A47 Blofield to North Burlingham Dualling

Scheme Number: TR010040

Volume 6
6.1 Environmental Statement
Chapter 11 – Noise and Vibration

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CHAPTER 11
NOISE AND VIBRATION

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Table of contents

Tables

11. Noise and Vibration

11.1. Introduction

11.1.1. As part of the Environmental Impact Assessment (EIA) process, this Environmental Statement (ES) chapter reports the predicted significant effects for noise and vibration as a result of the Proposed Scheme. This assessment includes a review of the existing baseline conditions, consideration of the potential impacts, identification of proportionate mitigation and enhancement and evaluation of residual effects and their significance.

11.1.2. The approach to this assessment follows the Scoping Report (February 2018) and subsequent agreed Scoping Opinion (March 2018) for the Proposed Scheme, in combination with the most up to date guidance in the Design Manual for Roads and Bridges (DMRB) LA 111 Noise and vibration, revision 2, hereafter referred to as DMRB LA 111.

11.1.3. The main chapter text is supported by the following appendices (**TR010040/APP/6.2**) and figures (**TR010040/APP/6.3**).

- Appendix 11.1: Glossary of terms
- Appendix 11.2: Legislation and policy framework
- Appendix 11.3: Baseline noise survey
- Appendix 11.4: Noise sensitive receptors
- Appendix 11.5: Construction noise assessment
- Figure 11.1: Noise location plan
- Figure 11.2: Operational noise barriers
- Figure 11.3: Road traffic noise level contours: Do-Minimum Opening Year
- Figure 11.4: Road traffic noise level contours: Do-Minimum Future Year
- Figure 11.5: Road traffic noise level contours: Do-Something Opening year
- Figure 11.6: Road traffic noise level contours: Do-Something Future year
- Figure 11.7: Noise difference contour: Long-term noise change without the Proposed Scheme
- Figure 11.8: Noise difference contour: Short-term noise change with the Proposed Scheme
- Figure 11.9: Noise difference contour: Long-term noise change with the Proposed Scheme
- Figure 11.10: Location of significant operational noise effects

11.2. Competent expert evidence

11.2.1. The competent expert has a BEng and MSc (environmental and architectural acoustics) and is a Member of the Institute Of Acoustics (MIOA). The competent expert is an acoustician with over 15 years in practice delivering and managing environmental noise assessments for challenging projects, both in the UK and

internationally. This includes EIA and non-EIA projects in a range of sectors, such as large residential developments, office and commercial premises, industrial facilities (including manufacturing, data centres and energy plants), wind farms and road schemes.

11.3. Legislative and policy framework

11.3.1. The relevant policy, standards and guidance documents used to inform the noise and vibration impact assessment are summarised in Appendix 11.2 (**TR010040/APP/6.2**). A list of relevant policies, standards and guidance is provided below:

- Control of Pollution Act, 1974;
- Noise Insulation Regulations, 1975 (amended 1988);
- National Networks National Policy Statement;
- National Planning Policy Framework, 2014;
- Noise Policy Statement for England, 2010;
- Planning Practice Guidance – Noise, 2019;
- Noise Action Plans 2019;
- Highways England policy on Road Investment Strategy (RIS) (current at the time of writing);
- The Broadland District Council *Development Management Development Plan Document* (DPD), 2015;
- World Health Organization (WHO) *Guidelines for Community Noise*, 1999;
- WHO *Night Noise Guidelines for Europe*, 2009;
- British Standard (BS) 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*;
- BS 5228-2:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Part 2: Vibratio*n;
- DMRB LA 111 *Noise and vibration,* Revision 2, 2020;
- DMRB LD 119 Roadside environmental mitigation and enhancement, Revision 0, 2020
- *Calculation of Road Traffic Noise* (CRTN); and
- The Institute of Environmental Management and Assessment *Guidelines for Environmental Noise Impact Assessment*.

11.3.2. Full references are provided in Section 11.13.

11.4. Assessment methodology

11.4.1. The assessment has been produced with consideration to the above policy and guidance and in accordance with methodology within DMRB LA 111 with further detail presented in Appendix 11.2 (**TR010040/APP/6.2**). This section sets out the approach and methods adopted for the assessment of noise and vibration through the key stages of the project.

Comparison with noise survey

11.4.2. The findings of a noise survey from June 2018 have been used to inform the operational noise modelling process. To this end, a comparison between measured baseline results from that survey with the predicted road traffic noise index, dB $L_{A10,18hr}$ for the Do Minimum Opening Year scenario has been undertaken.

Construction noise and vibration

11.4.3. The construction noise and vibration assessment is focused on 23 buildings closest to the construction works, as representative of those groups of receptors potentially more affected by significant construction noise effects.

11.4.4. The LOAEL for the construction noise assessment have been calculated from the 'Do-minimum opening year' noise model, using the TRL Method 3 to convert the dB $L_{A10,18hr}$ index into the $L_{Aeq,Day}$ index. The SOAEL have been determined as per BS 5228-1 Section E3.2 and Table E.1, in accordance with DMRB LA 111.

11.4.5. The level of noise from each phase of the construction activity has been predicted for a representative sample of noise sensitive receptors using the Datakustik Cadna/A® noise modelling software. This software applies the calculation methodologies of BS 5228-1:2009+A1:2014. Noise sources have been positioned based on the proposed construction phasing.

11.4.6. For construction phases with clearly identified areas, long-term construction activity has been modelled as an area source with the total sound power level identified in the Appendix 11.5 (**TR010040/APP/6.2**). The noise level predictions therefore represent the long-term average construction noise level accounting for the movement of plant and activities over the defined area.

11.4.7. For offline construction represented at Phase 1 as described in chapter 2 The Proposed Scheme (**TR010040/APP/6.1**), no localised work areas are identified. In this case a more conservative approach has been taken, using a point source at one metre height relative to the local ground level with the total sound power level identified in Appendix 11.5 (**TR010040/APP/6.2**) for each construction activity. This noise source was located at the closest distance from the offline construction zone to each receptor. In reality, the plant will normally be distributed across a greater area and the distance to the receptor would normally be greater. As such, noise levels predicted for Phase 1 represent the worst-case scenario. The same approach has been used for the construction of the gas main diversion route.

11.4.8. F.3.1.3 of BS 5228-2:2009+A1:2014 (Part 2) indicates that rotary bored piling tends to setup low levels of vibration. This assessment assumes that rotary bored

piling can be employed where piling within 30m of any sensitive receptor is required, as this typically produces a smaller magnitude of vibration than vibratory driven piles.

11.4.9. Potential levels of vibration during compaction activity have been predicted using the guidance provided in Annex E of BS 5228-2:2009+A1:2014, which is based on the TRL report *Ground-borne Vibration Caused by Mechanised Construction Works.*

Construction traffic noise

11.4.10. The construction traffic noise assessment has taken the baseline noise level to be consistent with the do-minimum opening year (DMOY) road traffic noise levels. The approach for the construction traffic assessment has been to identify the change in road traffic noise on the existing road network due to additional heavy vehicle movements. The significance of the short-term change in road traffic noise is considered using the same method as the operational noise assessment for the opening year (see below).

Operational noise

11.4.11. DMRB LA 111 requires that road traffic noise levels are predicted and assessed for four scenarios, as follows:

- Do-minimum opening year scenario (DMOY)
- Do-minimum future year scenario (DMFY)
- Do-something opening year scenario (DSOY)
- Do-something future year scenario (DSFY)

11.4.12. The four scenarios above are defined in Appendix 11.1 (**TR010040/APP/6.2**). Figures (see **TR010040/APP/6.3**) include noise contour maps that illustrate $L_{A10,18hr}$ road traffic noise levels for each scenario and noise difference contours to illustrate predicted traffic noise changes for the following comparisons:

- Long-term noise change without the Proposed Scheme (DMFY minus DMOY)
- Short-term noise change with the Proposed Scheme (DSOY minus DMOY)
- Long-term noise change with the Proposed Scheme (DSFY minus DMOY)

11.4.13. For the assessment, these comparisons are made for daytime (dB $L_{A10,18hr}$ index) and night-time (dB L_{night} index in accordance with TRL Method 3). The main focus of the operational noise assessment presented in section 11.8 is on daytime noise changes because is when the greater changes to noise levels are predicted.

11.4.14. For each of the comparisons described above, the number of receptors within the operational study area that are subject to no change, negligible, minor, moderate or major changes (that may be either increases or decreases) are reported in section 11.8.

11.4.15. The assessment of predicted daytime and night-time noise levels has been undertaken at the receptor façade and floor (i.e. ground floor, first floor etc) which experiences the greatest magnitude of noise change, in accordance with DMRB LA 111.

Value of receptors

11.4.16. Noise affects people in different ways. This may include factors such as annoyance and sleep disturbance, enjoyment of spaces, ability to communicate with others and ability to concentrate at home or at work.

11.4.17. Different receptors may be subject to the same sources and at the same times, but the significance is not the same (for example, dwellings which are occupied at night and commercial premises which are not occupied at night). Consequently, it is not appropriate to consider a single criterion when assessing the sensitivity of a receptor within an existing noise environment.

11.4.18. This assessment is focused on receptors with high sensitivity to noise and vibration. Most receptors that would be affected by noise and vibration arising from the Proposed Scheme are dwellings. However, there are other types of high sensitivity receptors in the study area that have been considered in the assessment, such as schools, nursing homes, places of worship, community facilities and public rights of way. Noise sensitive receptors identified within the operational noise study area are discussed in Appendix 11.5 (**TR010040/APP/6.2**).

Update to guidance and scope of assessment

11.4.19. Following a review of changes to DMRB guidance on noise and vibration (DMRB LA 111, revision 2, 2020), the Scoping Report for the Proposed Scheme (2018) has been reviewed. The Scoping Report is considered to remain valid, however, some elements have been amended. These are presented in Table 11-1 below.

Table 11-1 : Summary of scoping updates

Scoping document	Scoping item	Comment on Original Scope (2018)	Updated Scope (2020)
Scoping Report, 2018	Operational noise study area	Study area identified as an area within 1 km of the physical works associated with the Proposed Scheme. Within this study area, road traffic noise predictions performed at any sensitive receptor within 600m of a road where there is the possibility of a change of 1dB $L_{A10,18hr}$ upon Proposed Scheme opening, or 3dB $L_{A10,18hr}$ in the long term. Outside of the 1km area, sensitive receptors are identified adjacent to roads where the change in received road traffic noise level would, as a result of the Proposed Scheme, increase or decrease by at least 1dB $L_{A10,18hr}$ on opening or 3dB in the long term.	Operational study area includes the area within 600m of new road links or road links physically changed or bypassed by the project plus the area within 50m of other roads where there is the potential for moderate or major noise change in the short-term or long-term.
	Construction noise	The study area is the same as that defined for assessment of operational noise impacts. Assessment will be limited to areas where total noise (calculated construction noise plus baseline noise) exceeds baseline noise levels.	A study area of 300m from the closest construction activity was considered sufficient to evaluate the potential for significant effects at noise sensitive receptors.
	Construction vibration	Not defined	DMRB LA 111 notes that a study area encompassing a 100m area from vibration generating activity is normally sufficient. However, given the expected methods of work, a study area encompassing a 30m area from vibration generating activity was considered sufficient to evaluate the potential for significant effects due to vibration at sensitive receptors.
	Construction noise	Example Method 2 – 5dB(A) change' (Annex E 'Significance of Noise Effects' Section E.3.3) will be adopted for the assessment of effects at sensitive receptors	The lowest observed adverse effect level (LOAEL) and significant observed adverse effect level (SOAEL) (defined in Appendix 11.1 (**TR010040/APP/6.2**)) shall be established in accordance with Table 3.12 of DMRB LA 111. LOAEL based on baseline noise levels $L_{Aeq,T}$ and SOAEL threshold level determined as per BS 5228-1:2009+A1:2014 Section E3.2 and Table E.1
	Gas main diversion construction noise and vibration	Not defined	It is understood that gas main diversion works are proposed during early phases of the proposed road works.. As such, the gas pipeline construction works have been included in the assessment.

Scoping document	Scoping item	Comment on Original Scope (2018)	Updated Scope (2020)
	Significance criteria	Table 11.2 of the Scoping Report summarises proposed LOAEL and SOAEL values, based upon those adopted for other recent infrastructure schemes	Operational noise LOAELs and SOAELs are set out in DMRB LA 111 Table 3.49.1 for all noise sensitive receptors.
Scoping Opinion	Operational vibration	The ES should assess impacts from operational vibration where significant effects are likely to occur.	DMRB LA 111 states that "*Operational vibration is scoped out of the assessment methodology as a maintained road surface will be free of irregularities as part of the project design and under general maintenance, so operational vibration will not have the potential to lead to significant adverse effects*". As such, operational vibration has been scoped out of this assessment

Consultation

11.4.20. Norfolk County Council advised that Environmental Health is the remit of the local District Council in the area. The Environmental Health Department of Broadland District Council were consulted by email on 23 April 2020. The consultation email outlined the proposed approach to the assessment of noise and vibration due to the Proposed Scheme, advising that the assessment would be carried out in accordance with DMRB LA 111, Revision 2.

11.4.21. The use of baseline noise survey data obtained in June 2018 was reviewed and agreed by the Council to be valid for this assessment.

11.4.22. A request was made for information regarding any consented developments that may go ahead before the Opening Year of the Proposed Scheme. The East Area Team Manager at Broadland District Council provided this information and relevant planning application references on 11 June 2020.

11.4.23. The Environmental Health Officer at Broadland District Council commented on 28 April 2020 that they did not have further comments to the assessment approach and that it was the Broadland District Council aspiration that Highways England "*ensure that operational noise is minimised by the use of low noise surfacing and barriers etc*."

Assessment criteria

11.4.24. DMRB LA 111 sets the LOAEL and SOAEL along with the significance criteria for the assessment of construction noise and vibration and operational noise.

11.4.25. For construction noise and vibration, DMRB LA 111 advises that a significant effect would occur when a moderate or major impact is expected for 10 or more days or nights in any 15 consecutive days or nights; or for a total number of days exceeding 40 in any six consecutive months.

11.4.26. For operational noise, DMRB LA 111 advises that for an initial assessment of significance a moderate or major magnitude of noise change in the short-term should be classed as 'Significant'. It also requires that where the magnitude of change in the short-term is minor, moderate or major, further assessment is carried out to determine the final operational significance effect. The final operational noise significance is presented in Table 11-14.

11.4.27. These assessment criteria are also summarised in Appendix 11.2 (**TR010040/APP/6.2**).

11.5. Assessment assumptions and limitations

Construction noise and vibration assessment

11.5.1. Outline information regarding construction programme, schedule, construction compounds and works phasing are available at this stage. The majority of the construction work will take place during daytime. This assessment assumes that typical construction times will be between 07:00-19:00 weekday and 07:00-13:00 on Saturdays.

11.5.2. Night-time or weekend works will be required at some stages, such as to construct works accesses, road tie-ins and A47 cross-overs. These will need to be considered in further detail and discussed with the local planning authority.

11.5.3. At this stage, a diversion route is only defined for closures of sections of the existing A47. For eastbound traffic, traffic will use the A146 from Norwich to Gillingham outside Beccles, then the A143 to Great Yarmouth, the A47 through Great Yarmouth and then the A47 back to Acle. The same links in the opposite direction will be used for westbound traffic. Other diversion routes for the side roads are still to be developed.

11.5.4. Details of the construction phases, location of the representative sample of noise sensitive receptors, assumptions of plant used in the assessment and predicted construction noise levels are presented in Appendix 11.5 (**TR010040/APP/6.2**). The 23 noise sensitive receptors used in the construction noise assessment are also presented in Figure 11.1 (**TR010040/APP/6.3**).

11.5.5. The level of vibration created by rotary bored piling is of smaller magnitude than that generated from vibratory driven piles. This assessment assumes that rotary bored piling can be employed where piling within 30m of any sensitive receptor is required.

Construction traffic assessment

11.5.6. The assessment of construction traffic assumes that construction compound locations and vehicle numbers are as described in ES Chapter 2, The Proposed Scheme (**TR010040/APP/6.1**), paragraphs 2.6.10 to 2.6.17. The maximum number of lorry trips per day for any phase is given as 150. Therefore a total of 300 vehicle movements, that is return journeys, have been included in the construction traffic assessment. Based on the construction compound locations and site wide works, the expected additional vehicle movements have been included on the following roads:

- A47 eastbound, immediately west of the junction with the B1140
- A47 westbound, immediately east of the junction with the B1140
- B1140 northbound, immediately south of the A47
- A47 westbound in the vicinity of 1 and 2 Hall Cottages

11.5.7. It has been assumed that construction traffic will use the same access routes in phase two to eight as described and anticipated for phase one.

Operational noise assessment

11.5.8. Table 11-2 describes the assumptions and limitations incorporated into the operational noise assessment.

Table 11-2 : Noise model assumptions and limitations

Model element	Assumption and limitations
Road alignments	• The road alignments have been modelled based on geo-referenced shapefiles that reflect the design as described in Chapter 2 (The Proposed Scheme (**TR010040/APP/6.1**)). • These have been supplemented by OS Mastermap and Google Maps Satellite data.
Traffic data	• The level of road traffic noise from the road network has been predicted using traffic data provided, including pivoted speeds. $L_{A10,18hr}$ traffic noise levels and night-time noise levels have been predicted using Datakustik CadnaA® noise modelling software, in accordance with CRTN methodology and the modifications and guidance stated in DMRB LA 111. L_{night} traffic noise levels have been calculated using TRL Method 3. • The noise predictions contain the same inherent assumptions that were built into the traffic model. For a 1dB change to occur traffic flows need to increase by 25% or decrease by 20% (all other variables being equal). Therefore, small errors in traffic flow forecasts are unlikely to significantly affect results.
Topography	• The topography has been modelled based on 5m Digital Terrain Model (DTM) supplied by Highways England through the GeoStore. Digital Terrain/Surface Model - ©Astrium Ltd and Bluesky International Ltd. • The contours created from the DTM are at 1m intervals (vertical resolution). • The topography contours modelled for the Proposed Scheme were produced based on 3D drawings provided by the Highways engineering team and merged with the wider topography contours.
Buildings	• Buildings have been modelled based on OS Mastermap (Highways England Geostore) data. • Building heights have been derived from Google Maps data combined with eave height data from the above dataset.

Model element	Assumption and limitations
Road surface	• All rural roads have been assumed as comprising a hot-rolled asphalt surface. • The existing surface of the A47 trunk road has been modelled based on data from the Highways England Pavement Management System (HAPMS) • For all 'Do-Something' scenarios, a low noise surface (-3.5dB Road Surface Influence) has been included along the high speed sections of the Proposed Scheme.
Ground cover	• Intervening ground between any road and a receiver has been modelled as acoustically absorbent as the majority of the Proposed Scheme corridor passes through rural areas. • Buildings and roads have been included as acoustically hard (i.e. reflective).
Address data	• Address and receptor sensitivity data has been defined from OS AddressBase Plus data. • Public rights of way data was obtained from Norfolk County Council at https://maps.norfolk.gov.uk/highways/#. Public rights of way span over a considerable area/length and their use is of a transient nature. The assessment of the potential noise impacts has been undertaken across the total area/length of these NSRs to provide a balanced approach, considering the impact at the majority of the path rather than at a specific single location. Public rights of way with only a small section within the study areas have not been included in the assessment. • Non-residential sensitive receptors within the study area are not considered sensitive at night, and therefore have not been included in the night-time assessment tables.
Survey data	• The noise survey undertaken in June 2018 is considered robust and has been used to inform the noise model and for characterising the sound climate.

11.5.9. Data collection and analysis complemented by the assumptions stated above ensure the robustness of the assessment.

11.6. Study area

Construction noise and vibration

11.6.1. For the construction noise assessment, the study area has been defined as the area that is 300m from the closest construction activity.

11.6.2. For the construction vibration assessment, DMRB LA 111 notes that a study area encompassing a 100m area from vibration generating activity is normally sufficient, adding that variations in the study area can be defined for individual projects. Given the expected methods of work, a study area encompassing a 30m area from vibration generating activity is considered appropriate for identifying potentially worst-case significant effects since beyond this distance construction vibration, including from rotary piling would not be perceptible. This is discussed further in Section 11.8.

11.6.3. Some construction works would require temporary diversions of traffic on public roads where they interface with key construction activities. A diversion route study area has been defined to include a 25m width from the kerb line of the diversion routes as per LA 111 guidance.

Construction traffic

11.6.4. For the construction traffic assessment, a study area shall be defined to include a 50m width from the kerb line of public roads with the potential for an increase in

the baseline noise level of 1dB(A) or more as a result of the addition of construction traffic to existing traffic levels. Providing vehicle movements and routes are restricted as described in this chapter, increases in the baseline noise level due to the addition of construction related traffic are predicted to remain below 1dB(A). Therefore, a study area for the construction traffic assessment is considered unnecessary.

Operation

11.6.5. The operational study area for this assessment has been defined as the area within 600m of new road links or road links physically changed or bypassed by the project. This has been extended to include the area 50 metres either side of road links identified with a moderate or major noise change in the short-term or long-term. I.e. where the basic noise level changes show possible significant effects, as described in DMRB LA 111.

11.6.6. An analysis of other road links with potential to experience a short term basic noise level (BNL) change of more than 1.0dB(A) as a result of the project concluded that roads with a minor change in BNL (1.0-2.9dB) were a continuation of links within the above study area. DMRB LA 111 initial assessment of significance class minor magnitude of change as 'not significant', with no reasons for modifying this initial assessment at these links. As such, these road links were excluded from the modelled study area.

11.7. Baseline conditions

11.7.1. In order to establish the baseline sound conditions, noise monitoring was undertaken along the Proposed Scheme route in June 2018. Full details of the survey undertaken are presented in Appendix 11.3 (**TR010040/APP/6.2**).

11.7.2. Measured baseline results have been compared with the predicted road traffic noise index, dB $L_{A10,18hr}$ for the Do-Minimum Opening Year scenario. This comparison is shown in Table 11-3.

11.7.3. For this comparison, the $L_{A10,18hr}$ for the short-term measurements has been obtained by subtracting 1dB from the arithmetic mean of the three $L_{A10,15min}$ values, which is broadly in accordance with the Calculation of Road Traffic Noise (CRTN) shortened method.

Table 11-3 : Comparison of noise measurements and predictions (DMOY scenario)

Noise Monitoring Position	Predicted dB $L_{A10,18hr}$	Measured dB $L_{A10,18hr}$	Difference dB $L_{A10,18hr}$
ST1	62	67	+5
ST2	51	51	0
ST3	60	59	-1
ST4 H	63	59	-5
ST4 R	57	54	-3
ST5	50	52	+2
ST6	55	55	0
ST7	56	54	-2
ST8	62	62	0
ST9	71	75	+4
LT1*	61	54	-7
LT2	72	70	-2
LT3	52	54	+2
LT4	72	75	+3
LT5	72	71	-1
LT6*	70	71	+1

* Data collected with façade measurement and subsequently corrected to free field values

11.7.4. The comparison in Table 11-3 shows that at a majority of measurement positions there is a reasonably good correlation between the predicted and measured noise levels, with a difference of less than 3dB at ten out of fifteen positions.

11.7.5. The three receptors with the greatest difference with the noise model outputs are as follows:

- Position LT1 was located in the back garden of Izola, North Street, Blofield, NR13 4RH. Differences between the traffic model speed and actual speed on the A47 could explain this difference. It is noted that there is a dense belt of vegetation which may have had an acoustically absorptive effect, and this is not accounted for in CRTN predictions.
- Two of the positions (ST1 and ST4 H) are short-term positions for which the dB $L_{A10,18hr}$ index has been estimated via the CRTN shortened method. There is the possibility that the short-term measurements were taken while traffic conditions on adjacent roads were atypical.
- Position ST1 was located on the grass verge at the junction of Yarmouth Road with an Unnamed Road (leading to Waterlow and Hemblington Road). The Unnamed Road is not included in the noise model due to low traffic flows. However, actual flows on this road, even if low, might have affected the noise levels at the monitoring position.

- Position ST4 H was located in the back garden of no. 6 Main Road, North Burlingham, Norwich, NR13 4TA and the screening effect of the intervening building may be greater than predicted using the CRTN methodology.

11.7.6. It should be noted that there will rarely be perfect agreement between predicted and measured noise levels due to the comparison of relatively short-term measurement data against predicted noise levels using annual average traffic data. The measured noise levels are influenced by the local traffic conditions at the time of the survey, the meteorological conditions and will have contributions from other (non-road) noise sources such as trains passing, aircraft, farming activities, birdsong and more. In addition, the CRTN prediction method assumes light downwind propagation to every prediction point in the model. This is unlikely to occur in reality. This can result in wide variations between measured noise levels and predicted baseline noise levels.

11.7.7. In accordance with DMRB LA111, noise monitoring has been used to inform baseline noise modelling results. Given the above explanations and the good match at the majority of measurement positions, the modelled results are considered robust for representing the Do Minimum Opening Year scenario. No amendments to the noise model were considered necessary.

Noise sensitive receptors within the construction noise study area

11.7.8. A total of 303 noise sensitive receptors have been identified within the 300m study area from the closest construction activity. DMRB LA111 requires that construction noise levels are calculated at selected locations which are representative of all noise sensitive receptors in the study area. As a robust worst-case approach, a representative sample of the 23 closest noise sensitive receptors to the construction works have been used to inform the outcomes of the construction noise and vibration assessment.

11.7.9. There are a very large number of properties within the diversion route study area; it is not a proportionate approach to assess the impact of diversions in terms of the impact on individual receptors, as further detailed later in this chapter.

Noise sensitive receptors within the operational noise study area

11.7.10. Noise sensitive receptors include both residential receptors (dwellings) and non-residential (such as commercial premises, schools, community facilities and public rights of way). A total of 1,287 dwellings and 24 other sensitive receptors have been identified within the operational study area.

11.7.11. The operational study area is defined in paragraph 11.6.5 and is shown in Figure 11.1 (**TR010040/APP/6.3**). The study area consists of four sections. The area within 600 m of new road links or road links physically changed or bypassed by

the project is the largest section and includes the village of Blofield, the village of North Burlingham and Noise Important Areas[1] (NIA) 5206, 5207, 5208 and 5209.

11.7.12. There are three other distinct sections within 50 metres either side of road links identified with a moderate or major noise change in the short-term or long-term. These are as follows:

- 50m either side of the B1140 from Panxworth to the roundabout with the A47/A1064.
- 50m either side of Norwich Road from the junction with the A47 eastbound off-slip to the junction with Reedham Road, along with 50m either side of Reedham Road from this junction to Hill Farm.
- 50m either side of the Strumpshaw Road / Long Lane / Stone Road / Wood Lane Cantley Road corridor which runs between the junction of Blofield Road and Strumpshaw Road up to The Cock Tavern junction, along with the High Road (B1140) corridor from The Cock Tavern junction up to the junction with Sandy Lane in the village of Beighton.

11.8. Potential impacts

11.8.1. The potential impacts due to construction and operation of the Proposed Scheme are presented in the following section.

Construction noise

11.8.2. Construction noise generated by the project has the potential to adversely affect noise sensitive receptors within the 300m study area.

11.8.3. Details of construction phases, sample of noise sensitive receptors and predicted noise levels for each phase and activity are presented in the Appendix 11.5 (**TR010040/APP/6.2**).

11.8.4. The representative receptors for areas at which a moderate or major magnitude of impact could occur are presented in Table 11-4. These impacts could potentially result in significant adverse effects without mitigation.

[1] Noise Important Areas are areas particularly affected by noise. They are defined in the Noise Action Plans as the area where the 1% of the population that are affected by the highest noise levels from major roads are located according to the results of the strategic noise mapping.

Table 11-4 : Moderate and major magnitude of noise impact during construction

Phase	Activity	Noise sensitive receptor	Min. Distance (m)	Predicted façade noise level $L_{Aeq,T}$ (dB)	Magnitude of impact
Compounds set up and utility diversions	Earthworks	R15	112	65	Moderate
		R20	45	68	Moderate
	Surfacing	R20	45	66	Moderate
	Gas main diversion	R4	30	69	Moderate
		R10	20	73	Major
		R23	20	73	Major
Phase 1	Earthworks	R8	100	67	Moderate
		R9	100	67	Moderate
		R11	30	81	Major
		R12	35	81	Major
		R13	30	80	Major
		R14	75	70	Major
		R15	55	73	Major
		R20	100	65	Moderate
	Road Formation	R9	100	65	Moderate
		R11	30	77	Moderate
		R12	35	79	Major
		R13	30	78	Major
		R14	75	66	Moderate
		R15	55	71	Major
	Structures	R15	55	68	Moderate
	Surfacing	R12	35	73	Major
		R13	30	74	Major
		R14	75	65	Moderate
		R15	55	70	Major
Phase 3	Earthworks	R8	80	66	Moderate
Phase 4	Surfacing	R2	50	68	Moderate
		R3	45	67	Moderate

Phase	Activity	Noise sensitive receptor	Min. Distance (m)	Predicted façade noise level $L_{Aeq,T}$ (dB)	Magnitude of impact
Phase 5	Road Formation	R7	30	66	Moderate
		R20	30	69	Moderate
	Surfacing	R7	30	65	Moderate
		R20	30	68	Moderate
Phase 6	Earthworks	R7	25	67	Moderate
		R8	35	65	Moderate
	Road Formation	R7	25	65	Moderate
Phase 7	Road Formation	R1	65	68	Moderate
		R2	50	69	Moderate
		R3	50	68	Moderate
	Surfacing	R1	65	67	Moderate
		R2	50	68	Moderate
		R3	50	67	Moderate

11.8.5. Table 11-4 shows that the closest receptors to some construction activities will potentially experience a temporary moderate or major magnitude of impact without mitigation from one or more activities or phases.

11.8.6. DMRB LA 111 advises that a significant effect would occur when a moderate or major impact is expected for 10 or more days or nights in any 15 consecutive days or nights; or for a total number of days exceeding 40 in any six consecutive months.

11.8.7. Indicative dates for the duration of each phase are presented in Appendix 11.5 (**TR010040/APP/6.2**). At this stage, a precautionary approach has been adopted, considering that the assessed construction activities have the potential to exceed the above durations. In reality, this is unlikely to happen in the same area, affecting the same receptors for a prolonged period of time.

11.8.8. Section 11.9 presents specific noise mitigation measures and best practice techniques that are expected to reduce the potential for significant effect occurring due to noise from construction activity.

11.8.9. For the gas main diversion route, the contractor is expected to work in a linear fashion to complete the circa four kilometres of diversion in approximately three months. Therefore, it is extremely unlikely that the assumed plant would be at the shortest distance to the identified receptors for more than two or three days. As

such, the construction of the gas main diversion is unlikely to cause a significant adverse noise effect.

11.8.10. LA 111 states that the sudden change of traffic levels on diversion routes, as a result of night time closures, is likely to cause disturbance to receptors next to (within 25m of) the road. It notes that a major magnitude of impact should generally be determined at any noise sensitive receptors within the diversion study area where the routes are used at night.

11.8.11. The determination of impact in LA 111 assumes that diversion traffic is mostly using local roads. Due to the large scale of the road closures required, the proposed diversion routes for this scheme would use mainly A-roads and therefore applying a temporary major adverse magnitude of impact to every receptor is considered to over-predict the potential noise changes. There is potential for some short term significant adverse noise impacts to receptors along diversion routes during night-time periods.

11.8.12. Section 11.9 presents noise mitigation measures and best practice techniques that are expected to reduce the potential for significant effect occurring due to noise from construction activity.

Construction vibration

11.8.13. Table 11-5 sets out indicative distances, based on historical field measurements, at which certain construction activities are expected to result in a level of vibration below 1mm/s peak particle velocity (PPV).

Table 11-5 : Distances at which vibration will not exceed SOAEL

Construction Activities	Distance in meters from activity with typical vibration levels below 1mm/s (SOAEL)
Rotary Bored Piling[1]	20-30m
Bulldozer[2]	15-20m
Tunnelling machine in soil[2]	10-15m
Heavy Vehicles (e.g. dump trucks)[2]	5-10m

[1] BS5228-2 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration, Table D.6
[2] Transport Research Laboratory (TRL), Research Report 53, Ground vibration caused by civil engineering works, Figure 3

11.8.14. Table 11-5.2 in Appendix 11.5 (**TR010040/APP/6.2**) demonstrates that the majority of sensitive receptors are beyond 30 m from the closest construction activity. For these receptors the magnitude of vibration are predicted to be no greater than temporary minor, and as such construction vibration is unlikely to constitute a significant effect beyond this distance from construction works.

11.8.15. Receptors R4, R7, R11, R12, R13, R15 and R20 are within the range of 25 to 30m from the closest construction area during some construction activity. Based on Table 11-5 vibration levels at these receptors are expected to be just perceptible and therefore below the SOAEL threshold. A significant effect would only occur if SOAEL levels are exceeded for 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. The use of construction plant that causes high levels of vibration at the closest point to these receptors would not be predicted to occur for periods of several days. These receptors are not predicted to experience any significant effects due to construction vibration.

11.8.16. Special consideration is given to receptor R19, which is eight metres from positions at which construction activity could occur. These activities include the tie-in to new westbound dual carriageway during Phase 5. Vibratory compaction works are expected to occur during this phase.

11.8.17. Vibration levels from vibratory compaction have been estimated at receptor R19, assuming that the vibratory roller has two vibrating drums, a maximum drum vibration amplitude of 0.5mm and a drum width of one metre.

11.8.18. During start-up and run-down, there is a 5% probability that 5.1mm/s PPV will be exceeded at the receptor, 33% probability of exceeding 3.1mm/s PPV and 50% probability of exceeding 1.9mm/s PPV.

11.8.19. During steady state operation, there is a 5% probability that 5.1mm/s PPV will be exceeded at the receptor, 33% probability of exceeding 2.7mm/s PPV and 50% probability of exceeding 1.4mm/s PPV.

11.8.20. The above predicted vibration levels would be above the SOAEL but below 10 mm/s PPV, representing a moderate magnitude of impact.

11.8.21. For this impact to constitute a likely significant effect at R19, vibratory rollers activity would need to be operating at this distance of the property for 10 or more days or nights in any 15 consecutive days or nights; or for a total number of days exceeding 40 in any 6 consecutive months, which in reality is unlikely to occur.

11.8.22. Based on all the above, construction vibration is unlikely to constitute a significant effect at any vibration sensitive receptor during construction activity.

11.8.23. It should be noted that the primary cause of community concern in relation to construction vibration generally relates to building damage. However, with reference to BS 7385-2: 1993, minor cosmetic damage in light or unreinforced buildings would require levels of at least 15mm/s PPV. Based on the expected type of construction plant and the distances to the nearest buildings, it is considered that this is extremely unlikely to occur.

11.8.24. It is noted that a barn building at Poplar Farm (R12) is closer to the construction activity than the residential receptors, at approximately 20m of potential vibratory compaction works. As a worst-case, it is calculated that there is a 5% chance of exceeding 1.7mm/s during start-up and run-down vibratory compaction works, which is well below the 15mm/s threshold for minor cosmetic damage in light or unreinforced buildings. However, due to the fact that this is a not listed old building dating 18th century, a precautionary approach should be taken to prevent potential damage to the building structure.

Construction traffic

11.8.25. Construction traffic can have a temporary impact for sensitive receptors located along existing roads used by these vehicles. The potential for such impacts is dependent on the volume and route of construction traffic.

11.8.26. It is understood that most construction traffic movements will be directly to and from the main compound areas as well as the satellite compound areas. These are presented in Figure 2.1 (**TR010040/APP/6.3**). Table 2~~.~~-4 in ES Chapter 2 The Proposed Scheme (**TR010040/APP/6.1**) provides a summary of the likely HGV movements.

11.8.27. Table 11-6 below presents the predicted noise increases in road traffic noise levels due to the addition of construction related traffic at daytime during representative phases with the highest construction traffic movements.

Table 11-6 : Predicted noise increases due to construction related traffic in phases 0 and 1 during daytime

Phase	Indicative locations	Assumed route	Traffic flow (18-hour AAWT)	Speed (km/h)	% HGV	Predicted increase in road traffic noise level (dB(A))
0	Compounds	A47 eastbound, immediately west of junction with B1140	18673	80	4.1	0.4
		A47 westbound immediately east of junction with B1140	18412	80	4.5	0.4
		B1140 northbound immediately south of the A47	696	40	3.2	7.1
1	Site wide	A47 eastbound, immediately west of junction with B1140	18673	80	4.1	0.4
		A47 westbound in vicinity of 1 & 2 Hall Cottages	19325	87	4.2	0.4

11.8.28. Provided that construction related traffic uses the A47 during the daytime, the maximum number of trips per day (as described in Table 2~~.~~-34) is predicted to increase the baseline road traffic noise level by less than 1dB. It is noted that if construction related traffic uses the B1140 (~~Yarmouth~~ High Road) there is the potential for adverse significant noise effects. Given the difference in road traffic

flows between the A47 and surrounding minor roads, construction related traffic shall not use any roads other than the A47 to access site.

Operational noise

11.8.29. Table 11-7 to Table 11-9 present the predicted noise level change at all dwellings and non-residential sensitive receptors within the operational study area. The short-term noise change (Do-Something Opening Year versus Do-Minimum Opening Year) has been used for determining where initial significant effects due to operational road traffic noise could occur.

Noise changes over the long-term without the Proposed Scheme (Do-Minimum Future Year versus Do-Minimum Opening Year)

11.8.30. Table 11-7 compares road traffic noise levels for the Do-Minimum Opening Year scenario with the Do-Minimum Future Year scenario. The changes in road traffic noise level over the long-term without the Proposed Scheme result from forecast changes in traffic volume and traffic speed on the existing road network.

Table 11-7 : Summary of long-term noise changes, without the Proposed Scheme

Scenario/Comparison: Do-Minimum Opening Year 2025 versus Do-Minimum Future Year 2040						
Change in Noise Level, dB(A)		Magnitude of Impact	Daytime, dB $L_{A10,18hr}$		Night-time, dB $L_{night,outside}$	
			Number of Dwellings	Number of non-residential sensitive receptors	Number of Dwellings	Number of non-residential sensitive receptors
Increase in noise level	<3.0	Negligible	1197	18	772	N/A
	3.0 – 4.9	Minor	0	2	0	N/A
	5.0 – 9.9	Moderate	0	1	0	N/A
	>10.0	Major	0	0	0	N/A
No Change	0.0	No Change	5	0	84	N/A
Decrease in noise level	<3.0	Negligible	85	3	431	N/A
	3.0 – 4.9	Minor	0	0	0	N/A
	5.0 – 9.9	Moderate	0	0	0	N/A
	>10.0	Major	0	0	0	N/A

11.8.31. Table 11-7 demonstrates that, without the Proposed Scheme, all residential noise sensitive receptors are predicted to experience a negligible change or no change in road traffic noise level. Three non-residential sensitive receptors are predicted to experience a minor or moderate increase during the daytime.

Noise changes due to the Proposed Scheme upon opening (Do-Something Opening Year versus Do-Minimum Opening Year)

11.8.32. Table 11-8 : Summary compares predicted road traffic noise levels for the Do-Something Opening Year scenario with the Do-Minimum Opening Year scenario.

The changes in road traffic noise due to the Proposed Scheme upon opening are predicted from changes in traffic flows and speeds, as well as the proposed realignment of the A47. The changes allow for the embedded mitigation measures described in paragraphs 11.9.13 and 11.9.14.

Table 11-8 : Summary of short-term noise changes, with the Proposed Scheme

Scenario/Comparison: Do-Minimum Opening Year 2025 versus Do-Something Opening Year 2025						
Change in Noise Level, dB(A)		Magnitude of Impact	Daytime, dB $L_{A10,18hr}$		Night-time, dB $L_{night,outside}$	
			Number of Dwellings	Number of non-residential sensitive receptors	Number of Dwellings	Number of non-residential sensitive receptors
Increase in noise level	<1.0	Negligible	587	10	801	N/A
	1.0 – 2.9	Minor	244	6	191	N/A
	3.0 – 4.9	Moderate	78	4	50	N/A
	>5.0	Major	16	0	4	N/A
No Change	0.0	No Change	43	0	11	N/A
Decrease in noise level	<1.0	Negligible	107	1	44	N/A
	1.0 – 2.9	Minor	194	3	174	N/A
	3.0 – 4.9	Moderate	14	0	10	N/A
	>5.0	Major	4	0	2	N/A

Explanation of off-line impacts

11.8.33. With the Proposed Scheme in place road traffic noise level reductions are predicted at Panxworth, Acle and South Walsham and at receptors within the village of Brundall adjacent to The Street / Blofield Road / Strumpshaw Road and Long Lane / Stone Road / Wood Lane / Cantley Road.

11.8.34. Increase in road traffic noise levels are also predicted at receptors adjacent to the B1140 (High Road) at South Burlingham and Beighton Village Hall/Hopewell Gardens with the Proposed Scheme in place.

11.8.35. These changes in road traffic noise levels are due to changes to road users' behaviour caused by the Proposed Scheme, especially for long distance trips, as detailed below.

11.8.36. Road users between Great Yarmouth and north-west Norwich are more likely to use the improved A47 then join the A1270 at Postwick junction. Without the Proposed Scheme, road users would otherwise travel via Acle and South Walsham B1140 until reaching the A1270.

11.8.37. With the Proposed Scheme, road users from Cantley are expected to travel through South Burlingham and Beighton then use the B1140 (High Road) to join the improved A47. Without the Proposed Scheme, road users would otherwise

travel via Cantley Road, Wood Lane and Stone Road through Brundall then use Cucumber Lane to join the A47.

Consented developments

11.8.38. There are two developments with planning consent that are within the operational study area but are not represented in Table 11-8 above. These are understood to be; The Conifers, Orchard Close, Blofield, NR13 4SE (full planning approved) and Land east of Plantation Road, Blofield, NR13 4PL (registered outline planning application). As can be seen in Figure 11.8 (**TR010040/APP/6.3**), the noise change at both of these locations due to the Proposed Scheme is predicted to be negligible.

Beneficial impacts due to the Proposed Scheme upon opening

11.8.39. Beneficial impacts are predicted in the short term upon opening of the Proposed Scheme due to changes in road users' behaviour.

11.8.40. A large number of dwellings (194) are predicted to have a minor beneficial impact due to the Proposed Scheme. Fourteen dwellings are predicted to experience a moderate beneficial impact and four are predicted to experience a major beneficial impact due to the Proposed Scheme. Three non-residential sensitive receptors are predicted to experience a minor beneficial impact due to the Proposed Scheme.

11.8.41. The majority of dwellings predicted to experience a minor beneficial impact are located in Brundall, Acle, South Walsham and Panxworth. The other receptors predicted to experience a minor beneficial impact are located in North Burlingham and on South Walsham Road, and a single dwelling in Blofield.

11.8.42. The fourteen dwellings predicted to experience a moderate beneficial impact are located on Strumpshaw Road and Wood Lane. Three dwellings are located in Panxworth. Additionally, the Noise Important Area 5208 (the Old Post Office, see Figure 11.1 (**TR010040/APP/6.3**) and Figure 11.8 (**TR010040/APP/6.3**) is predicted to experience a moderate beneficial impact due to the Proposed Scheme.

11.8.43. The four dwellings predicted to experience a major beneficial impact are located on Wood Lane (south of Buckenham Wood).

11.8.44. The non-residential sensitive receptors predicted to experience a minor beneficial impact are St Marys Church, St Lawrence Church and Lackford Cottage.

Adverse impacts due to the Proposed Scheme upon opening

11.8.45. Adverse impacts are predicted in the short term upon opening of the Proposed Scheme due to:

- The expected increase in road users along the Proposed Scheme and parts of the surrounding road network, along with expected change in road users' behaviour (see paragraphs 11.8.36 and 11.8.37).
- The expected increase in traffic speed along the Proposed Scheme.

11.8.46. A large number (244) of dwellings are predicted to experience a minor adverse impact due to the Proposed Scheme upon opening. The majority of these dwellings are located in Blofield. The remaining dwellings predicted to experience a minor adverse impact are located within the section of the study area that is within 600 m of the Proposed Scheme. Three of the dwellings predicted to experience a minor adverse impact are also predicted to experience Do-Something road traffic noise levels that are above the SOAEL. These are:

- 9 Highview Close, Blofield
- 44 Highview Close, Blofield
- 2 Hall Cottages, The Windle

11.8.47. At 9 and 44 Highview Close the short term noise increase due to the Proposed Scheme is predicted to be 1.0dB. Both of these receptors are within or close to Noise Important Area 5206. At 2 Hall Cottages the short term noise increase due to the Proposed Scheme is predicted to be 1.9dB.

11.8.48. The effect of these minor noise increases that result in road traffic noise levels above the SOAEL are discussed further in Table 11-14.

11.8.49. There are 78 dwellings predicted to experience a moderate adverse impact due to Proposed Scheme upon opening. The majority of these are located in Blofield and along the B1140 (High Road). The remainder are located on Lingwood Road and Lingwood Lane. All of these dwellings are predicted to experience road traffic noise levels with the Proposed Scheme that are below the SOAEL.

11.8.50. Sixteen dwellings are predicted to experience a major adverse impact due to the Proposed Scheme upon opening. These are located in Blofield and along the B1140 (High Road). At all of these dwellings, predicted road traffic noise levels with the Proposed Scheme are below the SOAEL.

11.8.51. The dwellings in Blofield predicted to experience a moderate or major adverse impact due to the Proposed Scheme upon opening are located on Yarmouth Road. An explanation of the adverse impacts is presented in paragraph 11.8.45.

11.8.52. For dwellings along the B1140 (High Road), the moderate or major adverse impact is due to traffic re-routing as described in paragraphs 11.8.33 and 11.8.37.

11.8.53. There are six non-residential sensitive receptors predicted to experience a minor adverse impact due to the Proposed Scheme upon opening. These are:

- The Church of Saint Andrew in North Burlingham
- The Church of Saint Peter in North Burlingham
- The Scout Hall in Blofield
- Willow Barn on Lingwood Road
- Public rights of way Acle BOAT2
- Public rights of way Burlingham FP1

11.8.54. There are a further four non-residential sensitive receptors predicted to experience a moderate adverse impact due to the Proposed Scheme upon opening. These are:

- Beighton Village Hall
- Elderflower Barn on Lingwood Road
- Poppy Barn on Lingwood Road
- Public rights of way Burlingham FP3

11.8.55. At all of the above non-residential sensitive receptors, predicted road traffic noise levels with the Proposed Scheme are below the SOAEL.

Noise changes over the long-term with the Proposed Scheme (Do-Something Future Year versus Do Minimum Opening Year)

11.8.56. Table 11-9 compares road traffic noise levels for the Do-Something Future Year scenario with the Do-Minimum Opening Year scenario. The changes in road traffic noise due to the Proposed Scheme over the long-term are due to changes in traffic flows and speeds, as well as the proposed realignment of the A47. The changes take account of the embedded mitigation measures described in paragraphs 11.9.13 and 11.9.14.

Table 11-9 : Summary of long-term noise changes, with the Proposed Scheme

Scenario/Comparison: Do-Minimum Opening Year 2025 versus Do-Something Future Year 2040						
Change in Noise Level (dB(A))		Magnitude of Impact	Daytime, dB $L_{A10,18hr}$		Night-time, dB $L_{night,outside}$	
			Number of Dwellings	Number of non-residential Sensitive Receptors	Number of Dwellings	Number of non-residential Sensitive Receptors
Increase in noise level dB	<3.0	Negligible	924	17	999	N/A
	3.0 – 4.9	Minor	48	3	72	N/A
	5.0 – 9.9	Moderate	55	1	8	N/A
	>10.0	Major	0	0	0	N/A
No Change	0.0	No Change	12	0	10	N/A
Decrease in noise level	<3.0	Negligible	235	3	188	N/A
	3.0 – 4.9	Minor	10	0	9	N/A
	5.0 – 9.9	Moderate	3	0	1	N/A
	>10.0	Major	0	0	0	N/A

11.8.57. Table 11-9 demonstrates that the majority of sensitive receptors are predicted to experience a negligible or no noise change due to the Proposed Scheme over the long-term.

Consented developments

11.8.58. There are two developments with planning consent that are not represented in Table 11-9 above. The developments are described in paragraph 11.8.38. As can be seen in Figure 11.9 (**TR010040/APP/6.3**), the long term noise changes are predicted to be negligible at these locations.

Beneficial impacts due to the Proposed Scheme over the long term

11.8.59. Ten dwellings are predicted to experience a minor beneficial impact and three dwellings are predicted to experience a moderate beneficial impact due to the Proposed Scheme over the long-term.

11.8.60. The dwellings predicted to experience minor beneficial impacts are located in Panxworth, South Walsham and Stone Road/Wood Lane. The three dwellings predicted to have a moderate beneficial impact are on Wood Lane.

11.8.61. The minor/moderate beneficial impacts can be explained due to the anticipated changes in road users' behaviour due to the Proposed Scheme. This has been described above in paragraphs 11.8.33 and 11.8.37.

11.8.62. There are no non-residential receptors predicted to experience a perceptible beneficial impact due to the Proposed Scheme over the long term.

Adverse impacts due to the Proposed Scheme over the long term

11.8.63. There are 48 dwellings predicted to experience a minor adverse impact and 55 dwellings predicted to experience a moderate adverse impact due to the Proposed Scheme over the long term. All of these dwellings are located along the B1140 (High Road), Yarmouth Road, Lingwood Road and Lingwood Lane.

11.8.64. At all of these dwellings, predicted road traffic noise levels with the Proposed Scheme are below the SOAEL.

11.8.65. With respect to non-residential receptors, Poppy Barn, Elderflower Barn and public rights of way Burlingham FP3 are predicted to have a minor adverse impact in the long term. Beighton Village Hall is predicted to experience a moderate adverse impact. At all of these receptors, predicted road traffic noise levels with the Proposed Scheme are below the SOAEL.

11.9. Design, mitigation and enhancement measures

11.9.1. The design interventions and mitigation measures that have been introduced to reduce the potential for significant effects due to noise and vibration from the construction and operation of the Proposed Scheme are presented in this section.

Construction noise and vibration

11.9.2. Construction works will take place mainly during the daytime. Construction works outside of normal construction hours of 07:00-19:00 weekday and 07:00-12:00 on Saturdays shall be minimised as far as practicable, as detailed in the Environmental Management Plan. Where works outside of these hours are unavoidable (for example tie-in works), the Contractor will need to assess noise and vibration due to construction, consult with the local planning authority, and agree appropriate methods of mitigation that account for the location of works, hours of work and expected duration.

11.9.3. The permanent noise barriers that form part of the embedded mitigation for operational noise shall be built as early as possible in the construction programme so that they can offer noise mitigation during the construction phase. This would be of particular benefit to receptors R12, R13 and R20.

11.9.4. Mitigation measures in the form of temporary noise barriers shall be provided at the areas represented by the residential receptors in Table 11-10 where construction activity in the vicinity of the receptor will exceed 10 days or nights in any 15 consecutive days or nights; or for a total number of days exceeding 40 in any six consecutive months.

11.9.5. Temporary noise barriers shall have a minimum mass per unit of area of at least 7 kg/m^2 with no gaps at the joints or perimeter. The height of the temporary noise barrier shall be sufficient to completely hide the construction noise source from the receptors, as far as practicable.

Table 11-10 : Temporary noise barriers as specific construction noise mitigation measures

Receptor Reference	Receptor Address	Construction Phase	Activity
R2	97 Melai, Yarmouth Road, Blofield, Norwich, NR13 4LQ	Phase 4	Surfacing
		Phase 7	Road formation Surfacing
R3	109 Milestone Piece, Yarmouth Road, Blofield, Norwich, NR13 4LQ	Phase 4	Surfacing
		Phase 7	Road formation Surfacing
R7	Sunny Acres, Yarmouth Road, Blofield, Norwich, NR13 4LH	Phase 5	Road formation Surfacing
		Phase 6	Earthworks Road formation
R8	Sparrow Hall Bungalow, Yarmouth Road, Blofield, Norwich, NR13 4LH	Phase 1	Earthworks
		Phase 3	Earthworks
		Phase 6	Earthworks
R9	Brienz, Waterlow, Blofield, Norwich, NR13 4LJ	Phase 1	Earthworks Road formation
R11	The Old Post Office, Norwich Road, North Burlingham, Lingwood And Burlingham, Norwich, NR13 4SU	Phase 1	Earthworks Road formation
R12	Hornbeam Cottage Lingwood Road North Burlingham Lingwood And Burlingham Norwich NR13 4ST	Phase 1	Earthworks Road formation Surfacing
R13	The Lindens, Lingwood Road, North Burlingham, Lingwood And Burlingham, Norwich, NR13 4ST	Phase 1	Earthworks Road formation Surfacing
R14	4 Main Road, North Burlingham, Lingwood And Burlingham, Norwich, NR13 4TA	Phase 1	Earthworks Road formation Surfacing
R15	18 Island House, Main Road, North Burlingham,, Lingwood And Burlingham, Norwich, NR13 4TA	Compound set up	Earthworks
		Phase 1	Earthworks Road formation Structures Surfacing
R20	The Coach House, Acle Road, North Burlingham, Beighton, Norwich, NR13 4EL	Compound set up	Earthworks Surfacing
		Phase 1	Earthworks
		Phase 5	Road formation Surfacing

11.9.6. In addition, the Contractor shall carry out noise monitoring during relevant periods of the construction programme at positions that represent receptor R12 and R13. Real-time alerts can be provided to notify the Contractor when noise from works approaches the defined SOAEL levels, at which time methods of work can be altered. Where levels are found to be in excess of those predicted in this EIA, further mitigation measures will be implemented in discussion with affected property owners.

11.9.7. In addition to the above mitigation measures, best practice noise and vibration mitigation techniques shall be employed to include the following, where practicable:

- Select quieter plant than those assumed within this assessment;
- Ensure equipment is maintained, in good working order, and is used in accordance with the manufacturer's instructions;
- Use equipment that is fitted with silencers or mufflers;
- Set time restrictions on certain noisy and vibratory activities such as earthworks and surfacing;
- Manage deliveries to prevent queuing of site traffic;
- Do not leave plant running unnecessarily;
- Plant with highly directional sound emissions shall be angled so that the direction of highest sound emissions does not face towards receptors;
- Materials to be lowered instead of dropped from height;
- Alternative reversing warning systems such as white noise alarms shall be employed;
- The Contractor shall advise members of the construction team during toolbox talk briefings on quieter working methods;
- Any fixed plant such as generators shall be positioned at least 20m from nearest receptor.

11.9.8. The potential effects of construction noise and vibration on local community receptors can be lessened by effective communication. Good public relations are invaluable in securing public acceptance of construction noise. People are more tolerant of construction noise and vibration if they understand the reason for it, the likely duration, start and finish dates, and that measures are being employed to reduce noise and vibration as far as practicable. Letter drops explaining this would aid communication with the local community. A dedicated site contact for the public and a complaints-handling procedure shall also be put in place.

11.9.9. For temporary traffic diversion routes, the noise mitigation measures shall include the use of more than one diversion route for different closures. For each principal diversion the contractor shall review the options for temporary traffic management and diversion routes will be used following the least noise sensitive routes. Residents along routes likely to be affected by night time traffic diversions

with potential for significant noise effects will be notified in advance of arrangements.

11.9.10. Where vibration levels are predicted to exceed SOAEL (at The White House, Acle Road North, NR13 4EL during surfacing works), the contractor shall:

- carry these works out only during the daytime;
- inform the occupiers of the likely times and duration of works;
- monitor the vibration levels. Real-time alerts can be provided to notify the Contractor when vibration from works approaches the defined SOAEL levels, at which time methods of work can be altered; and
- carry out a building condition survey to identify any sensitive aspects of the building and to ensure the current status of the building is recorded.

11.9.11. As a precautionary approach, vibration monitoring and building condition survey should also be carried out at Poplar Farm barn to prevent damage to this 18th century not listed building.

Construction traffic

11.9.12. In order to avoid potential significant effects, construction related traffic can use the A47 as required, provided that the maximum number of HGV movements in Table 2-~~-43~~ are not exceeded. Additionally, construction related traffic arriving from off site shall not use any roads other than the A47.

Operation

11.9.13. As part of the Proposed Scheme, the A47 dual carriageway shall be surfaced with a low-noise road surface. For this high-speed carriageway, the surface material shall be specified to reduce road traffic noise by 3.5dB $L_{A10,18hr}$ when compared with conventional surfacing.

11.9.14. Noise barriers have been included as part of the Proposed Scheme design at the locations described in Table 11-11 and as presented in Figure 11.2 (**TR010040/APP/6.3**).

Table 11-11 : Permanent noise barrier requirements

Noise barrier ID	Location	Height (m)	Approximate length (m)	Type	Insertion loss, IL (dB)	Sound insulation category
1	North Blofield	3	265	Reflective	9.8	B3
2	Poplar Farm, Lingwood Road	3	400	Absorptive (Class A1)	4.8	B2
3	The White House, Acle Road	3	170	Reflective	4.8	B2
4	1 and 2 Hall Cottages, The Windle	2	130	Reflective	5.6	B2

11.9.15. The required noise barrier specification is presented in Table 11-11 and has been determined in accordance with DMRB LD 119 *Road side environmental mitigation and enhancement*. The required category of airborne sound insulation category is specified as per BS EN 1793-2. The category of absorptive performance is specified as per BS EN 1793-1 and in accordance with the stated requirements with DMRB LA 111.

11.9.16. The locations of the noise barriers are presented in Figure 11.2 (**TR010040/APP/6.3**). The barrier heights within Table 11-11 must be regarded as the height difference between the top of the acoustic barrier and the local height of the carriageway.

11.9.17. Barrier 1 is required to reduce already high levels of road traffic noise at the Noise Important Area 5207 and to avoid potential significant adverse effects due to the expected increase in traffic flows and speeds on the nearby A47.

11.9.18. Barrier 2 is required to avoid potential significant adverse effects at dwellings close to Poplar Farm. These effects would otherwise occur due to the realignment of the A47 as part of the Proposed Scheme.

11.9.19. Barrier 3 is required to avoid potential significant adverse effects at The White House. These effects would otherwise occur due to the realignment of the A47 (circa 8m closer to this receptor) along with increases in traffic flows and speeds that are expected due to the Proposed Scheme.

11.9.20. Barrier 4 is required to avoid potential significant adverse effects at 1 and 2 Hall Cottages (within Noise Important Area 5209). These effects would otherwise occur due to the increases in traffic flows and speeds that are expected due to the Proposed Scheme.

11.9.21. These barriers are also assessed in ES Chapter 7 Landscape and Visual (**TR010040/APP/6.1**) and incorporated into the Masterplan (**TR010040/APP/6.8**).

11.9.22. Adverse changes in road traffic noise are predicted to occur at receptors close to Yarmouth Road and the B1140, however road traffic noise levels with the Proposed Scheme are predicted to be below the SOAEL. Provision of acoustic barriers adjacent to these road is not practical since it would obstruct access to driveways. These roads are maintained by the local highways authority and Highways England is not responsible for the selection of road surface material type. No further mitigation for these receptors is deemed necessary.

11.9.23. Within and in close proximity to NIA 5206, two receptors are predicted to experience a noise change of 1.0dB due to the Proposed Scheme in the Opening Year and road traffic noise levels are predicted to be above the SOAEL. This NIA is beyond the RLB of the project. However, Highways England have confirmed that resurfacing maintenance works using low noise road surface for this area is to be completed before Opening Year of the Proposed Scheme and will be in operation before the year of scheme opening.. This will mitigate the significant adverse effects.

11.10. Assessment of likely significant effects

11.10.1. The residual effects due to noise and vibration once mitigation has been employed are presented in this section.

Construction vibration

11.10.2. The assessment has identified a moderate magnitude of impact during vibratory compaction works at R19. However, this is not predicted to result in a significant adverse effect as the vibratory rollers activity is not expected to be operating at short distance of the property for 10 or more days or nights in any 15 consecutive days or nights; or for a total number of days exceeding 40 in any 6 consecutive months.

11.10.3. The mitigation measures described in Section 11.9 (including monitoring) will ensure that residual significant effects due to construction vibration are avoided.

Construction noise

11.10.4. With temporary noise barriers, or the early provision of the permanent noise barriers, potential for significant effects due to noise from the construction of the Proposed Scheme remains at two receptors. The magnitude of impact with mitigation is presented in Table 11-12 and the assessment of residual significant effects explained further below.

Table 11-12 : Predicted moderate and major magnitude of impact with temporary noise barriers

Phase	Activity	NSR	Min. Distance (m)	Predicted façade noise levels, $L_{Aeq,T}$ (dB)	Magnitude of impact (mitigated)
Phase1	Earthworks	R12	35	71	Major
		R13	30	70	Major
	Road Formation	R12	35	69	Moderate
		R13	30	68	Moderate

11.10.5. For the assessment of noise from Phase 1 construction activity, a worst-case approach has been taken. Construction noise predictions account for the works occurring at the closest part of the construction area to each receptor. Furthermore, a large complement of construction plant has been assumed to be operating at this closest position during earthworks and road formation works.

11.10.6. Noise from Phase 1 construction activity as experienced at receptors represented by R12 and R13 would result in significant effects where these construction activities take place in close proximity to these receptors for 10 or more days or nights in any 15 consecutive days or nights; or for a total number of days exceeding 40 in any 6 consecutive months. Given the scale of the Proposed Scheme, it is expected that earthworks and road formation will progress in a linear fashion and in stages between the tie-in points. Therefore, noise from moving construction plant would be more transient than assumed in the assessment.

11.10.7. Further to the noise mitigation measures applied to the temporary traffic diversions, including use of multiple diversion routes, and prior notification, the magnitude of impact is predicted to minor. Temporary traffic diversions are therefore not predicted to result in any significant adverse residual effects.

11.10.8. In summary, subject to the provision of temporary or permanent noise barriers, appropriate construction noise monitoring and the mitigation measures described within Section 11.9, construction noise is not predicted to result in any significant residual effects.

Construction traffic

11.10.9. Provided that construction related traffic movements do not exceed those anticipated in Table 2-~~.~~4 of ES Chapter 2: The Proposed Scheme (**TR010040/APP/6.1**) and only the A47 is used for site access; increases in the basic noise level along roads used for construction traffic are predicted to have a negligible magnitude of impact. Therefore, no significant residual effects due to construction traffic are predicted for roadside receptors.

Operation

11.10.10. The changes in road traffic noise that result from the Proposed Scheme have been reported in accordance with DMRB LA 104 and LA 111 and include the mitigation measures described in Section 11.9.

11.10.11. An initial assessment of operational noise significance at noise sensitive receptors is presented in this Section and is summarised in Table 11-13. A moderate or major magnitude of impact at noise sensitive receptors are classed as 'Significant'.

Table 11-13 : Summary of the initial assessment of operational noise significance

Initial assessment of operational noise significance	Number of receptors at which the initial assessment of operational noise is significant or not significant			
	Adverse		Beneficial	
	Daytime, dB $L_{A10,18hr}$	Night-time, dB $L_{night,outside}$	Daytime, dB $L_{A10,18hr}$	Night-time, dB $L_{night,outside}$
Significant	97	55	18	12
Not significant	840	1004	348	232

11.10.12. Table 11-13 demonstrates that the initial assessment of significance of predicted traffic noise effects for the majority of noise sensitive receptors is not significant.

11.10.13. DMRB LA 111 then requires the final operational significance to be determined using the justifications in LA 111 Table 3.60 (reproduced in Appendix 11.2 (**TR010040/APP/6.2**)). In the short-term, potentially significant beneficial noise effects are predicted at a total of 18 dwellings. Noise Important Area 5208 (the Old Post Office) is predicted to have a potentially significant beneficial noise effect.

11.10.14. In the short-term, potentially significant adverse noise effects are predicted at a total of 97 noise sensitive receptors, of which three are non-residential sensitive receptors. The 94 dwellings predicted to have significant adverse noise effects are located on Yarmouth Road, Lingwood Road, Lingwood Lane and the B1140 (High Road). The three other sensitive (non-residential) receptors predicted to have potentially significant adverse noise effects are Beighton Village Hall, Poppy Barn and Elderflower Barn.

11.10.15. Dwellings on Lingwood Road, Lingwood Lane and B1140 (High Road) are also predicted to have potentially significant adverse noise effects.

11.10.16. The causes of the potentially significant noise effects are explained in Section 11.8.

11.10.17. Following the justifications within LA 111 Table 3.60, final operational noise significance at the identified noise sensitive receptors and Noise Important Areas has been determined. This is presented in Table 11-14.

Table 11-14 : Final operational noise significance summary table

Receptor Group	Magnitude of change	Significance of Environmental Effect	Justification of Significance Conclusion
Noise Important Area 5206 (9 & 44 Highview Close)	Minor/negligible adverse in the short term, negligible adverse in the long term	Not Significant	Two dwellings are predicted to have absolute noise levels above SOAEL and experience an increase in road traffic noise level of 1.0dB in the Opening Year without mitigation. A significant adverse effect will be avoided by resurfacing works with LNS at this NIA before the scheme opening year.
Noise Important Area 5207 (111 Brandsby)	Minor adverse in the short term, negligible adverse in the long term	Not significant	Absolute noise levels are predicted to increase due to the Proposed Scheme at positions overlooking the Yarmouth Road. However absolute noise levels are predicted to remain below SOAEL in all scenarios.
Noise Important Area 5208 (Old post office)	Moderate beneficial in the short term, negligible in the long term	Not significant	The long term impact is predicted to be negligible and of less magnitude than the short term. Therefore, the moderate beneficial impact in the short term is not significant.
Noise Important Area 5209 (1 and 2 Hall Cottages)	Minor adverse in the short term, negligible adverse in the long term	Not significant	2 Hall Cottage is predicted to have a minor increase in absolute noise levels in the short term, with embedded mitigation in place. Road traffic noise levels are predicted to reduce, stay the same or experience a negligible increase at facades currently above the SOAEL. At the opposite façade to the road, a minor adverse increase is predicted, however the road traffic noise level remains below the SOAEL. 1 Hall Cottage is predicted to have a negligible increase, reduction or no change in road traffic noise levels. Overall, a significant adverse effect at these receptors is not predicted.
Noise Important Area 5210	Negligible adverse in the short term, negligible adverse in the long term	Not significant	None of the dwellings at this location are predicted to have absolute noise levels at or above SOAEL, and noise increases due to the Proposed Scheme are less than 1.0dB. Therefore a significant adverse effect is not predicted.
Strumpshaw Road/Stone Road/Wood Lane	Major/moderate beneficial in the short term, moderate/minor beneficial in the long term	Significant beneficial	The long term impact is predicted to be of a lower magnitude than the short term. However, the major/moderate change at 17 dwellings in the short-term is considered a significant beneficial effect.
Panxworth	Moderate beneficial in the short term, minor/negligible beneficial in the long term	Not significant	The long term impact is predicted to be minor/negligible and of a lower magnitude than the short term impact. Therefore a significant beneficial effect is not predicted.
North Burlingham	Minor beneficial in the short term, negligible in the long term	Not significant	The long term impact is predicted to be negligible and of a lower magnitude than the short term impact. Therefore a significant beneficial effect is not predicted.

Receptor Group	Magnitude of change	Significance of Environmental Effect	Justification of Significance Conclusion
Panxworth, Ancle and South Walsham	Minor beneficial in the short term, negligible in the long term	Not significant	The long term impact is predicted to be negligible and of a lower magnitude than the short term impact. Therefore a significant beneficial effect is not predicted.
Yarmouth Road (Blofield)	Major/moderate adverse in the short term, minor/moderate adverse in the long term	Significant adverse	For 37 dwellings either side of Yarmouth Road an increase in road traffic noise level results from the predicted increase in traffic flows and speeds along this road. The impact magnitude remains moderate in the long-term and a significant adverse effect is predicted. Significant adverse effects are likely at dwellings within 80m of Yarmouth Road (between the A47 and the Danesbower Lane junction).
Blofield (beyond Yarmouth Road)	Minor/negligible adverse in the short term, negligible in the long term	Not significant	The long term impact is predicted to be negligible and of a lower magnitude than the short term impact. Therefore a significant adverse effect is not predicted.
Receptors on the B1140 (High Road)	Moderate/major adverse in the short term, moderate/minor adverse? in the long term	Significant adverse	The long term impact is predicted to be of a lower magnitude than the short term. However, 18 receptors are predicted to have a moderate adverse impact in the long term. Therefore significant adverse effects are likely at a number of dwellings on the B1140 (Cock Tavern to Sandy Lane).
Receptors on Lingwood Road/Lingwood Lane	Moderate/minor adverse in the short term, negligible/minor adverse? in the long term	Not significant	Road traffic noise levels at these receptors are below the SOAEL for any Do-Something scenario. Additionally, no moderate adverse impacts are predicted in the long term. Therefore, significant adverse effects are not predicted.
Public rights of way	Moderate/minor adverse in the short term, negligible/minor in the long term	Not significant	All minor impacts in the short term are predicted to be negligible in the long term. Moderate impact at Burlingham FP3 in the short term is predicted to be minor in the long term. The long term impact is predicted to be of a lower magnitude than the short term at all public rights of way. Therefore, significant adverse effects are not predicted.

11.10.18. In accordance with DMRB LA 111, a number of significant residual traffic noise effects are predicted due of the operation of the Proposed Scheme. These are both adverse and beneficial, as presented in Figure 11.10 (**TR010040/APP/6.3**) and as follow:

- Beneficial noise effects are predicted at 17 dwellings in the vicinity of Strumpshaw Road/Stone Road/Wood Lane.
- Adverse noise effects are predicted at 37 dwellings in the vicinity of Yarmouth Road (A47 to the Danesbower Lane junction).
- Adverse noise effects are predicted at 18 dwellings in the vicinity of the B1140 (Cock Tavern to Sandy Lane).

11.10.19. It is noted that adverse noise effects are not predicted to occur at receptors affected by new road links or road links physically changed or bypassed by the

project, but due to predicted increases in road traffic flows and speeds beyond the RLB as a result of the Proposed Scheme.

11.10.20. Despite the significant adverse noise effects predicted in the vicinity of Yarmouth Road and B1140 High Road, the absolute road traffic noise level at opening year will be comparable to local B roads in the vicinity in and around Blofield.

11.10.21. The assessment also identifies that there are no dwellings where the façade noise level is at least 68dB $L_{A10,18h}$ and the noise from the new or altered highways causes the total level to increase by at least 1dB. As such, no properties are forecast to be eligible for insulation under the Noise Insulation Regulations.

11.11. Monitoring

11.11.1. The requirements for monitoring in relation to noise and vibration are presented below.

Construction

11.11.2. Likely significant environmental effects from noise and/or vibration during construction shall be monitored. Monitoring of likely significant effects should include one or more of the following:

- Measurement of noise during construction at locations representative of R12 (Hornbeam Cottage) and R13 (The Lindens) during earthworks and road formation.
- Measurement of vibration at locations representative of R19 (The White House, Acle Road) during vibratory compaction works.
- Verification that specific noise and vibration mitigation measures are in place for activities where there is potential for likely significant effects to occur in their absence.
- Checking that noise and vibration management procedures and practices are sufficient to ensure that significant adverse effects are avoided.

Operation

11.11.3. The likely significant environmental effects from noise during operation shall be monitored and include:

- Ensuring mitigation measures included with the project design are incorporated with the as-built project. Where they are not included, measures will be taken to ensure resultant noise levels, taking account of any additional mitigation installed but not included in the assessed design, are no higher than those set out in this assessment.

- Ensuring specifications of noise mitigation measures, including barriers and low noise surfaces, meet design specifications.

11.11.4. DMRB LA 111 also notes that 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 due to the following reasons:

- The assessment is based on annual average conditions with and without the project to ensure a like for like comparison which is not possible to replicate through monitoring within a reasonable timescale.
- Monitoring in the absence of the project would need to be completed before the start of the construction works, and would therefore be a number of years before the monitoring with the Proposed Scheme in operation. In addition, the assessment completed for the environmental statement is based on calculated noise levels from road traffic only, whereas ambient noise monitoring can be affected by other noise sources such as people, agricultural activities, military activities, aircraft etc.

11.12. Summary

11.12.1. This chapter considers the potential noise and vibration impacts of the Proposed Scheme on noise sensitive receptors.

11.12.2. The study area for construction noise, construction vibration and operational traffic noise have been determined using Design Manual for Roads and Bridges guidance. Noise modelling has been undertaken for all noise sensitive receptors within the corresponding study areas.

11.12.3. As part of the assessment a baseline noise survey was undertaken in June 2018 to gain an understanding of the existing noise climate within the vicinity of the Proposed Scheme. A majority of the measurement positions correlated well with the predicted values at those locations. Therefore, no adjustments have been made to the noise model based on the findings of the survey.

11.12.4. A construction noise assessment has been undertaken, which shows that some of the closest receptors to some construction activities are predicted to experience a temporary moderate or major magnitude of impact without mitigation. Suitable means of reducing the significance of noise from construction have been assessed and shall be implemented, including the provision of temporary acoustic barriers (or early provision of permanent acoustic barriers).

11.12.5. An assessment of potential construction vibration impacts has been undertaken. It is concluded that the Proposed Scheme is not predicted to give rise to any potential significant vibration effects.

11.12.6. A construction traffic assessment has been undertaken. It is concluded that, providing the anticipated vehicle movements and routes are restricted as described in this chapter, potential significant effects are unlikely.

11.12.7. The assessment of operational noise indicates that there is predicted to be both significant adverse and significant beneficial noise effects associated with traffic changes following opening of the Proposed Scheme.

11.12.8. Significant beneficial effects are predicted at 17 dwellings either side of Strumpshaw Road/Stone Road/Wood Lane. These significant beneficial effects are due the expected change in road users' behaviour brought about by the Proposed Scheme, especially for long distance trips.

11.12.9. Significant adverse traffic noise effects are predicted at the following locations:

- 37 dwellings in the vicinity of Yarmouth Road (A47 to the Danesbower Lane junction).
- 18 dwellings in the vicinity of B1140 High Road (Cock Tavern to Sandy Lane).
- Two dwellings at the Noise Important Area 5206 (9 & 44 Highview Close).

11.12.10. Impacts at Yarmouth Road and High Road are predicted from traffic re-routing and more road users choosing these routes to access the improved A47 between Blofield and North Burlingham. Mitigation has not been proposed at off-line locations since these are under the control of the local highways authority and acoustic barriers are impractical because they would obstruct access to driveways.

11.12.11. Impacts at the NIA 5206 are predicted due to increase in traffic flows and speeds beyond the RLB as a result of the Proposed Scheme. This is mitigated through confirmed maintenance works by Highways England (see Environmental Management Plan TR04004/APP/7.6), which will resurface this section of the A47 with LNS prior to Opening Year of the Proposed Scheme.

11.12.12. The embedded mitigation measures that have been included in this assessment are all within the red line boundary of the Proposed Scheme. These comprise of a low noise surface along the proposed A47 dual carriageway, with a minimum road surface influence of -3.5dB, and four noise barriers.

11.12.13. The assessment identifies proportionate and reasonable actions to avoid significant adverse impacts on health and quality of life from noise and vibration as a result of the new development, providing compliance with the main objectives of the National Planning Policy Framework, Noise Policy Statement for England, Planning Practice Guidance on noise and National Policy Statement for National Networks.

11.13. References

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