects of the BNL are included in the calculation and these have therefore been excluded.

7.3.15 DMRB LA 111 goes on to advise that: *"Variations in the study area can be defined for individual projects."*

7.3.16 A traffic model has been produced for the Proposed Scheme by the project team to provide traffic flows both with and without the Proposed Scheme. This traffic model covers most of Norfolk, and over 200 road links are predicted to experience positive or negative noise changes in excess of 1dB in the short-term as a result of the Proposed Scheme. It would not be proportionate or appropriate to include all these links in the Operational Noise Study Area and therefore the following approach has been adopted for road links which fall outside the boundary of the area that is within 600m of the Proposed Scheme carriageways:

- All road links anticipated to experience a noise level increase of 3dB or more (which as set out below have the potential to result in significant adverse effects) have been included;
- All road links anticipated to experience a positive or negative change of 1dB or more within 5 kilometres of the Proposed Scheme have been included; and
- Some short road links such as roundabouts or access roads have been excluded where no receptors are within the 50m area either side of the road.

7.3.17 This approach is considered appropriate as the inclusion of any links experiencing a 3dB increase in noise ensures that all moderate / major impacts are considered within the Operational Noise Study Area.

7.3.18 DMRB LA 111 notes that detailed noise modelling does not need to be undertaken for all wider network road links expected to experience a noise

level change of more than 1dB. Therefore, for the purpose of this assessment the detailed noise modelling area will be set at a distance of 600m from the Proposed Scheme carriageways. This will hereafter be referred to as the detailed calculation area.

7.3.19 The operational noise Study Area is depicted in **Appendix 7.8: Noise and Vibration Figures - Figure 7.2: Operational noise Study Area**. The detailed calculation area is depicted on **Appendix 7.8: Noise and Vibration Figures - Figure 7.3: Detailed calculation area** (Document Reference 3.07.08).

Method of baseline data collation

Surveys

7.3.20 Noise surveys were undertaken in the vicinity of the Proposed Scheme in 2021 at five locations. The purpose of the surveys, and measured noise levels are discussed further in Section 7.4.

7.3.21 The noise survey methodology and locations were agreed with the EHOs at Broadland District Council and Breckland District Council.

Assessment methodology

7.3.22 The principal guidance document for the assessment of permanent operational impacts as a result of the Proposed Scheme is DMRB LA 111. Guidance for the assessment of construction phase impacts is contained within BS 5228, with guidance also presented within DMRB LA 111. BS 5228-1 (i.e. Part 1) contains information about the prediction and measurement of noise from construction sites and operations, as well a database of source noise levels for commonly used equipment and activities on construction sites and the threshold of significant effect in respect of noise impact at dwellings.

Reporting of noise levels

7.3.23 This Chapter is necessarily technical in nature and includes noise level descriptors (both criteria and results) in terms of the following parameters:

- $L_{A10,18hr}$ – The noise level exceeded for 10% of the time period from 06:00 – 00:00 hours. The $L_{A10,18hr}$ is typically used to report daytime road traffic noise levels; and
- $L_{Aeq,T}$ - The average equivalent noise level over a time period, T.

Construction noise and vibration

Construction noise

7.3.24 At this stage, full details of construction activities and methods have not been finalised. The assessment of potential impacts therefore relies on outline construction information available at this stage. To adequately assess the potential impacts and associated mitigation measures, it is appropriate to undertake a quantitative assessment based on a number of reasonable worst-case assumptions. A set of informed assumptions of expected construction stages and associated operations and plant to be employed have been generated. Consideration has been given to the programme of activities, and professional experience gained from other similar infrastructure projects. Early contractor engagement has also been used to further inform the assessment. It is therefore considered that the adopted assessment approach is proportionate to the current stage of the Proposed Scheme.

7.3.25 The following activities, encompassing all anticipated key noise generative construction activities have been considered in the construction stage assessment:

- Activity 1 - Site clearance and earthworks (including enabling works and landscaping)
- Activity 2 - Structure construction
- Activity 3 - Road construction

7.3.26 The proposed daytime core working hours are 07:00 – 19:00 during weekdays and 08:00 – 13:00 on Saturdays. It is assumed that the vast majority of works would be undertaken during daytime core working hours.

7.3.27 However, there is the potential for some out of hours works to be required as once critical construction activities (to include but not be limited to concrete pours, lifting activities, road pavement construction and highway tie ins) have started, it may not be practical to halt the works until these activities are complete. Therefore, an assessment has been undertaken of potential night-time works (the most sensitive period) for Activities 2 and 3. Given its size, the River Wensum viaduct is the structure most likely to result in night-time significant effects and piling works associated with this structure are therefore the focus of the assessment for Activity 2 - Structure construction.

7.3.28 It is understood that some of the works on the A1067 at the northern end of the Proposed Scheme would be undertaken during the night-time, in order to minimise disruption to traffic along this route. These works are also therefore included in the night-time construction noise assessment and are covered by Activity 3 – Road Construction.

7.3.29 The construction of the Proposed Scheme is complex, with many activities and sub activities occurring across the Red Line Boundary. Furthermore, noise and vibration levels from construction operations are inherently variable, with noise levels fluctuating on an hour-to-hour, day-to-day and week-to-week basis. Given the assessment within this chapter is indicative in nature, it would not be proportionate to assess a large number of construction activities. The Site would include a number of compounds and earth stockpiles. As the Site clearance and earthworks activity is anticipated to occur within the majority of the Site Boundary and includes various construction plant for moving material around the Site, it is considered that noise levels from this activity would be representative of noise levels from compounds and stockpiles.

7.3.30 Calculation methodologies within BS 5228-1 have been used to predict noise levels from the three key construction activities.

7.3.31 The assessment of predicted construction noise for the above activities has been undertaken considering the guidance set out within BS 5228-1 and DMRB LA 111 as well as the requirements of the NPSE.

7.3.32 A number of habitat creation areas are proposed in proximity to the Proposed Scheme which are within the Red Line Boundary. Any construction works required to provide these areas are likely to be of short duration and minor in nature and are therefore not assessed within this chapter. This was the position as set out in the EIA Scoping Addendum submitted in July 2022 for the Proposed Scheme.

Construction vibration

7.3.33 The assessment of construction related vibration involves the:

- Identification of areas where potentially significant vibration generative activities may be required;
- determination of construction vibration Study Area (100m from these activities);
- calculation of possible ground-borne vibration levels associated with identified activities;
- determination of a distance buffer within which significant adverse effects are predicted;
- identification of vibration-sensitive receptors within the identified distance buffer(s); and
- identification of mitigation as appropriate.

7.3.34 The calculation and assessment of potential construction vibration effects has been undertaken following the guidance presented within BS 5228-2 and other guidance documents referenced therein. Guidance presented within DMRB LA 111 has also been considered along with the requirements of the NPSE.

7.3.35 The two main construction plant which have the potential to generate vibration are road rollers and piling rigs.

7.3.36 Road rolling would be required along the length of the new carriageways associated with the Proposed Scheme and is therefore assessed in this chapter.

7.3.37 Piling is only anticipated to be required for structures (under and overbridges) and retaining walls. There are no receptors within the Construction Vibration Study Area, and the closest receptor (Old Hall Farm) to any piling works is approximately 290m away.

7.3.38 Given the large distance to nearby sensitive receptors (all of which are outside the Construction Vibration Study Area), it is considered that significant construction vibration effects would not occur at sensitive receptors and therefore vibration from piling works has not been assessed within this chapter.

Construction traffic noise

7.3.39 A quantitative assessment of noise from construction traffic has been undertaken. Calculations have been undertaken following the methodology set out in DMRB LA 111 to determine the BNL changes as a result of the additional construction vehicles along key routes likely to be used to access the Proposed Scheme.

7.3.40 Changes in noise levels along these key routes have been assessed in line with the guidance presented within the DMRB LA 111.

7.3.41 Traffic flows have been provided for a peak scenario (as set out within the **Transport Assessment** (Document Reference: 4.01.00), assuming the anticipated highest number of vehicles accessing the Site via each access point. In order to adopt a worst-case approach, resulting in more vehicles using the existing road network, this scenario does not include any vehicles accessing the Site directly from the A47.

Operational road traffic noise

7.3.42 In accordance with the DMRB LA 111 guidance, the operational road traffic noise assessment has been based on calculated noise levels using the methodology detailed in CRTN and Appendix A of DMRB LA 111.

7.3.43 CRTN presents a methodology for the calculation of road traffic noise based on road related factors (such as gradient and surface type) and traffic related factors (such as flow, speed and the proportion of heavy duty vehicles). The propagation of noise is also covered in the CRTN methodology.

7.3.44 The assessment within this chapter is based on traffic data which excludes the traffic mitigation schemes. The traffic mitigation schemes are expected to improve traffic flows in the surrounding area and reduce noise levels, therefore, their exclusion is considered to result in a conservative assessment. **Appendix 7.2: Complimentary traffic mitigation schemes assessment** (Document Reference 3.07.02) includes a high-level assessment of the off-site traffic mitigation schemes and how these influence the noise and vibration assessment.

7.3.45 Noise change due to the Proposed Scheme has been determined for all identified sensitive receptors within the detailed calculation area for the following comparisons:

- Short-term – do-minimum opening year (DM2029) compared against do-something opening year (DS2029);
- Long-term – do-minimum opening year (DM2029) compared against do-something future year (DS2044); and
- Long-term future baseline - do-minimum opening year (DM2029) compared against do-minimum design year (DM2044).

7.3.46 Do-minimum refers to the situation without the Proposed Scheme and do-something refers to the situation with the Proposed Scheme. The operational stage road traffic noise assessment relies primarily on an appraisal of predicted road traffic noise levels. A detailed noise modelling exercise has

therefore been undertaken to quantify the future baseline for the year 2044 (15 years after the Proposed Scheme opening year).

7.3.47 In addition to the noise level changes as a result of the Proposed Scheme, the absolute noise levels for the two do-minimum and do-something scenarios will also be calculated. In order to comply with the NPSE and NPPF, these absolute levels have been compared to the LOAEL and SOAEL thresholds as set out within DMRB LA 111 (and discussed in greater detail from paragraph 7.3.87).

7.3.48 The significance of predicted noise levels and noise level change has been determined in accordance with the guidance presented within DMRB LA 111.

Night-time noise

7.3.49 DMRB LA 111 requires that the assessments consider not just the daytime period in terms of $L_{A10,18h}$, but also the night-time period in terms of $L_{Aeq,8hr}$.

7.3.50 The methodology within CRTN allows for the prediction of the daytime dB $L_{A10,18hr}$ value. The TRL report 'Converting the UK traffic noise index $L_{A10,18h}$ to EU noise indices for noise mapping' provides three methods for the conversion of the $L_{A10,18hr}$ to the $L_{Aeq,8hr}$ value. Given that detailed hourly traffic data are not available, method 3 from the TRL report has been adopted as being the most appropriate for adoption within noise level calculations. The TRL report identifies conversion equations for two different road types: motorway and non-motorway. In this case, as none of the roads in the detailed calculation area are motorways, all calculations to determine the $L_{Aeq,8hr}$ have utilised the non-motorway correction.

Representative noise levels for buildings

7.3.51 The noise levels calculated are façade levels for buildings during the 18-hour period from 06:00 to midnight and free-field levels (i.e. no reflecting surfaces apart from the ground within 3.5m of the microphone position) incident on the façade of buildings during the 8-hour night-time period from 23:00 to 07:00. All levels are calculated at a default height of 4m relative to the surrounding

ground level unless the building has been identified as a bungalow in which case a height of 1.5m has been adopted. Human receptors within noise sensitive open areas are assessed in terms of free-field noise levels at 1.5m above the ground.

7.3.52 Where a building is predicted to experience different changes in noise level on different façades, the greatest magnitude of change in noise has been reported in line with DMRB LA 111. Hence:

- When all façades show a decrease in noise level, the largest decrease has been reported;
- When all façades show an increase in noise level, the largest increase has been reported;
- When some façades show an increase in noise level and others a decrease, the largest increase or decrease (in absolute terms) would be reported; and
- Where the greatest magnitude of noise change is equal on more than one façade, the façade experiencing the greatest magnitude of noise change and highest do-something noise level has been selected.

7.3.53 When determining SOAEL and LOAEL categories, the highest absolute noise level for the building is reported.

3D noise model

7.3.54 The existing and future road traffic noise climate has been determined using a 3D noise model populated with traffic flow data. Details of the data sources used in the noise model are presented in **Appendix 7.3: Operational Road traffic noise assessment assumptions and source information** (Document Reference: 3.07.03). The noise level predictions have been undertaken based on CRTN (further details of which are set out in **Appendix 7.1: Legislation, policy and guidance** (Document Reference 3.07.01)).

7.3.55 The CRTN prediction methodology uses Annual Average Weekday Traffic (AAWT) flows over an 18-hour period between 06:00 – 00:00 hours. The CRTN methodology is only valid where the 18-hour traffic flow is 1000 vehicles or greater. Given the rural nature of the Proposed Scheme, several roads within the detailed calculation area have a traffic flow below this threshold. There is no guidance within DMRB LA 111 on how roads with a flow of less than 1000 vehicles in one scenario, but greater than 1000 in another scenario should be considered within the assessment, and therefore, professional judgement is required. The approach adopted (which is typical for assessments such as this) is as follows:

- Where roads have a flow above 1000 vehicles in all scenarios, the road has been included in the noise model.
- Where a road has a flow above 1000 vehicles in at least one scenario, the road has been included and the flow uplifted to 1000 vehicles in the scenarios where it was below 1000.
- Where a road has a flow of below 1000 vehicles in all scenarios, it has not been included in the noise model.

7.3.56 The $L_{A10,18h}$ value calculated by the noise model and which the assessment criteria within DMRB LA 111 is based, is the noise level exceeded for 10% of the period (06:00 – 00:00). For example, Wood Lane carries an AAWT flow of 6243 vehicles in the do-minimum 2029 scenario, but an AAWT flow of 963 vehicles in the do-something 2029 scenario. Were this road to be removed from the noise model in both scenarios, this reduction in traffic flow would not be considered in the assessment. Further, were the road to be removed from the do-something scenario only, this would suggest a much higher reduction in noise along Wood Lane than would actually occur. The approach followed is therefore considered robust and conservative.

Road surface corrections

7.3.57 Amongst a number of factors, the road surface type can influence noise levels from a road. The current design is for the Proposed Scheme to be surfaced with a stone mastic asphalt, low noise road surface type.

7.3.58 The A47 is managed by National Highways. The A47 North Tuddenham to Easton application is a Nationally Significant Infrastructure Project which has been granted a Development Consent Order (DCO) to dual and realign the carriageways. The A47 North Tuddenham to Easton DCO application states that the main A47 carriageways will be surfaced with a low noise road surface.

7.3.59 It is also understood that the A1270 is also surfaced with a low noise road surface. All other roads have been assumed to have a hot rolled asphalt surface type and surface corrections have been applied in accordance with DMRB LA 111.

Noise insulation regulations

7.3.60 The NIR are in place to ensure that when new highways are constructed in proximity to existing dwellings, mitigation, in the form of secondary glazing (and ventilation where appropriate) is provided where set eligibility criteria are met.

7.3.61 In accordance with DMRB LA 111, an indicative assessment has been undertaken to determine properties which are forecast to be eligible for insulation under the NIR. The NIR provide criteria for overall noise levels and set out procedures for assessment of the requirement to provide noise insulation to residential properties adjacent to new and altered highway schemes. To qualify for compensation under the NIR, the following four criteria must all be fulfilled at 1m in front of the most exposed door or window of an eligible room (including living rooms and bedrooms) in the façade of a property:

- Be within 300m of the Proposed Scheme;

- Show a relevant noise level (the noise level in the future year with the Proposed Scheme) of at least 68dB $L_{A10,18h}$ (façade);
- Show a noise increase between the relevant noise level and the prevailing noise level of at least 1dB(A); and
- The contribution to the increase in the relevant noise level from the Proposed Scheme must be at least 1dB(A).

Table 7-4 Noise levels predicted for the NIR

NIR definition	Parameter used
Prevailing noise level	$L_{A10,18h}$ Do-Minimum opening year 2029 [1]
Relevant noise level	$L_{A10,18h}$ Do-Something future year 2044
Maximum noise level from altered highways within 15 years (L'_A)	$L_{A10,18h}$ Do-Something future year 2044 from The Scheme
Maximum noise level from all other highways within 15 years (L'_B)	$L_{A10,18h}$ Do-Something future year 2044 from all the roads outside of the Scheme

Notes:

[1] Strictly the prevailing level relates to the time immediately before the works to construct or improve the highway were begun, not the year of opening. Consequently, the assessment of eligibility in terms of the NIR in this Chapter must be seen as indicative.

Significance criteria

7.3.62 The significance level attributed to each effect has been assessed based on the sensitivity / value of the affected receptor(s) and the magnitude of change arising from the Proposed Scheme, as well as a number of other factors that are outlined in more detail in **Chapter 5: Approach to EIA** (Document Reference: 3.05.00). The sensitivity of the affected receptor is assessed on a scale of high, medium, low and negligible, and the magnitude of change is assessed on a scale of major, moderate, minor, negligible and no change, as set out in **Chapter 5: Approach to EIA** (Document Reference: 3.05.00).

7.3.63 All receptors assessed within this Chapter are considered to be of high sensitivity to noise and vibration. Therefore, following the assessment of the magnitude of impact at a receptor there is no further consideration of the sensitivity of the receptor in determining the classification of effect.

7.3.64 However, DMRB LA 111 allows for the consideration of contextual factors in the determination of significance and it is therefore the case that impacts of minor magnitude could be significant and impacts of moderate or major magnitude could be non-significant. For this reason, noise and vibration effects within this chapter are either reported as 'significant' or not significant' without a classification of the effect.

Effect significance

7.3.65 The following terms have been used to define the significance of the effects identified and apply to both beneficial and adverse effects:

- Major effect: where the Proposed Scheme could be expected to have a substantial improvement or deterioration on receptors;
- Moderate effect: where the Proposed Scheme could be expected to have a noticeable improvement or deterioration on receptors;
- Minor effect: where the Proposed Scheme could be expected to result in a perceptible improvement or deterioration on receptors; and
- Negligible: where no discernible improvement or deterioration is expected as a result of the Proposed Scheme on receptors, including instances where no change is confirmed.

7.3.66 Separate to the requirement of the EIA to determine significant effects as discussed above, the NPSE also references the need to consider significance in terms of effect levels (the NOAEL, LOAEL and SOAEL descriptors as described within the NPSE). For construction noise and vibration, the impact magnitude scales presented in the following subsections detail how the LOAEL and SOAEL descriptors have been applied within the assessment as part of testing the policy requirements of the NPSE. For the operational noise

assessment, the absolute LOAEL and SOAEL thresholds are presented separately to the impact magnitude scales.

Construction noise

7.3.67 The assessment of construction noise is based on comparing predicted noise levels during construction phases to threshold levels set based on the existing ambient noise levels at receptors.

7.3.68 DMRB LA 111 advises that the ABC method within BS 5228-1 is used to set the construction noise threshold levels for the relevant periods. The ABC method is set out within Table E.1 in BS 5228-1 and has been reproduced in **Appendix 7.1: Legislation policy and guidance** (Document Reference: 3.07.01). Three categories, A, B and C, are described in terms of threshold values for a daytime (07:00 to 19:00 weekdays, 07:00 to 13:00 Saturday), evening (19:00 – 23:00) and weekend, and a night-time period (23:00 to 07:00). If the construction site noise level exceeds the relevant threshold value this may be deemed a significant impact subject to a duration threshold.

7.3.69 DMRB LA 111 advises that the SOAEL (or threshold level) is set in accordance with the ABC method for each of the three assessment periods. DMRB LA 111 also advises that the LOAEL is set at the baseline noise level (dB $L_{Aeq,T}$) for the relevant period.

7.3.70 Following the derivation of the LOAEL and SOAEL thresholds for construction noise Table 7-5 presents the magnitude of impact scale for construction noise (which is in accordance with DMRB LA 111 Table 3.16) in terms of the LOAEL and SOAEL thresholds.

Table 7-5 Construction noise - magnitude of impact scale in terms of LOAEL and SOAEL

Construction noise level	Magnitude of impact
Below LOAEL	Negligible
Above or equal to LOAEL and below SOAEL	Minor
Above or equal to SOAEL and below SOAEL +5dB	Moderate
Above or equal to SOAEL +5dB	Major

7.3.71 Given the rural environment of the Proposed Scheme, and the low baseline noise levels (further details are provided in Section 7.4 below), it is assumed that the BS 5228-1 category A thresholds (the most stringent) would be most appropriate. This means the daytime SOAEL is set at 65dB $L_{Aeq,T}$. The baseline noise levels obviously vary across the Proposed Scheme, meaning the LOAEL would be different for each receptor. In order to be proportionate a single LOAEL has been derived for all receptors based on the measured baseline noise levels. The measured levels at the three unattended monitoring positions have been averaged for all the weekday daytime periods between 07:00 – 19:00 hours for the daytime and 23:00 – 07:00 hours for the night-time. This is considered robust as noise levels below the SOAEL would not be considered significant even if above the LOAEL.

7.3.72 For the night-time, the average of the measured night-time noise levels indicated that the category B thresholds from BS 5228-1 would be appropriate. However, as the measurement locations are not necessarily representative of all receptors, and given the sensitivity of the night-time period, a worst-case approach has been adopted to utilise the category A thresholds for the night-time, to align with the daytime period. As such, rather than adopting the LOAEL in line with the baseline levels, it has been taken to be 5dB below the SOAEL.

7.3.73 As the construction noise level predictions are in terms of façade levels, but the measured noise levels were free-field, a 3dB correction has been added to the measured levels to derive the façade criteria.

7.3.74 On this basis, Table 7-6 presents the magnitude of impact scale adopted for the construction noise assessment.

Table 7-6 Construction noise – magnitude of impact scale

Daytime construction noise level, (façade) dB $L_{Aeq,T}$	**Night-time construction noise level (façade), dB $L_{Aeq,T}$**	**Magnitude of impact**
< 55	< 40	Negligible
55 – 65	40 - 45	Minor
65 - 70	45 - 50	Moderate
> 70	> 50	Major

Construction traffic noise

7.3.75 Given the potential for construction routes to cover a vast area where baseline noise measurements or predictions may not be available, an alternative approach is advised in DMRB LA 111 for noise impacts associated with construction vehicles.

7.3.76 BNL calculations are undertaken for potentially affected routes with and without the predicted construction vehicles. The noise level change has been considered against the magnitude of impact scale presented in Table 7-7 (which is in accordance with DMRB LA 111 Table 3.17).

Table 7-7 Construction traffic noise – magnitude of impact scale

Noise level change as a result of construction traffic, dB $L_{A10,18hr}$	**Magnitude of impact**
< 1.0	Negligible
1.0 – 2.9	Minor
3.0 – 4.9	Moderate

Noise level change as a result of construction traffic, dB $L_{A10,18hr}$	Magnitude of impact
≥ 5.0	Major

Construction noise significance of effect

7.3.77 With regard to the potential significance of predicted impacts from construction noise (including construction traffic noise) DMRB LA 111 states the following:

"*Construction noise and construction traffic noise shall constitute a significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:*

- *10 or more days or nights in any 15 consecutive days or nights;*
- *A total number of days exceeding 40 in any 6 consecutive months."*

7.3.78 Therefore, for a significant adverse effect to occur as a result of construction noise, impacts of moderate or major magnitude would need to be predicted at a particular receptor for a period exceeding the above durations.

Construction vibration

7.3.79 DMRB LA 111 provides a magnitude of impact scale for construction vibration which is inherently based on the LOAEL and SOAEL thresholds. It is therefore appropriate to first derive these thresholds before the magnitude of impact scale.

7.3.80 Table 7-8 presents the LOAEL and SOAEL thresholds used for this assessment which are taken from DMRB LA 111.

Table 7-8 Construction vibration LOAEL and SOAEL thresholds (reproduced from DMRB LA 111 Table 3.31)

Time Period	LOAEL	SOAEL
All time periods	0.3mm/s PPV	1.0mm/s PPV

7.3.81 For construction vibration the magnitude of impact scale has been determined based on DMRB LA 111. DMRB LA 111 aligns a negligible magnitude of impact with the LOAEL and the moderate and major magnitude of impact with the SOAEL. Table 7-9 presents the magnitude of impact scale for construction vibration.

Table 7-9 Construction vibration - magnitude of impact scale

Vibration level, PPV mm/s	Magnitude of impact
≤ 0.3	Negligible
0.4 – 0.9	Minor
1.0 – 9.9	Moderate
≥ 10.0	Major

7.3.82 With regard to the potential for significant effects to occur as a result of construction vibration, DMRB LA 111 states:

"*Construction vibration shall constitute a likely significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:*

- *10 or more days or nights in any 15 consecutive days or nights; or*
- *A total number of days exceeding 40 in any 6 consecutive months."*

7.3.83 Therefore, for a significant adverse effect to occur as a result of construction vibration, impacts of moderate or major magnitude would need to be predicted at a particular receptor for a period exceeding the above durations.

Operational road traffic noise

7.3.84 The LOAEL and SOAEL thresholds for operational road traffic are defined in DMRB LA 111 (Table 3.49.1) and have been reproduced in Table 7-10 below.

Table 7-10 Operational road traffic noise LOAEL and SOAEL thresholds (reproduced from DMRB LA 111 Table 3.49.1)

Time period	LOAEL	SOAEL
Day (06:00 – 24:00)	55dB $L_{A10,18hr}$ façade	68dB $L_{A10,18hr}$ façade

Time period	LOAEL	SOAEL
Night (23:00 – 07:00)	40dB L_{night}, outside (free-field)	55dB L_{night}, outside (free-field)

NOTE: 'L_{night}' is equivalent to the '$L_{Aeq,8hr}$' descriptor which is used in this chapter.

7.3.85 As stated above in paragraph 7.3.48, noise level changes for the Proposed Scheme have been determined for the following scenarios:

- Short-term – DM2029 v DS2029
- Long-term – DM2029 v DS2044
- Long-term future baseline – DM2029 v DM2044

7.3.86 The magnitude of impact scale for the short-term noise level change is defined in Table 7-11, as adopted from DMRB LA 111 Table 5.54a.

Table 7-11 Operational road traffic noise - magnitude of impact scale - short-term

Short-term noise level change, dB	Short-term magnitude of impact
< 1.0	Negligible
1.0 – 2.9	Minor
3.0 – 4.9	Moderate
≥ 5.0	Major

7.3.87 The magnitude of impact scale for the long-term noise level change (including the long-term future baseline change) is defined in Table 7-12, as adopted from DMRB LA 111 Table 3.54b.

Table 7-12 Operational road traffic noise – magnitude of impact scale – long-term

Long-term noise level change, dB	Long-term magnitude of impact
< 3.0	Negligible
3.0 – 4.9	Minor
5.0 – 9.9	Moderate
≥ 10.0	Major

7.3.88 In contrast to the magnitude of impact scales for construction noise and vibration, where only adverse impacts are likely, the above scales for short- and long-term operational road traffic impacts apply for both adverse and beneficial noise level changes. A negative noise level change (a noise level reduction as a result of the Proposed Scheme) would lead to a beneficial impact, whilst a positive noise level change (a noise level increase as a result of the Proposed Scheme) would lead to an adverse impact.

7.3.89 Also, in contrast to the construction noise and vibration assessments, the potential significance of an effect depends on both the predicted magnitude of impact, and a range of contextual factors which need to be considered which are discussed further in Table 7-14 below. Notwithstanding this, the DMRB LA 111 suggests that an initial assessment of potential significance is undertaken using the short-term noise level change as shown below in Table 7-13.

Table 7-13 Operational road traffic noise – initial estimation of significance

Short-term magnitude of noise level change	Initial estimation of significance
Negligible	Not significant
Minor	Not significant
Moderate	Significant
Major	Significant

7.3.90 DMRB LA 111 goes on to state (in paragraph 3.59) that:

> *"Where the magnitude of change in the short term is negligible at noise sensitive buildings, it shall be concluded that the noise change will not cause changes to behaviour or response to noise and as such, will not give rise to a likely significant effect."*

7.3.91 Where noise level changes in the short-term of minor, moderate or major magnitude of impact are predicted, further consideration should be given as to whether these changes could lead to significant effects.

7.3.92 Table 3.60 within DMRB LA 111 (which has been reproduced as Table 7-14 below) sets out the factors which should be considered as part of this decision.

Table 7-14 Determining final operational significance on noise sensitive buildings (reproduced from DMRB LA 111 Table 3.60)

Local circumstance	Influence on significance judgement
Noise level change (is the magnitude of change close to the minor / moderate boundary?)	1) Noise level changes within 1 dB of the top of the 'minor' range can indicate that it is more appropriate to determine a likely significant effect. Noise level changes within 1 dB of the bottom of a 'moderate' range can indicate that it is more appropriate to consider a change is not a likely significant effect.
Differing magnitude of impact in the long term to magnitude of impact in the short term	1) Where the long term impact is predicted to be greater than the short term impact, it can be appropriate to conclude that a minor change in the short term is a likely significant effect. Where the long term impact is predicted to be less than the short term it can be appropriate to conclude that a moderate or major change in the short term is not significant. 2) A similar change in the long term and non-project noise change can indicate that the change is not due to the project and not an indication of a likely significant effect.

Local circumstance	Influence on significance judgement
Absolute noise level with reference to LOAEL and SOAEL (by design this includes sensitivity of receptor)	1) A noise change where all do-something absolute noise levels are below SOAEL requires no modification of the initial assessment. 2) Where any do-something absolute noise levels are above the SOAEL, a noise change in the short term of 1.0 dB or over results in a likely significant effect.
Location of noise sensitive parts of a receptor	1) If the sensitive parts of a receptor are protected from the noise source, it can be appropriate to conclude a moderate or major magnitude change in the short term and/or long term is not a likely significant effect. 2) Conversely, if the sensitive parts of the receptor are exposed to the noise source, it can be more appropriate to conclude a minor change in the short term and/or long term is a likely significant effect. 3) It is only necessary to look in detail at individual receptors in terms of this circumstance where the decision on whether the noise change gives rise to a significant environmental effect is marginal.
Acoustic context	1) If a project changes the acoustic character of an area, it can be appropriate to conclude a minor magnitude of change in the short term and/or long term is a likely significant effect.

Local circumstance	Influence on significance judgement
Likely perception of change by residents	1) If the project results in obvious changes to the landscape or setting of a receptor, it is likely that noise level changes will be more acutely perceived by the noise sensitive receptors. In these cases it can be appropriate to conclude that a minor change in the short term and/or long term is a likely significant effect. 2) Conversely, if the project results in no obvious changes for the landscape, particularly if the road is not visible from the receptor, it can be appropriate to conclude that a moderate change in the short term and/or long term is not a likely significant effect.

7.3.93 The approach to the determination of significant effects within DMRB LA 111, allowing for professional judgement and consideration of contextual factors means that receptors experiencing minor magnitudes of impact can be considered significant, and receptors experiencing moderate or major magnitudes of impact can be considered non-significant.

7.4 Baseline conditions

Baseline noise climate

7.4.1 At the northern end of the Proposed Scheme, the noise climate is dominated by road traffic noise from Fakenham Road (A1067). Moving south there is some contribution to the noise climate from road traffic on the nearby local roads, albeit at a low level. At the southern end of the Proposed Scheme, the noise climate is dominated by road traffic noise from the A47.

7.4.2 The assessment of the Proposed Scheme includes the as-consented A47 North Tuddenham to Easton DCO scheme in all ‘with’ and ‘without’ scenarios.

7.4.3 Generally, for receptors not located nearby to either the A1067 or A47, the Proposed Scheme covers a predominantly rural area and the existing ambient noise levels are low.

Noise important areas

7.4.4 Noise Important Areas are locations that the Department for the Environment and Rural Affairs (Defra) has identified as containing the 1% of the population that are affected by the highest noise levels. These areas are identified in accordance with the results of strategic noise mapping, in order to identify the areas that require potential action to reduce noise levels. Based on Round 3 of the UK noise mapping project undertaken by Defra, it has been confirmed that there are no Noise Important Areas within the immediate vicinity of the Proposed Scheme, including within the detailed calculation area.

Noise survey

7.4.5 Noise surveys were undertaken for the Proposed Scheme at five locations. The noise surveys were undertaken during 2021 at a time when significant COVID-19 restrictions were not in place and outside of school holiday periods. The impact of COVID-19 on the measured noise levels is therefore anticipated to be minimal. The locations are shown in **Appendix 7.8: Noise and Vibration Figures - Figure 7.3: Detailed calculation area** (Document Reference 3.07.08).

7.4.6 The noise survey data from 2021 is considered to remain valid, as it is unlikely the noise levels would have changed notably since the survey was undertaken. Further, the assessments within this chapter are predominantly predictive, and small changes in baseline noise levels would not affect the conclusions of the assessment.

7.4.7 The noise survey was not updated following the change to the Proposed Scheme alignment, as the survey locations are considered to provide appropriate coverage within the vicinity of the Proposed Scheme.

7.4.8 Unattended measurements were undertaken as follows:

- Measurement position 1 (MP1) – In the rear garden of Breck Barn Cottage off Weston Road. The microphone was mounted on a tripod at a height of approximately 1.5m. Given the available space in the garden, the measurement was not strictly free-field given the proximity

to the garden fence, however, for the purpose of this assessment a robust assumption has been made that the measurement should be considered free-field because these measurements have primarily been used to derive the noise model background correction which is discussed further below, assuming the measurement is free-field, and therefore not adding a 3dB façade correction is worst-case in the context of this assessment. Measurements were undertaken at this location from 2 July to 8 July 2021;

- Measurement position 2 (MP2) - In a small woodland area off Ringland Lane. The microphone was mounted on a tripod at a height of approximately 1.5m and was in free-field conditions. Measurements were undertaken at this location from 22 September to 29 September 2021; and
- Measurement position 3 (MP3) – In a field adjacent to Weston Green Road, opposite the residential properties at Green Farm. The microphone was mounted on a tripod at a height of approximately 1.5m and was in free-field conditions. Measurements were undertaken at this location from 22 September to 29 September 2021.

7.4.9 The purpose of the unattended measurements was to gain an understanding of the noise levels in the central area of the Proposed Scheme, away from the A47 and A1067 where noise levels are lower. The following section describes how these measurements have been incorporated into the noise assessment within this chapter.

7.4.10 The attended measurements were undertaken as follows:

- Measurement position 4 (MP4) – Adjacent to the A1067, measurements were taken over a three-hour period on 8 July 2021. This measurement was undertaken in accordance with the CRTN shortened measurement procedure and was in free-field conditions; and

- Measurement position 5 (MP5) – Adjacent to Paddy's Lane in the rear garden of The Cottage in free-field conditions. The measurement was undertaken over a three-hour period on 2 July 2021 and was in accordance with the CRTN shortened measurement procedure. This measurement position is located outside of the detailed calculation area, however, this area and Paddy's Lane are included within the noise model as the road is sufficiently close to the detailed calculation area to contribute to the noise levels.

7.4.11 The purpose of the two attended measurements was to give an understanding of noise levels from the A1067 and Paddy's Lane in order to review against the predicted levels from the noise model. Measurements were not undertaken close to the A47 as it is assumed the proposed dualling would be complete in advance of the Proposed Scheme and therefore current noise levels are not representative of the future situation where the A47 dualling is complete. Comparison of the noise model and the measured levels at MP4 and MP5 indicate that the noise model overpredicts slightly in comparison to the measured levels, but this is likely as a result of increases in traffic flows between the surveys were undertaken in 2021 and the opening year of 2029.

7.4.12 Table 7-15 presents a summary of the unattended noise levels measured on Site. Ranges in noise levels are presented for each measurement position based on the daytime and night-time periods. Only full periods are presented in the table.

Table 7-15 Summary of noise levels measured at MP1, MP2 and MP3

Measurement position	Daytime 10th percentile level, dB $L_{A10,18h}$ (06:00 – 00:00)	Daytime background level, dB $L_{A90,18h}$ (06:00 – 00:00)	Night-time average equivalent level, dB $L_{Aeq,8h}$ (23:00 – 07:00)	Night-time background level, dB $L_{A90,8h}$ (23:00 – 07:00)
MP1	49 - 52	29 - 35	39 – 48	22 - 32
MP2	42 - 54	25 - 38	35 – 52	20 - 33
MP3	41 - 56	28 - 38	35 – 45	22 - 31

7.4.13 Table 7-16 presents a summary of the attended noise measurements at MP4 and MP5.

Table 7-16 Summary of noise levels measured at MP4 and MP5

Measurement position	Date / start time	Average equivalent noise level, dB $L_{Aeq,3h}$	10th percentile noise level, dB $L_{A10,13h}$
MP4	08/07/2021 10:35	59	60
MP5	02/07/2021 10:30	52	57

7.4.14 Full details of the noise survey, including equipment information is presented in **Appendix 7.4: Noise survey details** (Document Reference: 3.07.04).

Noise model background noise

7.4.15 The noise model only includes road traffic sources, meaning that all other man-made and natural sources such as aircraft, trees / leaves rustling, agricultural vehicles and birdsong are not included. Furthermore, given the majority of the minor roads within the detailed calculation area do not carry a sufficient vehicle flow to be included in the noise model (less than 1000 AAWT), the do-minimum noise model scenarios are likely to be underestimating noise levels for much of the area.

7.4.16 To account for the potential contribution from sources not included in the acoustic model or excluded from the calculation, a noise floor for existing ambient noise has been applied. This is especially relevant for more remote

locations away from existing roads, where the noise model may be less accurate.

7.4.17 The background noise levels (dB $L_{A90,18h/8h}$) for the three long-term measurement positions have been averaged for all full weekday periods. These levels (31dB during the daytime and 26dB during the night) have been applied as the noise floor to the noise model. The noise floor is applied so that existing noise levels in areas distant from road sources are more accurately represented.

7.4.18 The noise model noise floor avoids unrealistically low noise levels at those receptors toward the centre of the Proposed Scheme, where there are no nearby noise sources in the do-minimum scenario. However, a comparison of the measured noise levels and the noise model predictions at these locations shows that the noise model is still under-predicting. However, it was considered that adding higher background noise corrections could lead to underestimating noise level changes in some locations.

7.4.19 The noise model only includes road traffic sources, and the results presented within this assessment should be seen in this light. For example, a number of receptors at a large distance from the Proposed Scheme are predicted to experience high noise level changes, however, in reality it may be that other sources dominate for much of the time and the Proposed Scheme is not audible at all times.

7.4.20 Situations such as this, where local very lightly trafficked roads are replaced by a distant much busier road are difficult to assess given the different nature of the sources. Nearby local roads result in short, high noise levels, followed by periods of quiet, whereas, the Proposed Scheme would generate lower, but more constant noise levels.

7.4.21 The approach adopted for this assessment is considered conservative, because the noise level changes presented may be higher than would occur in reality.

Baseline Noise Levels

7.4.22 **Appendix 7.8: Figures - Figure 7.4: Do-minimum noise contours** (Document Reference: 3.07.08) presents a noise contour plot showing the predicted noise levels in 2029 without the Proposed Scheme within the detailed calculation area.

Future baseline

Operational Stage

7.4.23 The operational stage road traffic noise assessment relies primarily on an appraisal of predicted road traffic noise levels. A detailed noise modelling exercise has therefore been undertaken to quantify the future baseline for the year 2044 (15 years after the Proposed Scheme opening year).

7.4.24 The do-minimum future year (2044) model scenario is used to determine the future baseline. The future baseline building receptor noise levels are categorised according to the relevant LOAEL and SOAEL threshold, and the noise changes from 2029 to 2044 (without the Proposed Scheme). The results of this analysis are presented in **Appendix 7.5: Future baseline assessment** (Document Reference: 3.07.05).

7.5 Sensitive receptors

7.5.1 Given the differing Study Areas for the construction noise and vibration, and operational assessments, it is appropriate to consider the sensitive receptors within each area individually.

7.5.2 Existing sensitive receptors within the Study Areas have been identified using the AddressBase Plus® data (AddressBase data is an Ordnance Survey data product. The data used for this assessment has been provided by Norfolk County Council) and the results of the desk study. The receptor dataset has then been supplemented where the desk study identified other non-address-based receptors such as outdoor space sensitive areas.

7.5.3 Low Farm, Ringland is located close to the southern end of the River Wensum viaduct and lies within the operational noise and construction noise and

vibration Study Areas. However, it has been confirmed that the dwelling at Low Farm would be purchased by NCC (the Applicant) and would not be inhabited during the construction stage. The property may be used as a site office (which would require submission of a change of use application to Broadlands District Council) during the construction stage, but this would not be considered a noise sensitive receptor. Following the opening of the Proposed Scheme, the property would not return to residential use unless a planning application for a change of use back to residential is submitted and approved, which the Applicant does not intend to do. Any future planning application would need to consider the noise levels from the Proposed Scheme and how they affect the property. On this basis, Low Farm is not included as a sensitive receptor in any assessment within this Chapter.

7.5.4 Within this Chapter, several receptors are mentioned with Old Hall Farm within their address. Given their proximity to the proposed Scheme, these receptors are discussed regularly. To avoid confusion, the receptors are referred to as follows:

- Old Hall Farm – A single property, which has recently been extended. It is understood that this is the main residential building within the Old Hall Farm estate.
- Old Hall Farm Cottages – Two properties in close proximity to the A1067, next to Woodstock.
- Old Hall Farm barns – Three properties which are recently understood to have been converted to residential use through a change of use application. As the postal address of these three receptors is not known, they have been referred to as Old Hall Farm barns. The barns are located approximately 40m from the main residential property at Old Hall Farm
- Old Hall Farm holiday let – A single holiday let which is understood to be located within the Old Hall Farm estate, located approximately 70m from the main residential property at Old Hall Farm

Construction noise and vibration

Construction noise

7.5.5 In line with DMRB LA 111 construction noise impacts have been assessed at sample receptors (representative of those around them) at key locations surrounding the proposed works. It would not be proportionate to assess construction noise levels at all receptors within the Construction Noise Study Area. Table 7-17 presents sample receptors which are considered to provide a good coverage around the Proposed Scheme and be a representative of other nearby receptors within 300m of the main works on Site.

Table 7-17 Sample receptors for construction noise assessment

Receptor Number	Receptor Location
C1	Mouse Wood Farm, Wood Lane, Honingham, NR9 5AU
C2	Pump Farm, Weston Green Road, Weston Longville, NR9 5LA
C3	Field Farm, Ringland Lane, Weston Longville, NR9 5JT
C4	Peacehaven, Fakenham Road, Taverham, NR8 6HS
C5	Deighton Hills House, Fakenham Road, Taverham, NR8 6HS
C6	2 Breck Barn Cottage, Ringland, NR8 6JL
C7	Norwood, Honingham, NR9 5AT
C8	2 The Cottages, Breck Road, Weston Green, Weston Longville, NR9 5LQ
C9	Woodstock, Fakenham Road, Attlebridge, NR9 5TQ
C10	Old Hall Farm, Fakenham Road, Attlebridge, NR9 5TQ

7.5.6 These receptors are shown on **Appendix 7.8: Noise and Vibration Figures - Figure 7.1: Construction Study Area** (Document Reference 3.07.08).

7.5.7 Construction noise impacts are not considered to cause a significant effect in open space receptors due to the localised impact; the extent of the area impacted relative to the total available area; the availability of alternative space; the transient use of these spaces by people, the temporary nature of construction works, and the adoption of mitigation measures.

Construction Vibration

7.5.8 The construction assessment only considered vibration impacts from road rollers which would only occur at receptors close to these works. Therefore, the construction vibration assessment focusses on the receptors at Old Hall Farm Cottages and Woodstock which are located close to the A1067 at the northern end of the Proposed Scheme.

Operational noise

7.5.9 As the Operational Noise Study Area extends well beyond the Proposed Scheme, a receptor specific assessment is not undertaken for this entire area. All receptors within this area are considered, but noise level changes are not reported individually.

7.5.10 A receptor specific assessment is only undertaken within the detailed calculation area (600m from the Proposed Scheme carriageways). Within this area, the following sensitive receptors have been assessed:

- 4 residential receptors;
- One holiday let (at Old Hall Farm estate) and
- One wedding venue (The Keeper and the Dell).

7.5.11 The holiday let was identified from a satellite imagery search and was confirmed on letting websites. The wedding venue was identified from a satellite imagery search and was confirmed by the venue's website. It is unclear which buildings / outside areas are used as part of the venue and therefore, a receiver location has been used in the model in the central area of the Site which is considered representative for the whole venue. Whilst the venue may operate during the night-time period (23:00 – 07:00) it is considered that the daytime period (06:00 – 00:00) would cover the majority of the venue's operating hours and therefore, predictions have only been undertaken for the daytime.

7.5.12 The locations of these receptors are shown on **Appendix 7.8: Noise and Vibration Figures - Figure 7.3: Detailed calculation area** (Document Reference 3.07.08).

7.5.13 Furthermore, operational noise impacts have been considered on outdoor spaces where humans may be affected by noise as follows:

- River Wensum Site of Special Scientific Interest (SSSI);
- River Wensum Special Area of Conservation (SAC); and
- Wensum Valley Hotel, Golf and Country Club golf course (the clubhouse and some of the course lie outside the detailed calculation area).

7.5.14 There are various public rights of way (PRoW) within the detailed calculation area which may be affected by the Proposed Scheme. The operational noise impacts on users of the PRoW are discussed collectively in Section 7.6. As these external receptors cover a large area, and the noise levels (both in terms of absolute noise levels, and noise level changes) would vary across the area. The impacts are considered based on the noise contour plots rather than predictions at a particular location. This assessment is presented in Section 7.6 below.

7.6 Assessment of potential effects, mitigation, monitoring and residual effects

Construction phase

Potential effects

7.6.1 Any construction works near to receptors have the potential to cause disturbance to nearby residents due to noise and vibration. Given the scale of the construction works associated with the Proposed Scheme, there is the potential for significant adverse construction noise and vibration effects to occur.

7.6.2 Furthermore, vehicles associated with the construction of the Proposed Scheme (in particular heavy duty vehicles) using the existing road network have the potential to result in increases in road traffic noise which could be significant.

7.6.3 Mitigation measures have therefore been included in the Outline Construction Environmental Management Plan (Document Reference 3.03.01) which will inform the Contractor's CEMP during the construction phase.

Embedded mitigation

7.6.4 In advance of the commencement of the main works on Site, Section 61 consent (in line with the Control of Pollution Act 1974) will be sought from Broadland District Council. The purpose of the Section 61 consent will be to agree appropriate noise and vibration controls and mitigation measures, once greater details are known about the construction working methods that will be adopted on Site. The Section 61 consent application will also identify the need for any additional mitigation measures, as discussed below from paragraph 7.6.36.

7.6.5 The benefit of obtaining a Section 61 consent is that it allows Broadland District Council further opportunities to consider the potential for noise and vibration impacts during construction and agree appropriate controls and mitigation measures, closer to the start of works when more details are known.

7.6.6 Best Practicable Means (BPM) as defined in the Control of Pollution Act 1974 should be adopted throughout the Proposed Scheme. The most relevant and specific commitments with respect to noise and vibration are set out below:

- all construction plant used on the Site will be in good working order and certificates of inspection and maintenance will be held on Site and available on request;

- all plant items should be properly maintained and operated according to manufacturers' recommendations and in such a manner as to avoid causing excessive noise and vibration;
- as far as reasonably practicable, all plant items should be sited so that noise and vibration at nearby sensitive properties is minimised;
- all plant items operating intermittently on the Site should be shut down in the intervening periods;
- all pneumatic tools should be fitted with silencers or mufflers where practicable;
- no loud music or loud radios will be played on the Site;
- construction vehicles should not idle on local roads waiting to enter the Site;
- works (including deliveries) would be programmed such that the requirement for working outside normal working hours is minimised;

  where construction works are occurring within 50m of a residential property, if appropriate, temporary environmental noise barriers will be installed around plant items to provide screening; and
- the importance of noise and vibration and its potential to affect those living and working nearby will be included in the general induction training for the Site and specific training will be given to staff who will have particular responsibility for managing noise and vibration during construction.

7.6.7 These measures are also reported in **Environmental Statement Appendix 1: Outline Construction Environmental Management Plan (OCEMP)** (Document Reference 3.03.01).

Monitoring

7.6.8 Construction works shall be monitored on site to ensure that best practicable means and other appropriate mitigation measures are being adhered to.

7.6.9 The scope of any noise and / or vibration monitoring will be agreed with Broadland District Council as part of the Section 61 consent that the contractor will apply for.

Residual effects

On-site noise effects

7.6.10 This assessment considers the noise effects likely to arise during construction works associated with the Proposed Scheme. It is expected that there would be some disruption in terms of noise impacts at existing sensitive receptors, however, disturbance would be localised, and works would be temporary.

7.6.11 The majority of on-site works would be undertaken during core construction working hours (07:00 – 19:00 hours on weekdays and 08:00 – 13:00 on Saturdays). However, there is the potential for night-time working associated with certain critical activities associated with the construction of structures and for the A1067 upgrades. The daytime and night-time works have been assessed individually.

7.6.12 Features between the source and receptor can also help to obstruct the passage of noise. When works are being undertaken where a line of sight to the plant is obscured, a notable reduction in noise levels would be experienced. However, in order to be cautionary, the construction assessment has been undertaken assuming that no screening from existing topography or buildings will be present.

7.6.13 The calculation methodology contained in BS 5228-1 has been used to predict the levels of noise that are potentially generated by the works at the nearby sensitive receptors. The construction plant emission data have been taken from Annex C of BS 5228-1. Details of these plant and their noise emission levels, as well as their assumed 'on-time', are shown in **Appendix 7.6: Construction plant assumptions** (Document Reference: 3.07.06).

Daytime works

7.6.14 Noisy activities within the construction areas would vary in distance to noise sensitive dwellings over time due to the nature of the Proposed Scheme.

Therefore, for the daytime works, two scenarios have been assessed where receptors are within 300m of construction activities; an average scenario and a worst-case scenario. Where receptors are over 300m from the anticipated location of the activity, noise levels have not been predicted as significant effects are unlikely beyond this distance (marked with 'NA' in the below tables).

7.6.15 The average case scenario assumes all plant is operating at a distance of 150m from the receptor location or the shortest distance to the activities where the distance is greater than 150m.

7.6.16 The average case is itself cautionary in that given the length of the Proposed Scheme, for much of the time, works would be undertaken at distances much greater than 150m.

7.6.17 The worst-case scenario is only assessed where activities are anticipated to occur less than 150m from sensitive receptors. The worst-case scenario assumes that three of the louder items of plant for each activity operating at the closest distance to the receptor and the remaining plant at a distance of 150m. Where receptors are located beyond 150m the worst-case noise level prediction is the same as the average case (and based on the distance between the receptor and the works).

7.6.18 The main construction works have been assumed to be undertaken within the Site Boundary (although excluding the small easements where only minor works are anticipated to be undertaken for example close to receptors C6, C7 and C8) and as set out by the contractor.

7.6.19 All three activities require consideration for the daytime assessment, although Activity 1 - Site clearance and earthworks (including enabling works and landscaping) affects the greatest number of receptors.

7.6.20 Table 7-18 presents the predicted noise levels at the identified noise sensitive receptors for both the worst-case (WC) and average case (AVG) scenarios for the on-site works during each activity.

Table 7-18 Predicted daytime construction noise levels (façade levels)

Receptor Number	Activity 1 WC, dB $L_{Aeq,10hr}$	Activity 1 AVG, dB $L_{Aeq,10hr}$	Activity 2 WC, dB $L_{Aeq,10hr}$	Activity 2 AVG, dB $L_{Aeq,10hr}$	Activity 3 WC, dB $L_{Aeq,10hr}$	Activity 3 AVG, dB $L_{Aeq,10hr}$
C1	66	63	Not applicable	Not applicable	Not applicable	Not applicable
C2	70	63	Not applicable	Not applicable	Not applicable	Not applicable
C3	61	61	Not applicable	Not applicable	Not applicable	Not applicable
C4	65	65	Not applicable	Not applicable	Not applicable	Not applicable
C5	66	65	Not applicable	Not applicable	Not applicable	Not applicable
C6	60	60	Not applicable	Not applicable	Not applicable	Not applicable
C7	61	61	Not applicable	Not applicable	Not applicable	Not applicable
C8	58	58	Not applicable	Not applicable	Not applicable	Not applicable
C9	78	65	Not applicable	Not applicable	76	65
C10	64	64	56	56	64	64

7.6.21 As set out above, noise levels have been predicted at sample receptors based on their proximity to the on-site works. Hence, where activities are occurring at a distance of more than 300m from any specific receptor, noise levels have not been predicted at that receptor location.

7.6.22 Table 7-19 presents the above predicted noise levels in terms of the magnitude of impact category.

Table 7-19 Magnitudes of impact for construction noise (daytime)

Receptor Number	Activity 1 WC, impact	Activity 1 AVG, impact	Activity 2 WC, impact	Activity 2 AVG, impact	Activity 3 WC, impact	Activity 3 AVG, impact
C1	Moderate	Minor	Not applicable	Not applicable	Not applicable	Not applicable
C2	Major	Minor	Not applicable	Not applicable	Not applicable	Not applicable
C3	Minor	Minor	Not applicable	Not applicable	Not applicable	Not applicable
C4	Moderate	Moderate	Not applicable	Not applicable	Not applicable	Not applicable
C5	Moderate	Moderate	Not applicable	Not applicable	Not applicable	Not applicable
C6	Minor	Minor	Not applicable	Not applicable	Not applicable	Not applicable
C7	Minor	Minor	Not applicable	Not applicable	Not applicable	Not applicable
C8	Minor	Minor	Not applicable	Not applicable	Not applicable	Not applicable
C9	Major	Moderate	Not applicable	Not applicable	Major	Moderate
C10	Minor	Minor	Minor	Minor	Minor	Minor

7.6.23 Moderate or major significant adverse noise impacts are predicted at five of the ten receptors as a result of the works during the worst-case scenario.

7.6.24 It is assumed that the durations discussed in paragraph 7.3.80 (10 out of any 15 consecutive days or a total of 40 days in any 6 month period) are likely to be exceeded given the nature of these works, and therefore, it has been assumed that these impacts could result in significant adverse effects.

7.6.25 On this basis, **significant** adverse construction noise effects (taking into account the embedded mitigation measures) are anticipated at the following sample receptors as a result of on-site construction noise during the daytime based on either the worst-case or average scenario:

- C1 – Mouse Wood Farm;
- C2 – Pump Farm;

- C4 – Peacehaven;
- C5 – Deighton Hills House; and
- C9 – Woodstock.

Night-time works

7.6.26 As discussed above, there is the potential for night works to occur for certain critical construction activities. In particular, night works may be required for the proposed structures. Whilst there are no receptors within 300m of the proposed structures, an assessment has been undertaken for the closest receptors to these works to ensure that all potential significant effects are identified. Given its size, the River Wensum viaduct is the proposed structure that is most likely to require night works and is therefore the focus of this assessment.

7.6.27 Furthermore, night-time works are also proposed along the A1067 in order to minimise disruption to traffic along this route.

7.6.28 On account of the location of the night-time works, this assessment focusses on receptors C5 – Deighton Hills House, C9 – Woodstock and C10 - Old Hall Farm which are all located at the northern end of the Proposed Scheme.

7.6.29 Only worst-case predictions have been undertaken for the night-time works, meaning that for the majority of night-time working, the noise levels are likely to be lower than predicted. Table 7-20 presents the predicted noise levels for both the structure construction and road construction during the night-time along with the associated magnitude of impact.

Table 7-20 Predicted night-time construction noise levels (façade levels)

Receptor	Activity 2 – Structure construction, predicted noise level dB $L_{Aeq,T}$	Activity 2 – Structure construction, magnitude of impact	Activity 3 – Road construction, predicted noise level dB $L_{Aeq,T}$	Activity 3 – Road construction, magnitude of impact
C5 – Deighton Hills House	Not applicable	Not applicable	55	Major
C9 – Woodstock	51	Major	76	Major
C10 - Old Hall Farm	49	Moderate	59	Major

7.6.30 Predictions are not provided for C5 for Activity 2 - Structure construction as the distance is over 700m away.

7.6.31 Whilst the magnitude of impact for all receptors is moderate or major for both activities, these noise levels would only result in significant adverse effects if the noise levels exceed the durations outlined in paragraph 7.3.80 (10 out of any 15 days or 40 days in 6 months).

7.6.32 A worst-case approach has been adopted in the derivation of the most stringent night-time criteria from BS 5228-1. As the criteria have been adopted universally for all receptors, in reality a higher criterion might be appropriate for some receptors such as C9 – Woodstock which is located close to the existing A1067.

7.6.33 With the exception of Activity 3 – Road construction at C9 – Woodstock, the predicted noise levels are not particularly high in absolute terms.

7.6.34 Given the current uncertainty around the frequency of potential night works, it is not possible to confirm whether the durations in paragraph 7.3.80 would be exceeded. However, in order to be cautionary at this stage, it has been assumed that these durations might be exceeded and therefore significant

effects are anticipated at the receptors, C5 – Deighton Hills House, C9 – Woodstock and C10 – Old Hall Farm for both activities assessed.

7.6.35 Whilst significant effects could occur at all three sample receptors during the night, it is appropriate to consider further mitigation for the receptors at C9 – Woodstock, as the predicted noise levels from Activity 3 – Road construction are notably louder than the other works, given the proximity of the receptors to the A1067.

7.6.36 BS 5228-1 advises (in Annex E) that temporary re-housing should be offered where noise levels are predicted to exceed 65dB $L_{Aeq,T}$ (façade) for durations exceeding 10 out of any 15 nights or 40 nights in a 6 month period. It is therefore proposed that as part of the Section 61 consent process, additional assessments should be undertaken to determine whether these thresholds are likely to be exceeded at the properties surrounding C9 - Woodstock. If this is the case, then temporary re-housing should be offered for the duration of the night-time works. Given the likely frequency of night works is not yet known, it is not possible to determine whether the required durations would be exceeded at this stage.

7.6.37 Given the limited frequency of night-time works currently anticipated, noise insulation is not considered an appropriate mitigation measure for these properties and, temporary re-housing for the small amount of night works is, if required, considered more appropriate. This would be reviewed as further assessments are undertaken as part of the Section 61 consent process prior to construction works commencing.

7.6.38 Whilst temporary re-housing would ameliorate the significant effect at the receptors at C9 – Woodstock, as discussed above, given the uncertainty around the night works at this stage, residual **significant adverse construction noise effects** are anticipated at C5 – Deighton Hills House, C9 – Woodstock and C10 – Old Hall Farm, during the night-time.

On-site vibration effects

7.6.39 As discussed from paragraph 7.3.34 onwards, given the large distance to receptors from any piling works, the main activity considered likely to generate vibration at nearby receptors is road rolling.

Road rollers

7.6.40 For vibratory road rollers, it is anticipated that vibration levels of greater than or equal to 1mms^{-1} (equivalent to an adverse impact of moderate magnitude, which is a significant effect) would only be generated at distances within 25m of road carriageways. The only sensitive receptors within 25m of where road rolling would occur are Old Hall Farm Cottages and Woodstock at the northern end of the Proposed Scheme. Whilst the impacts at these receptors could be of moderate or major magnitude, it is unlikely that road rolling would occur for durations exceeding those outlined within paragraph 7.3.85 (10 days in 15 or 40 days in 6 months). On this basis, it is considered that the effects for all receptors as a result of construction vibration from road rollers would be **not significant**.

7.6.41 This calculation assumes a roller with two drums, 0.4mm amplitude and a drum width of 2m (e.g. a small ride on roller). The calculation incorporates a 5% chance of exceeding the criterion and is applicable to the start up and run down of machinery. During steady-state operation, vibration levels would be lower.

Construction traffic noise

7.6.42 Construction traffic noise levels have been calculated for the roads closest to the Site that would be used by vehicles. Beyond the local roads, construction traffic is expected to use the A47 and A1067.

7.6.43 The Transport Assessment considers three scenarios based on different access routes being available for construction traffic. Noise levels for construction vehicles have been assessed for all three scenarios, but for simplicity, only the highest (worst-case) noise level change has been presented for each road link. This means that in reality, depending on the

routes available, the noise level changes may be less than predicted. The construction traffic flows have been added to the do-minimum scenario to create a 'with Proposed Scheme construction traffic' scenario, which is itself compared to the do-minimum 2029 scenario. The difference in traffic flow during construction and the proposed opening year (2029) would be minimal, and therefore the comparison is considered to be valid.

7.6.44 Table 7-21 presents the noise level change as a result of construction traffic (compared to the DM2029 scenario) for the peak scenario. The magnitude of impact is also presented within the table.

Table 7-21 Construction traffic noise level changes

Road link	**Predicted noise level change, dB**	**Magnitude of impact**
A1067 (west of Marl Hill Road)	0.4	Negligible
A1067 (east of Marl Hill Road)	0.7	Negligible
Marl Hill Road	5.4	Major
Wood Lane - Paddy's Lane	3.7	Moderate
A47 (west of Wood Lane) Westbound	0.2	Negligible
A47 (west of Wood Lane) Eastbound	0.2	Negligible
A47 (east of Wood Lane) Eastbound	0.0	Negligible
A47 (east of Wood Lane) Westbound	0.1	Negligible

7.6.45 Based on the significance of effect scale in Table 7-7, impacts of negligible and minor magnitude are considered not significant. However, the major adverse impact at Marl Hill Road and moderate adverse impact at Wood lane – Paddy's Lane require further consideration.

7.6.46 Construction traffic would travel along Marl Hill Road and then Ringland Lane to enter the Proposed Scheme, however, Ringland Lane is not assessed as this would be within the Site Boundary and would be temporarily closed for periods of the Proposed Scheme construction.

7.6.47 DMRB LA 111 states that the Construction Traffic Noise Study Area should be within 50m of the kerb of roads used by construction vehicles. The only receptors which are within 50m of Marl Hill Road are those fronting the A1067. The noise levels at these receptors would be dominated by the A1067 and therefore a comparison of noise levels from Marl Hill Road in isolation is less appropriate. It is considered that the actual noise level change resulting from the construction vehicles is likely to be less than 5.4dB at these receptors. On this basis it is considered that the actual noise level change would be less, and at a magnitude unlikely to result in a significant effect.

7.6.48 As there are multiple receptors located within 50m of Wood Lane and Paddy's Lane, and noise levels would be dominated by traffic on these roads, it is not appropriate to adjust the initial conclusion of significance. Therefore, the effect as a result of construction traffic noise at receptors along Wood Lane and Paddy's Lane (1 Wood Farm Cottage, 2 Wood Farm Cottage and Mouse Wood Farm) is anticipated to be **significant.**

7.6.49 The effects as a result of construction traffic noise on all other access routes to the Site are anticipated to be **not significant**.

Operational phase

Potential effects

7.6.50 Given the introduction of a new road into the area, there is the potential for adverse noise impacts to occur at nearby properties as a result of road traffic noise.

7.6.51 Operational noise impacts are likely to occur both as a result road traffic using the Proposed Scheme itself, and changes in traffic on the existing road network.

7.6.52 As it is considered that there is the potential for significant adverse effects to occur, consideration has been given throughout the design process to mitigation measures which have been incorporated into the Proposed Scheme. These are described in the following section.

Embedded mitigation

7.6.53 Noise mitigation for operational road traffic noise can be considered in terms of mitigating the source, the pathway of noise or at the receiver.

7.6.54 In terms of mitigation at source, this includes the design of the road itself, the 3D alignment of the carriageways and the road surface type.

7.6.55 The Proposed Scheme alignment is designed to avoid passing close to residential receptors wherever possible. This is demonstrated by the very few receptors within the detailed calculation area.

7.6.56 The pavement surface type can impact the noise levels produced by vehicles. For the entire Proposed Scheme, a low noise surface would be used. For context, at speeds above 75kph, a low noise road surface would be 3dB quieter than a standard hot rolled asphalt surface type (based on the road surface corrections provided in DMRB LA 111).

7.6.57 The path of noise between source and receiver can be mitigated through screening measures in the form of earth bunds or acoustic barriers. Extensive earthworks have been included for the Proposed Scheme, either constructing the road in cutting or earth bunds parallel to the route which helps to visually screen the road from nearby receptors and also provides noise benefits to receptors.

7.6.58 Screening measures for noise mitigation generally only provide notable benefits in terms of noise level reduction where receptors are within 300m of the road carriageway. As there are few receptors within this distance to the Proposed Scheme carriageway, the benefits from additional screening measures, beyond those inherent in the Proposed Scheme design would be limited. Furthermore, DMRB LA 111 advises that the value for money of

operational noise mitigation should be considered. The value for money can be calculated based on a comparison of the cost of the mitigation, against the monetised acoustic benefits of the mitigation to human receptors in residential properties. For acoustic mitigation to be value for money, notable noise level decreases at multiple residential properties are generally required. In this case, as the dwellings within the detailed calculation area are fairly isolated, acoustic barriers would not be value for money. Furthermore, given the large distances to most of the residential properties within the detailed calculation area, the benefits from additional acoustic barriers would likely be too small to be perceptible to existing residents.

7.6.59 On this basis, with the exception of the River Wensum viaduct (which is discussed in the following paragraph, no acoustic barriers have been recommended for the Proposed Scheme. In any case, the earthworks inherently included in the Proposed Scheme design are considered to provide extensive screening to nearby dwellings.

7.6.60 The River Wensum viaduct is not screened by earthworks and also passes through the sensitive ecological areas of the River Wensum SSSI and SAC. Furthermore, the properties at the northern end of the Proposed Scheme are located closer to the carriageway than in other areas. On this basis, a 1.2m high acoustic barrier is proposed for the entire length of both carriageways of the River Wensum viaduct.

7.6.61 These measures, being inherently part of the Proposed Scheme design, are therefore included in the assessment of residual operational noise effects in the following section.

7.6.62 Finally, secondary glazing or noise insulation can be installed for individual receptors in order to reduce noise levels inside dwellings. The NIR sets out eligibility criteria which should be met in order for properties to be offered noise insulation. In the case of the Proposed Scheme, generally noise levels at dwellings within the detailed calculation area are low and an enhanced façade sound insulation performance would have limited benefit to residents

inside their homes as it is likely that acceptable internal noise levels would be achieved with their existing façade and glazing. In any case, noise insulation is generally not considered as mitigation for a significant effect as it only reduces internal noise levels but not external levels.

Monitoring

7.6.63 DMRB LA 111 suggests that operational noise mitigation measures, including acoustic barriers and low noise road surfaces, shall be monitored to ensure they meet design specifications.

7.6.64 With regard to operational noise monitoring once the Proposed Scheme is open to traffic, DMRB LA 111 states:

"Post construction noise monitoring cannot provide a reliable gauge for whether the predicted magnitude and extent of operational adverse impacts are greater or less than those predicted in the assessment"

7.6.65 On this basis, no operational noise monitoring is proposed.

Residual effects

7.6.66 Absolute levels and noise level changes have been assessed for both the short-term and long-term. For the short-term, a comparison has been made between noise levels with the Proposed Scheme in the opening year (2029) and noise levels without the Proposed Scheme in the opening year. This comparison considers only the change in noise levels due to the Proposed Scheme. For the long-term, a comparison has been made between the noise levels with the Proposed Scheme in the design year (2044) and the noise levels without the Proposed Scheme in the opening year. This comparison includes the change in noise level as a result of the Proposed Scheme as well as general traffic growth.

7.6.67 Noise predictions have been carried out for 44 residential receptors and two other sensitive receptors within the detailed calculation area.

7.6.68 **Appendix 7.8: Noise and Vibration Figures - Figure 7.4: Do-minimum noise contours** and **Appendix 7.8: Noise and Vibration Figures - Figure**

7.5: Do-something 2029 noise contours (Document Reference 3.07.08) show the DM2029 and DS2029 absolute noise levels respectively. The DS2044 contours have not been produced as these follow a very similar pattern to the DS2029 noise contour plots.

7.6.69 **Appendix 7.8: Noise and Vibration Figures - Figure 7.6: Short-term noise change contours** and **Appendix 7.8: Noise and Vibration Figures - Figure 7.7: Long-term noise change contours** (Document Reference 3.07.08) present noise level change contour maps for the short-term and long-term comparisons respectively.

7.6.70 Table 7-22 and Table 7-23 presents the number of residential receptors which exceed the LOAEL and SOAEL for the short-term and long-term comparisons respectively.

Table 7-22 Numbers of dwellings compared to LOAEL and SOAEL thresholds in the short-term

Noise Level	DM 2029 day	DM 2029 night	DS 2029 day	DS 2029 night	Day comparison	Night comparison
Below LOAEL	27	23	28	19	+1	-4
Greater than or equal to LOAEL and less than SOAEL	14	18	13	22	-1	+4
Greater than or equal to SOAEL	3	3	3	3	0	0

7.6.71 Table 7-22 shows that there are no changes to the number of residential receptors that exceed the SOAEL as a result of the Proposed Scheme, and a similar number of properties anticipated to exceed the LOAEL.

Table 7-23 Numbers of dwellings compared to LOAEL and SOAEL thresholds in the long-term

Noise Level	DM 2029 day	DM 2029 night	DS 2044 day	DS 2044 night	Day comparison	Night comparison
Below LOAEL	27	23	26	13	-1	-10
Greater than or equal to LOAEL and less than SOAEL	14	18	15	28	+1	+10
Greater than or equal to SOAEL	3	3	3	3	0	0

7.6.72 Table 7-23 shows that in the long-term the pattern of changes is similar to in the short-term, although two further properties on Fakenham Road are anticipated to exceed the SOAEL as a result of the Proposed Scheme.

7.6.73 The wedding venue is predicted to be below the LOAEL during both the daytime and night-time for all scenarios (short-term and long-term). The holiday let (Old Hall Farm estate) is anticipated to experience noise levels between the LOAEL and SOAEL for all scenarios (short-term and long-term).

7.6.74 Table 7-24 presents the predicted short-term change in noise level for residential receptors within the detailed calculation area, sorted into the magnitude of impact bands as set out within DMRB LA 111.

Table 7-24 Short-term road traffic noise level changes

Short-term noise level change	Daytime, number of residential receptors	Night-time, number of residential receptors
Negligible increase	4	4
Minor increase	3	3
Moderate increase	10	12
Major increase	24	22
No Change	0	0
Negligible decrease	0	0

Minor decrease	0	0
Moderate decrease	0	0
Major decrease	3	3

7.6.75 Both the wedding venue and holiday let (Old Hall Farm estate) are anticipated to experience a major increase in noise levels in the short-term.

7.6.76 Table 7-25 presents the predicted long-term change in noise level for residential receptors within the detailed calculation area.

Table 7-25 Long-term road traffic noise level changes

Long-term noise level change	Daytime, number of residential receptors	Night-time, number of residential receptors
Negligible increase	6	6
Minor increase	8	11
Moderate increase	9	15
Major increase	18	9
No Change	0	0
Negligible decrease	0	0
Minor decrease	0	0
Moderate decrease	3	3
Major decrease	0	0

7.6.77 Both the wedding venue and holiday let (Old Hall Farm estate) are anticipated to experience a major increase in noise levels in the long-term.

7.6.78 DMRB LA 111 sets out that an initial estimation of significance should be undertaken based on the predicted short-term noise level changes and the criteria within **T**able 7-13. Based on this initial estimation, it is anticipated that there would be both significant adverse and beneficial impacts resulting from the Proposed Scheme and further consideration is therefore required.

7.6.79 DMRB LA 111 describes a framework of contextual factors (reproduced above in Table 7-14) which shall be considered in the final determination of operational noise significant effects, and as such there is inevitably an element of professional judgement and balance to be applied when determining significance.

7.6.80 For receptors experiencing a short-term noise level change of moderate or major magnitude (which initially would be considered a significant effect), the contextual factors set out within Table 7-14 have been considered when determining whether the initial assessment of significance is retained or adjusted.

7.6.81 For receptors experiencing a short-term noise level change of minor magnitude, which would initially be considered a non-significant effect, similar considerations have been made in considering whether these impacts should be considered significant.

7.6.82 Some universal judgements have been made in order to be consistent across the Proposed Scheme. Given the rural nature of the Proposed Scheme, absolute noise levels are generally low and for the majority of receptors are below the LOAEL both without and with the Proposed Scheme. The NPSE defines the LOAEL as "*the level above which adverse effects on health and quality of life can be detected".* It is therefore considered that, below this level there would be no adverse effects on health or quality of life, or in turn changes to residents' behaviour or business operations which would constitute a significant adverse effect. On this basis, for this assessment, where a receptor is predicted to experience an absolute noise level below the LOAEL both without and with the Proposed Scheme (at all façade points) a significant effect does not occur, regardless of the magnitude of impact. Where noise levels are predicted to be below the LOAEL, these would fall into the no observed effect level (NOEL) category, within which there is no detectable effect on health and quality of life.

7.6.83 This is not to say that these residents would not be able to hear road traffic noise resulting from the Proposed Scheme itself or changes in traffic flows resulting from the Proposed Scheme. However, it is considered that the level of noise would be such that residents should not be disturbed by the noise. For many receptors towards the central area of the Proposed Scheme, away from the A1067 and A47, it is likely that currently the noise levels are dominated by the small number of local vehicles using the existing road network, agricultural activities and vehicles, noise from animals such as bird song and trees and leaves rustling. Once the Proposed Scheme has been constructed, these sources are still likely to be audible, however, low level constant road traffic noise from the Proposed Scheme is also likely to be audible.

7.6.84 As DMRB LA 111 encourages professional judgement and consideration of context alongside numerical factors, some decisions regarding whether a receptor is likely to experience a significant effect are not clear cut. In order to be robust, a generally cautious approach has been taken with regard to these judgements.

7.6.85 Table 7-26 along with **Appendix 7.8: Noise and Vibration Figures - Figure 7.8: Operational noise receptor groups** (Document Reference 3.07.08) sets out groups of receptors based on their daytime short-term magnitude of impact along with other contextual factors to determine final operational significance on noise sensitive buildings.

Table 7-26 Receptor summary and determination of significance - operational road traffic noise

Receptor Group	Number of Properties	Short-term magnitude of impact	Significance	Justification
1	3	Major and moderate decrease (above LOAEL)	**Significant beneficial**	These three receptors are located directly off Wood Lane which is expected to carry far fewer vehicles once the Proposed Scheme is operational. The short-term noise impacts at these properties fall within the major beneficial magnitude of impact category and are above the LOAEL. On the basis that the noise climate at these properties would be improved by the Proposed Scheme, these receptors would experience a **significant beneficial noise effect**.
2	4	Negligible increase	**Not significant**	These four receptors are located to the South of the A47 re-alignment, and road traffic from the A47 dominates the noise climate rather than the Proposed Scheme. Negligible noise level changes are unlikely to be perceptible to residents and on this basis, the effects at these properties are **not significant**.

Receptor Group	Number of Properties	Short-term magnitude of impact	Significance	Justification
3	3	Minor adverse (above SOAEL)	**Not significant**	These three receptors are located adjacent to the A1067 to the west of the Proposed Scheme and are anticipated to experience minor adverse changes on the rear façades which face the Proposed Scheme. The façades facing the A1067 are predicted to exceed the SOAEL, however, negligible noise level changes are predicted at these façades as a result of fewer vehicles using the A1067 once the Proposed Scheme is operational. The façades where minor adverse impacts are anticipated all experience noise levels well below the SOAEL. On this basis, given the balance of noise level increases and decreases, and the A1067 remaining the dominant noise source for these receptors, it has been concluded that the effects are **not significant**.

Receptor Group	Number of Properties	Short-term magnitude of impact	Significance	Justification
4	21	Moderate / major adverse (below LOAEL)	**Not significant**	As discussed in paragraph 7.6.81, the NPSE states that the LOAEL is the threshold above which adverse effects on health and quality of life can occur. It is therefore considered that below the LOAEL, a significant effect would not occur. The predicted noise levels at these receptors are below the LOAEL in the DS2029 scenario during the daytime and night-time (for the two receptors at Old Hall Farm barns, the noise level is anticipated to exceed the LOAEL but not on the façades where moderate or major noise level increases are predicted). The 21 receptors within this group are located across the detailed calculation area with the largest cluster at Green Farm. The particularly high magnitudes of impact at these receptors are as a result of the very low baseline noise levels from road traffic at these receptors. The noise measurements undertaken on site indicate that, in reality, noise levels are higher than predicted in the do-minimum scenario as a result of other sources, but these are not accounted for in the model. This means the actual noise level changes experienced at these receptors would likely be lower than predicted. On this basis it is considered that the effects at these receptors is **not significant**. /

Receptor Group	Number of Properties	Short-term magnitude of impact	Significance	Justification
5	1	Major adverse (marginally above LOAEL)	**Not significant**	This receptor (Norwood) is anticipated to experience a major adverse noise level change. Whilst this receptor exceeds the LOAEL, the highest noise level at the property is 40.1dB in the DS2029 night-time scenario which is a 0.1dB exceedance of the LOAEL. Furthermore, the receptor is located adjacent to The Broadway which would no longer be a public road following the completion of the Proposed Scheme. As The Broadway carries a fairly low vehicle volumes (below 1000 AAWT) it is not included in the noise model, however, the reduction in traffic along the route as a result of the Proposed Scheme would reduce noise levels on this road. On this basis, it has been considered that the effects at these receptors would be **not significant**.

Receptor Group	Number of Properties	Short-term magnitude of impact	Significance	Justification
6	9	Moderate Adverse (above LOAEL)	**Significant Adverse**	These nine receptors are located north-east of the Proposed Scheme. The noise levels at these receptors are dominated by the A1067 or A1270. The noise level increases at these receptors results from additional traffic which is predicted to use the A1067 and A1270 following the introduction of the Proposed Scheme. It should be noted that these receptors are already habituated to noise from these roads. However, on balance, as the impacts are moderate and exceed the LOAEL, it is considered that **significant adverse effects** would occur at these receptors.
7	3	Major Adverse (above LOAEL)	**Significant Adverse**	These receptors are predicted to experience major adverse changes and noise levels above the LOAEL. Similar to above, it is likely that in reality these noise level changes would be lower than predicted, however, given the setting of these receptors, which is likely to be affected by the Proposed Scheme it is considered that they would experience **significant adverse effects**.

7.6.86 It is appropriate to consider whether additional mitigation measures could be adopted where significant adverse effects are predicted.

7.6.87 For the receptors in Group 6, as the noise levels are dominated by roads outside of the Proposed Scheme Red Line Boundary (A1067 and A1270). For these receptors mitigation measures are not considered practical given they would be required outside the Red Line Boundary and screening measures would not be suitable for some of the properties as it would restrict their access.

7.6.88 For the receptors in Group 7, as they are located over 300m from the Proposed Scheme carriageways, as discussed above in paragraph 7.6.57, mitigation in the form of screening is unlikely to provide notable noise benefits.

7.6.89 Furthermore, for both these groups, noise mitigation at the receptor itself through noise insulation is not considered to be appropriate as they do not meet the eligibility criteria set out in the NIR (this is discussed further in paragraph 7.6.106 below).

7.6.90 Whist major adverse noise level increases are anticipated in the short-term at the wedding venue, as the predicted noise levels are below the LOAEL in all scenarios, similarly to group 4 above, the effect at this receptor is considered **not significant**.

7.6.91 The holiday let is similar to the receptors in group 4, in that major adverse noise level changes are predicted, but only on façades of the property which do not exceed the LOAEL. Whilst the LOAEL is exceeded on other façades of the property, the noise level changes are either negligible or minor in magnitude. On this basis, the effect at this receptor is considered **not significant**.

7.6.92 Where sensitive receptors cover a large area, the determination of significance is primarily based on the variation in short-term noise level change in the receptor, as presented in **Appendix 7.8: Noise and Vibration Figures – Figure 7.6: Short-term noise change contours** (Document Reference: 3.07.08).

7.6.93 The golf course is anticipated to experience impacts of predominantly moderate adverse magnitude in the short-term, with a small area of major impact close to the Proposed Scheme. However, the absolute noise levels, considering the entire area of the golf course within the detailed calculation area are low, with much of the golf course experiencing noise levels below the LOAEL. Furthermore, it is anticipated that road traffic noise from the A1067 and Fakenham Road is already the dominant noise source across the golf course, and therefore the addition of the Proposed Scheme, would not change the acoustic character of the area. As discussed above, it is likely that in reality, the noise level changes would be lower than predicted as the noise model only includes road traffic noise and no other sources such as leaves and trees rustling and birdsong which may also contribute to the noise climate on the golf course. A 1.2m high barrier has been included on the River Wensum viaduct to reduce noise levels from the Proposed Scheme and a low noise road surface type would be installed. On this basis it is considered that the effect for human receptors within the golf course is **not significant**.

7.6.94 The River Wensum SSSI and SAC covers a vast area, well beyond the detailed calculation area. Large noise level changes of moderate magnitude are anticipated in the area of the SSSI and SAC closest to the Proposed Scheme. However, the absolute noise levels reduce noticeably at greater distances from the Proposed Scheme towards the edges of the detailed calculation area and are below the LOAEL. On this basis and considering that adverse noise impacts would occur only for a very small area of the overall SSSI and SAC it is considered that the operational road traffic noise effects for human receptors in these areas are **not significant**.

7.6.95 Some of the various PRoW within the detailed calculation area are anticipated to experience high noise level changes, the absolute noise levels are low with the exception of the areas closest to the Proposed Scheme. Furthermore, as users of the PRoW are transient, they would only be affected by noise from the Proposed Scheme for a short period and on this basis the effects for human receptors using the PRoWs are considered **not significant**.

Policy compliance

7.6.96 In addition to the assessment of significant effects with regard to the EIA Regulations, DMRB LA 111 states that the assessment shall determine compliance with the relevant sections of the NPSE, NPPF and the Government's associated planning guidance.

7.6.97 The NPSE suggests that where receptors are anticipated to exceed the LOAEL, the effects should be mitigated. The NPSE states that mitigation should be sustainable in line with Government policy. This is typically taken to mean that the mitigation is value for money (i.e. the cost of the mitigation is less than the monetised acoustic benefits of the mitigation in terms of health benefits from reduced noise levels).

7.6.98 In this case, given the receptors are mostly located at a distance of over 300m from the Proposed Scheme, and all are predominantly isolated, it is not considered that any mitigation measures beyond those incorporated into the Proposed Scheme design would be value for money on account of the limited acoustic benefit to existing residences. Acoustic barriers generally are of limited benefit where receptors are over 300m from the road carriageway. Also, for an acoustic barrier to be value for money it would usually need to provide good noise benefits to many properties.

7.6.99 On this basis, whilst a number of receptors are anticipated to exceed the LOAEL and SOAEL thresholds, as no further mitigation measures (to those already incorporated into the Proposed Scheme design) would be sustainable, the Proposed Scheme is considered compliant with national noise policy.

Wider network noise level changes

7.6.100 In addition to noise level changes within the detailed calculation area, the operational noise Study Area includes a number of road links further afield which are predicted to experience a short-term BNL change (increase or decrease) of more than 1dB as a result of the Proposed Scheme.

7.6.101 As the traffic model covers a vast area (most of Norfolk) it is not appropriate to report noise level changes on every road link. Instead, only those roads anticipated to experience changes of moderate or major magnitude have been reported as these links could constitute significant effects.

7.6.102 Impacts have only been considered significant where the noise level changes in the short-term are of 3dB or greater (increase or decrease) and there is at least one receptor within 50m from the kerb of the road (in line with the operational noise Study Area set out within DMRB LA 111).

7.6.103 On this basis, **significant** beneficial wider network effects are anticipated at receptors within 50m of the following road links:

- B1535 (between A1067 and Heath Road);
- Rectory Road (west of B1535); and
- Beech Avenue (between Maple Drive and Ringland Road)

7.6.104 **Significant** adverse wider network effects are anticipated at receptors within 50m of the following road links:

- Taverham Road;
- Fir Covert Road (north of A1270);
- A1270 (west of Broadland Northway Roundabout);
- Station Road (through Attlebridge);
- Old Fakenham Road; and
- Mattishall Lane (between A47 and Burgh Lane).

7.6.105 These links are shown on **Appendix 7.8: Noise and Vibration Figures - Figure 7.9: Wider network noise changes** (Document Reference 3.07.08).

7.6.106 As these links are outside the Red Line Boundary, it is not possible to provide mitigation. Further, as receptors along these routes generally gain their

access from the road experiencing the impact, screening measures would not be appropriate. These effects are therefore considered residual effects.

7.6.107 **Appendix 7.2: Complimentary Traffic mitigation schemes assessment** (Document Reference: 3.07.02) considers the assessment of off-site traffic mitigation schemes which are proposed to help traffic flows in the area. Some of these measures reduce the impacts at these road links.

Noise insulation regulations

7.6.108 In order to qualify for compensation under the NIR, four criteria must be fulfilled as presented from paragraph 7.3.63 onwards. An indicative assessment has been undertaken in order to consider potential eligibility for noise insulation.

7.6.109 Within the detailed calculation area there are no dwellings which are predicted to meet all four criteria based on this assessment.

Cumulative effects

7.6.110 The assessment of cumulative impacts from nearby committed developments is included within **Appendix 7.7: Assessment of cumulative impacts** (Document Reference: 3.07.07).

In-combination climate change impacts

7.6.111 Noise levels are affected by meteorological conditions; however, the effects of temperature in particular are fairly limited, and it is not considered that hotter temperatures as a result of currently predicted climate change would alter the conclusions of this chapter in any way.

7.6.112 On this basis it is not anticipated that any in-combination climate change impacts would result in changes to the conclusion of the noise and vibration assessment.

7.7 Opportunities for environmental enhancement

7.7.1 Beyond the measures discussed within this chapter such as earth bunds which would provide screening to nearby receptors, no further enhancement measures are appropriate for the Proposed Scheme.

7.8 Limitations and uncertainties

7.8.1 Both the operational noise and construction traffic assessments are based on traffic data predictions. The traffic data have been provided by the project team in a format fit for use within this assessment.

7.8.2 Construction noise and vibration predictions have been based on assumed plant schedules, locations and operating times. As the design develops, there is the potential for these assumptions to change throughout the programme as a result of updated information and any situations arising on Site. Despite the assumptions that have been made, the approach to the assessment is considered proportionate and suitable for the objective of identifying where a significant effect might arise.

7.9 Summary

7.9.1 Table 7-27 provides a summary of the findings of the assessment.

Table 7-27 Summary of noise and vibration effects

Key to table:

P / T = Permanent or Temporary, D / I = Direct or Indirect, ST / MT / LT = Short Term, Medium Term or Long Term, N/A = Not Applicable

Receptor	Potential effects	Additional mitigation	Residual effects	Monitoring
Construction phase On-site construction noise ▪ C1 – Mouse Wood Farm (daytime) ▪ C2 – Pump Farm (daytime) ▪ C4 – Peacehaven (daytime) ▪ C5 – Deighton Hills House (daytime and night-time) ▪ C9 – Woodstock (daytime and night-time) ▪ C10 – Old Hall Farm (night-time)	Given the proximity of construction works, disturbance as a result of noise levels from on-site activities could occur at these receptors.	Best practicable means as set out in Section 7.6.	Significant adverse effect T / D / ST	Construction works shall be monitored on site to ensure that best practicable means and other appropriate mitigation measures are being adhered to.

Receptor	Potential effects	Additional mitigation	Residual effects	Monitoring
Construction phase On-site construction noise ▪ C3 – Field Farm (daytime and night-time) ▪ C6 – 2 Breck Barn Cottage (daytime and night-time) ▪ C7 – Norwood (daytime and night-time) ▪ C8 – 2 The Cottages (daytime and night-time) ▪ C10 – Old Hall Farm (daytime)	Given the proximity of construction works, disturbance as a result of noise levels from on-site activities could occur at these receptors.	Best practicable means as set out in Section 7.6.	Non-significant adverse effects T / D / ST	Construction works shall be monitored on site to ensure that best practicable means and other appropriate mitigation measures are being adhered to.

Receptor	Potential effects	Additional mitigation	Residual effects	Monitoring
Construction phase Off-site construction traffic noise Receptors within 50m of the site access route on Wood Lane / Paddy's Lane	Given the additional vehicles using the existing road network to access the Site, disturbance for nearby residents could occur	Best practicable means as set out in Section 7.6.	Significant adverse effects T/I/ST	Construction works shall be monitored on site to ensure that best practicable means and other appropriate mitigation measures are being adhered to.
Construction phase Off-site construction traffic noise Receptors within 50m of all Site access routes apart from Wood Lane / Paddy's Lane.	Given the additional vehicles using the existing road network to access the Site, disturbance for nearby residents could occur	Best practicable means as set out in Section 7.6.	Non-significant adverse effects T/I/ST	Construction works shall be monitored on site to ensure that best practicable means and other appropriate mitigation measures are being adhered to.

Receptor	Potential effects	Additional mitigation	Residual effects	Monitoring
Construction phase On-site construction vibration Receptors at Woodstock and Old Hall Farm Cottages within 25m of Proposed Scheme carriageways	Disturbance due to vibratory road rolling	Best practicable means as set out in Section 7.6.	Non-significant adverse effects (not significant due to works not exceeding required durations) T/D/ST	Construction works shall be monitored on site to ensure that best practicable means and other appropriate mitigation measures are being adhered to.
Operational phase 3 residential receptors (group 1)	Beneficial impacts anticipated as a result of reduced traffic flows on Wood Lane.	None required.	Significant beneficial effect P/D/LT	None required.
Operational phase 29 residential receptors (groups 2-5) Wedding venue Holiday let (at Old Hall Farm estate) Golf course and SSSI / SAC	Adverse impacts as a result of road traffic noise from the Proposed Scheme, and increases in traffic flow on surrounding roads.	None required.	Non-significant adverse effects P/D/LT	None required.

Receptor	Potential effects	Additional mitigation	Residual effects	Monitoring
Operational phase Operational road traffic noise 12 residential receptors (groups 6 and 7)	Adverse impacts as a result of road traffic noise from the Proposed Scheme and increases in traffic flow on surrounding roads.	None required.	Significant adverse effect P/D/LT	During the construction phase and following completion of the Proposed Scheme, monitoring shall be undertaken to ensure the mitigation measures, including any earthworks providing screening and low noise road surface have been implemented.

Receptor	Potential effects	Additional mitigation	Residual effects	Monitoring
Operational phase Wider road network Receptors within 50m of: ▪ B1535 (between A1067 and Heath Road) ▪ Rectory Road (west of B1535) ▪ Beech Avenue (between Maple Drive and Ringland Road)	Decreases in road traffic noise from existing roads as a result of the Proposed Scheme.	None required	Significant beneficial effect P/I/LT	None required.

Receptor	Potential effects	Additional mitigation	Residual effects	Monitoring
Operational phase Wider road network Receptors within 50m of: ▪ Taverham Road ▪ Fir Covert Road (north of A1270) ▪ A1270 (west of Broadland Northway Roundabout) ▪ Station Road (through Attlebridge) ▪ Old Fakenham Road ▪ Mattishall Lane (between A47 and Burgh Lane)	Increases in road traffic noise from existing roads as a result of the Proposed Scheme.	None required	Significant adverse effect P/I/LT	None required.

7.10 References

Ref. 7.1 The European Parliament and the Council of the European Union (2002). Directive 2002/49/EC relating to the assessment and management of environmental noise (the Environmental Noise Directive

Ref. 7.2 The European Commission (2014) Environmental Impact Assessment Directive 2014/52/EU

Ref. 7.3 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017

Ref. 7.4 HM Government,) The Noise Insulation Regulations 1975 (as amended 1988)

Ref. 7.5 HM Government (1974). Control of Pollution Act 1974

Ref. 7.6 Department for Communities and Local Government (2023). National Planning Policy Framework (NPPF)

Ref. 7.7 Department for Environment, Food and Rural Affairs (2010). Noise Policy Statement for England (NPSE)

Ref. 7.8 Department for Transport (2014). National Policy Statement for National Networks (NPS NN)

Ref. 7.9 Broadland District Council (2015). Broadland Local Plan, Development Management Development Planning Document

Ref. 7.10 National Highways, Design Manual for Roads and Bridges, Sustainability & Environment Appraisal, LA 111 Noise and Vibration, Revision 2, May 2020 (DMRB LA 111)

Ref. 7.11 Calculation of Road Traffic Noise (CRTN) (1988). Department of Transport and Welsh Office.

Ref. 7.12 Converting the UK traffic noise index LA10,18h to EU noise indices for noise mapping. P G Abbott and P M Nelson (TRL Limited). Project Report PR/SE/451/02.

Ref. 7.13 British Standard (BS) 5228 Code of practice for noise and vibration control on construction and open sites. Part 1: Noise. BS 5228:2009+A1:2014 (BS 5228-1).

Ref. 7.14 British Standard (BS) 5228 Code of practice for noise and vibration control on construction and open sites. Part 2: Vibration. BS 5228:2009+A1:2014 2014 (BS 5228-2).

Ref. 7.15 Department for Communities and Local Government (Published 29 November 2016, last updated 1 October 2019). Planning Practice Guidance: Department for Communities and Local Government