West Winch Housing Access Road

Environmental Statement: Chapter 10 Noise and Vibration

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Glossary of Abbreviations and Defined Terms

Abbreviation	Description
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.
Decibel, dB	A scale for comparing the ratios of two quantities, including sound pressure and sound power.
DM2027	Do-minimum scenario for the opening year 2027 which does not include the Proposed Scheme.
DM2042	Do-minimum scenario for the design year 2042 which does not include the Proposed Scheme.
DS2027	Do-something scenario for the opening year 2027 which includes the Proposed Scheme.
DS2042	Do-something scenario for the design year 2042 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.
$L_{Aeq,T}$	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.
$L_{A10,T}$	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. $L_{A10,18hr}$ – The noise level exceeded for 10% of the time period from 06:00 – 00:00 hours. Generally used to describe road traffic noise
$L_{A90,T}$	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.

Abbreviation	Description
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.
Peak Particle Velocity (PPV)	Descriptor for the magnitude of vibration.
Section 61	As set out in the Control of Pollution Act, Section 61 is the 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 (SPL)	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 (SWL)	Sound power measured on a decibel scale, relative to a reference value of 10^{-12} W.

1 Introduction

1.1.1 This chapter reports the outcome of the assessment of likely significant noise and vibration effects arising from the construction and operation of the Proposed Scheme.

1.1.2 The chapter describes the assessment methodology and the baseline conditions relevant to the assessment. It provides a summary of the likely significant effects leading to any additional mitigation measures required to avoid, reduce or, if possible, offset any likely significant adverse effects. The likely residual effects and any required monitoring after these measures have been employed are also provided.

1.1.3 This chapter (and its associated figures and appendices) is intended to be read as part of the wider Environmental Statement (ES). Noise impacts on heritage receptors will be included in Chapter 7: Archaeology and Heritage and noise impacts on ecological receptors will be included in the Chapter 8: Ecology.

1.1.4 This chapter has a number of associated appendices that are listed below:

- Appendix 10.1 – Legislation, Policy and Guidance
- Appendix 10.2 – Noise Survey Details
- Appendix 10.3 – Construction Plant Assumptions
- Appendix 10.4 – Operational Noise Modelling Assumptions
- Appendix 10.5 – Future Baseline

2 Legislative Framework, Policy and Guidance

2.1 Legislative Framework

2.1.1 The applicable legislative framework 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. 10.1**);
- Directive 2014/52/EU of the European Parliament, 2014 - Assessment of the effects of certain public and private projects on the environment (**Ref. 10.2**);
- The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations) (**Ref. 10.3**);
- Noise Insulation Regulations 1975 (as amended) (NIR) (**Ref. 10.4**); and
- The Control of Pollution Act 1974 (**Ref. 10.5**).

2.1.2 The relevant sections of the above documents are summarised in **Appendix 10.1: Legislation, Policy and Guidance**.

2.2 Policy

2.2.1 The applicable planning policy is summarised as follows:

- National Planning Policy Framework (NPPF), 2023 (**Ref. 10.6**);
- Noise Policy Statement for England (NPSE), 2010 (**Ref. 10.7**);
- National Policy Statement for National Networks (NPS NN), 2014 (**Ref. 10.8**);
- East of England Plan >2031 (Draft Revision to the Regional Spatial Strategy for the East of England) (**Ref. 10.9**);
- Norfolk County Council Local Transport Plan (**Ref. 10.10**); and

- King's Lynn & West Norfolk Borough Council Site Allocations and Development Management Policies Plan (**Ref. 10.11**).

2.2.2 The relevant sections of the above documents are summarised in **Appendix 10.1: Legislation, Policy and Guidance**.

2.3 National Noise Policy

2.3.1 The NPSE provides more detail than the NPPF and sets out the long-term vision of the Government's noise policy which applies to all forms of external noise. The NPSE repeatedly 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.

2.3.2 The NPSE introduces and describes three categories, or levels, describing 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.

2.3.3 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."

2.4 Guidance

2.4.1 The applicable guidance documents are summarised as follows:

- National Highways, Design Manual for Roads and Bridges, Sustainability & Environment Appraisal, LA 111 Noise and Vibration, Revision 2, May 2020 (**Ref. 10.12**);
- Calculation of Road Traffic Noise (CRTN). Department of Transport and Welsh Office. 1988 (**Ref. 10.13**);
- 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. 10.14**);
- 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. 10.15**); 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. 10.16**).

2.4.2 In addition, this chapter has been prepared in accordance with the Government's National Planning Practice Guidance: Noise (**Ref. 10.17**).

2.4.3 The relevant sections of the above documents are summarised in **Appendix 10.1: Legislation, Policy and Guidance**.

3 Consultation, Scope, Methodology and Significance Criteria

3.1 Consultation Undertaken to Date

3.1.1 Table 3-1 provides a summary of the consultation activities undertaken in support of the preparation of this assessment.

Table 3-1 – Summary of consultation undertaken

Body / organisation	Individual / stat body / organisation	Meeting dates and other forms of consultation	Summary of outcome of discussions
Borough Council of Kings Lynn and West Norfolk	Environmental Health Officer (EHO)	Emails - 2019	Emails have been exchanged between the project team and the EHO regarding the noise and vibration assessment. The baseline survey locations and methodology were discussed and agreed. The assessment methodology was discussed and agreed.

Body / organisation	Individual / stat body / organisation	Meeting dates and other forms of consultation	Summary of outcome of discussions
Borough Council of Kings Lynn and West Norfolk	Environmental Health Officer	Email – September 2023	An email was sent to the EHO at Borough Council of Kings Lynn and West Norfolk to confirm the previously agreed assessment methodology and noise survey remained valid for this assessment. No response was received from Borough Council of Kings Lynn and West Norfolk.

3.2 Scope of the Assessment

3.2.1 The scope of this assessment has been established through an ongoing scoping process. Further information can be found in **Chapter 5: Approach to EIA**.

3.3 Elements scoped out of the assessment

3.3.1 As reported in the EIA Scoping Report (**Appendix 1.1**), the elements shown in Table 3-2 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:

Table 3-2 – Elements scoped out of the assessment at the scoping stage

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 will be free of irregularities as part of project design and under general maintenance, so operational vibration is likely to be negligible and therefore will not have the potential to lead to significant adverse effects.
Noise and vibration during highway maintenance works	The Proposed Scheme will 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 will 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.

3.3.2 Since the EIA Scoping Report was prepared and as part of the ongoing scoping process, it has been considered appropriate to scope out the following noise and vibration impacts from this assessment.

Table 3-3 – Elements scoped out of the assessment as part of the ongoing scoping process

Element scoped out	Justification
Noise and vibration from construction traffic	Whilst existing receptors close to, and on routes leading to, the Proposed Scheme may experience some noise from the traffic generated by the construction works, the effect is unlikely to be significant compared to noise from other sources Or lead to a significant increase in road traffic noise compared to baseline noise levels. Further, it is assumed that construction traffic will generally use main A-roads, as identified in Chapter 16: Traffic and Transport to access the site, where the increase in heavy vehicles associated with the Proposed Scheme is unlikely to result in large noise level changes. Nevertheless, construction traffic movements should not be uncontrolled, and so the route(s) to and from the Site should be agreed with the Local Council to minimise effects on local receptors.
Temporary diversion route traffic noise	It is unlikely that any major highways will need to be closed for multiple days/nights in a row. Whilst it is anticipated that brief closures will be required on both the A10 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 as the durations identified in paragraph 3.19 of DMRB LA111 are unlikely to be exceeded. 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.

3.4 Elements scoped into the assessment

Construction Phase

3.4.1 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; and
- Temporary construction vibration effects.

Operation Phase

3.4.2 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

3.4.3 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

3.4.4 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*".

3.4.5 Based on the above, the following study areas have been adopted for the construction phase:

- Construction noise – 300m from the main on-site construction works; and

- Construction vibration – 100m from any vibration generating construction activity.

3.4.6 The construction noise and vibration study areas are shown in Figure 12.1.

Operational noise

3.4.7 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."

3.4.8 The Basic Noise Level (BNL) is described in the Calculation of Road Traffic Noise (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 and road surface as described in CRTN.

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

3.4.10 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 1 dB. 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.

3.4.11 The operational noise Study Area is depicted in **Figure 12.2**. The Detailed Calculation Area is depicted on **Figure 12.3**.

3.5 Method of Baseline Data Collation

Surveys

3.5.1 Noise surveys were undertaken in the vicinity of the Proposed Scheme in 2019 at four locations. The purpose of the surveys, and measured noise levels are discussed further in **Appendix 10.2 – Noise Survey Details.**

3.5.2 The noise survey methodology and locations were agreed with the EHO at Borough Council of Kings Lynn and West Norfolk.

3.6 Assessment Methodology

3.6.1 Guidance for the assessment of construction phase impacts is contained within BS 5228, with guidance also presented within DMRB LA 111. The principal guidance document for the assessment of permanent operational impacts as a result of the Proposed Scheme is DMRB LA 111.

3.7 Construction noise and vibration

Construction noise

3.7.1 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. 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.

3.7.2 The following activities, encompassing all anticipated key noise generating 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 (bridge construction)
- Activity 3 – Road construction (drainage and road surface)

3.7.3 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 will be undertaken during daytime core working hours. However, there is the potential for some out of hours works to be required along the A47 upgrades. Therefore, an assessment has been undertaken of potential night-time works (the most sensitive period) for Activity 3. The daytime and night-time works have been assessed individually.

3.7.4 The construction of the Proposed Scheme is complex, with many activities and sub activities occurring across the Site. 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.

3.7.5 The Site will include a number of compounds and earth stockpiles. As the site clearance and earthworks activity is anticipated to occur within 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.

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

3.7.7 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.

3.7.8 A schedule of construction plant has been collated by professional experience and experience of similar schemes. **Appendix 10.3: Construction Noise and Vibration** provides the plant and machinery assumed for the construction noise assessment. This includes the items, quantities and assumed utilisation

rates used in the prediction of noise levels during each of the key activities. The construction plant emission data have been taken from Annex C of BS 5228-1.

3.7.9 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 will 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.

Construction vibration

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

3.7.11 The two main construction plant which have the potential to generate vibration are vibratory compactors and piling rigs.

3.7.12 The main source of ground-borne vibration is anticipated to be the use of vibratory compactors (rollers) during earthworks. Perceptible levels of vibration can also be experienced during the use of vibratory rollers during the final stages of surfacing. Vibration from the use of vibratory rollers has therefore been assessed in this chapter.

3.7.13 Piling is only anticipated to be required for structures (overbridge). Bored piling is proposed, which produces generally low levels of vibration as stated in BS 5228-2 "*The levels of vibration associated with continuous flight auger injected piling and pressed-in piling are minimal*". Therefore, an assessment of vibration from piling works has not been assessed within this chapter.

Operational road traffic noise

3.7.14 In accordance with 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.

3.7.15 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.

3.7.16 The operational noise assessment is based on the three dimensional design of the road, earthworks and structures.

3.7.17 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 (DM2027) compared against do-something opening year (DS2027);
- Long-term – do-minimum opening year (DM2027) compared against do-something future year (DS2042); and
- Long-term future baseline - do-minimum opening year (DM2027) compared against do-minimum design year (DM2042).

3.7.18 The do-minimum scenarios include 300 new dwellings within the West Winch Growth Area. The do-something scenarios include 4000 new dwellings within the West Winch Growth Area.

3.7.19 Do-minimum refers to the situation without the Proposed Scheme and do-something refers to the situation with the Proposed Scheme. The committed developments' traffic data that are included within the do-minimum and do-something scenarios have been described in **Section 16.1.154** of **Chapter 16: Traffic and Transport**.

3.7.20 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 10.3.68).

3.7.21 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

3.7.22 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 $L_{Aeq,8hr}$.

3.7.23 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 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

3.7.24 The noise levels calculated are façade levels for buildings during the 18-hour period from 06:00 to 00:00 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.

3.7.25 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.

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

3D noise model

3.7.27 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 10.4: Operation Noise Modelling Assumptions**. The noise level predictions have been undertaken based on CRTN (further details of which are set out in **Appendix 10.1: Legislation, policy and guidance**). Assumptions made during the modelling process have been identified in **Appendix 10.4: Operational Noise Modelling Assumptions**.

Road surface corrections

3.7.28 Amongst a number of factors, the road surface type can influence noise levels from a road. As the design speed of the Proposed Scheme is below 75kph, a low noise road surface would not have an impact on the results of the

modelling as the same correction would be applied when compared to hot rolled asphalt.

Noise Insulation Regulations

3.7.29 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 68 dB $L_{A10,18h}$ (façade);
- Show a noise increase between the relevant noise level and the prevailing noise level of at least 1 dB(A); and
- The contribution to the increase in the relevant noise level from the Proposed Scheme must be at least 1 dB(A).

3.7.30 Table 3-4 defines the parameters used for each of the NIR defined noise levels.

Table 3-4 – Noise levels predicted for the NIR

NIR definition	Parameter used
Prevailing noise level	$L_{A10,18h}$ Do-Minimum opening year 2027
Relevant noise level	$L_{A10,18h}$ Do-Something future year 2042
Maximum noise level from altered highways within 15 years (L'_A)	$L_{A10,18h}$ Do-Something future year 2042 from the Proposed Scheme

NIR definition	Parameter used
Maximum noise level from all other highways within 15 years (L'_B)	$L_{A10,18h}$ Do-Something future year 2042 from all the roads outside of the Scheme

Table Notes:

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.

3.8 Significance Criteria

3.8.1 Based on professional judgement, 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.

3.8.2 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.

3.9 Effect Significance

3.9.1 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.

3.9.2 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

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

3.9.4 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 10.1: Legislation policy and guidance**. 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.

3.9.5 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.

3.9.6 Following the derivation of the LOAEL and SOAEL thresholds for construction noise, Table 3-5 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 3-5 – 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 +5 dB	Moderate
Above or equal to SOAEL +5 dB	Major

3.9.7 The receptors likely to be affected by construction noise include those adjacent to the A10 (at the northern and southern extents of the Proposed Scheme), which already experience high ambient noise levels, and rural receptors which will be close to the Proposed Scheme but currently experience low ambient noise levels.

3.9.8 It is therefore appropriate for these receptors to be assessed against different significance criteria in light of the baseline noise levels. For receptors close to the A10, the Category C (least stringent) values from BS 5228-1 are appropriate, whilst for the rural receptors, the Category A (most stringent) values are appropriate. During the night-time, as works are only likely to affect receptors at the north of the Proposed Scheme, close to the A10, the Category C thresholds are considered appropriate. The categories have been assigned based on the noise survey data. The criteria adopted for each of the assessed receptors is discussed below in **Section 10.8.**

3.9.9 As the negligible magnitude of impact threshold (LOAEL) is set at the existing baseline noise level, this can result in the negligible, minor and moderate magnitude of impact categories being very close together. For the Category C criteria, the negligible threshold has been set to 5 dB below the moderate threshold in order to ensure that reasonable criteria are adopted.

3.9.10 As such, the daytime construction noise magnitude of impact scale is presented in Table 3-6.

Table 3-6 – Construction noise magnitude of impact scale during the daytime (façade)

Magnitude of Impact	**Category A, dB $L_{Aeq,T}$**	**Category B, dB $L_{Aeq,T}$**	**Category C, dB $L_{Aeq,T}$**
Negligible	<56	<65	<70
Minor	56 - 65	65-70	70 - 75
Moderate	65 – 70	70-75	75 - 80
Major	>70	>75	>80

3.9.11 The night-time construction noise magnitude of impact scale is presented in Table 3-7.

Table 3-7 – Construction noise magnitude of impact scale during the night-time (façade)

Magnitude of Impact	**Category C, dB $L_{Aeq,T}$**
Negligible	<50
Minor	50 - 55
Moderate	55 – 60
Major	>60

3.9.12 With regard to the potential significance of predicted impacts from construction 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."*

3.9.13 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

3.9.14 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.

3.9.15 Table 3-8 presents the LOAEL and SOAEL thresholds used for this assessment which are taken from DMRB LA 111.

Table 3-8 – Construction vibration LOAEL and SOAEL

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

3.9.16 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 1-9 presents the magnitude of impact scale for construction vibration.

Table 3-9 – Construction vibration – magnitude of impact scale

Vibration level, PPV mm/s	Magnitude of impact	Significance
≤ 0.3	Negligible	Not Significant
0.4 – 0.9	Minor	Not Significant
1.0 – 9.9	Moderate	Significant
≥ 10.0	Major	Significant

3.9.17 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."*

3.9.18 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

3.9.19 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 3-10 below.

Table 3-10 – Operational road traffic noise LOAEL and SOAEL thresholds

Time period	LOAEL	SOAEL
Day (06:00 – 24:00)	55 dB $L_{A10,18hr}$ façade	68 dB $L_{A10,18hr}$ façade
Night (23:00 – 07:00)	40 dB L_{night}, outside (free-field)	55 dB L_{night}, outside (free-field)

3.9.20 The magnitude of impact scale for the short-term noise level change is defined in Table 3-11, as adopted from DMRB LA 111 Table 5.54a.

Table 3-11 – 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

3.9.21 The magnitude of impact scale for the long-term noise level change (including the long-term future baseline change) is defined in Table 3-12, as adopted from DMRB LA 111 Table 3.54b.

Table 3-12 – 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

3.9.22 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.

3.9.23 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 and are discussed further in Table 1-14 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 3-13.

Table 3-13 – 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

Short-term magnitude of noise level change	Initial estimation of significance
Major	Significant

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

3.9.25 *"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."*

3.9.26 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.

3.9.27 Table 3.60 within DMRB LA 111 (which has been reproduced as Table 3-14 below) sets out the factors which should be considered as part of this decision.

Table 3-14 – Determining final operational significance on noise sensitive buildings

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.

Local circumstance	Influence on significance judgement
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.
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 1.0dB 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.

3.9.28 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.

4 Baseline Conditions

4.1 Baseline Noise Climate

Noise Important Areas

4.1.1 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. The following noise important areas have been identified within the operational noise study area. These noise important areas are all located along the A10. These have been identified geographically in **Figure 12.4**.

- 5187
- 5189
- 5190
- 5191
- 11358
- 11359
- 14279

Noise Survey

4.1.2 Noise surveys were undertaken for the Proposed Scheme at four locations. The noise surveys were undertaken in June 2019. The measurement locations are shown in **Appendix 10.2 – Noise Survey Details**.

4.1.3 The noise survey data from 2019 is considered to remain valid, as it is unlikely the noise levels will have changed notably since the survey was undertaken. Furthermore, the assessments within this chapter are predominantly predictive, and small changes in baseline noise levels would not affect the conclusions of the assessment.

4.1.4 Unattended measurements were undertaken as follows:

- Measurement Position 1 (MP1) – MP1 was installed near the dwellings on Rectory Lane to the west of the Proposed Scheme, approximately 30m from Rectory Lane. The measurements started at 14:00 on the 11 June 2019, but ended on the 16 June 2019 due to battery failure.
- Measurement Position 2 (MP2) – MP2 was installed near the dwelling on Chequers Lane to the west of the Proposed Scheme, approximately 20m from Chequers Lane. The measurements started at 15:00 on the 11 June 2019 and ended at 17:00 on the 18 June 2019.

- Measurement Position 3 (MP3) – MP3 was installed approximately 5m from the A47 Constitution Hill. The measurements started at 11:00 on the 12 June 2019 and ended at 13:00 on the 18 June 2019.
- Measurement Position 4 (MP4) – MP4 was installed within the rear gardens of the dwellings which back onto the A10 and front onto Poplar Road, approximately 8m from the A10.The measurements started at 15:00 on the 11 June 2019 and ended at 14:00 on the 18 June 2019.

4.1.5 For all of the measurement positions apart from MP4, the microphone was mounted on a tripod at a height of 1.2m above the ground, with MP4 at a height of 3m above the ground.

4.1.6 The purpose of the unattended measurements was to gain an understanding of the existing baseline noise levels in the vicinity of dwellings close to the Proposed Scheme.

4.1.7 Table 4-1 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, with only full periods presented.

Table 4-1 – Summary of noise levels measured at MP1, MP2, MP3 and MP4

Measurement Position	**Daytime 10th percentile level, dB $L_{A10,18h}$ (06:00 – 00:00)**	**Night-time average equivalent level, dB $L_{Aeq,8h}$ (23:00 – 07:00)**
MP1	50 – 54	40 – 50
MP2	46 – 54	43 - 50
MP3	72 – 76	62 – 68
MP4	70 – 75	61 – 68

4.1.8 The results of the noise monitoring have been compared to the results of the DM2027 noise modelling that has been carried out. The results of the noise modelling are within 1-2 dB of the measured noise level range at each of the measurement positions during the daytime, which demonstrates that the model results align well with the measured baseline noise levels.

4.1.9 Full details of the noise survey, including equipment information is presented in **Appendix 10.2: Noise Survey Details**.

5 Future Baseline

5.1.1 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 2042 (15 years after the Proposed Scheme opening year).

5.1.2 The do-minimum future year (2042) 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 2027 to 2042 (without the Proposed Scheme). The results of this analysis are presented in **Appendix 10.5: Future Baseline**.

5.1.3 It is identified that all receptors will experience negligible or no change in noise level in the long term without the Proposed Scheme.

6 Design and Embedded Best Practice Mitigation Measures

6.1 Construction Noise and Vibration

6.1.1 The adoption of Best Practicable Means (BPM), as defined in the Control of Pollution Act 1974, will be a fundamental primary mitigation measure. The manifestation of BPM will be a series of noise and vibration control measures, which will be incorporated within the Outline Construction Environmental Management Plan (OCEMP).

6.1.2 The most relevant measures demonstrating BPM 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 will 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 will be sited so that noise and vibration at nearby sensitive properties is minimised;
- all plant items operating intermittently on the site will be shut down in the intervening periods;
- all pneumatic tools will be fitted with silencers or mufflers where practicable;
- no loud music or loud radios will be played on the site;
- construction vehicles will not idle on local roads waiting to enter the site;
- works (including deliveries) will 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.

6.2 Operational Noise

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

6.2.2 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.

6.2.3 The Proposed Scheme alignment has been designed to avoid passing close to residential receptors as far as reasonably practicable. Further information on the environmental constraints considered in the evolution of the Proposed Scheme alignment is provided in **Chapter 4**.

6.2.4 The pavement surface type can reduce the noise levels produced by vehicles. The Proposed Scheme has a design speed lower than 75 kph and as such would not gain a benefit from a low noise surface (based on the road surface corrections provided in DMRB LA 111).

6.2.5 The path of noise between source and receiver can be mitigated through screening measures in the form of earth bunds or acoustic barriers.

6.2.6 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 the majority of residential receptors are further than this distance to the carriageway of the Proposed Scheme, the benefits from screening measures 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 close proximity of the Proposed Scheme 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.

6.2.7 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.

6.2.8 Mitigation has been considered at a scheme wide level. Specific mitigation measures have been considered for receptors where significant effects have been identified as set out from **Section 10.8.42**.

7 Sensitive Receptors

7.1.1 Given the differing study areas for the construction noise and vibration, and operational assessments, it is appropriate to consider the sensitive receptors for each assessment individually.

7.1.2 Existing sensitive receptors within the Study Areas have been identified using the AddressBase Plus® data and the results of the desk study.

7.2 Construction Noise and Vibration

Construction Noise

7.2.1 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 7-1 presents sample receptors which are considered to provide a good coverage around the Proposed Scheme and be representative of other nearby receptors within 300m of the main works on site.

Table 7-1 – Sample receptors for construction noise assessment

Receptor Number	Receptor Location
C1	East Anglia House, 1 West Winch Road, West Winch, PE33 0NF
C2	Brook Farm, Rectory Lane, North Runcton, PE33 0NR
C3	44 Norfolk House, Rectory Lane, North Runcton, PE33 0QS
C4	26 Chequers Lane, North Runcton, PE33 0QN
C5	High Orchard, Chequers Lane, North Runcton, PE33 0QN
C6	22 Orford Place, West Winch, PE33 0UB
C7	9 Poplar Road, West Winch, PE33 0NH
C8	Cranfield, 331 Lynn Road, West Winch, PE33 0PB

7.2.2 These receptors are shown on **Figure 12.5: Construction Receptors.** Any sensitive receptors located further away than those identified above should experience lower noise levels (and by association impacts and effects).

7.3 Construction Vibration

7.3.1 The construction assessment only considers vibration impacts from vibratory compactors. This has been done for a single property, C8- Cranfield – as this is the closest sensitive receptor to the works (20m). Any sensitive receptors located further away than those identified above should experience lower vibration levels (and by association impacts and effects).

7.4 Operational noise

7.4.1 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:

- 1366 residential receptors; and
- 14 non-residential receptors.

8 Assessment of Potential Effects, Mitigation and Residual Effects

8.1 Construction Phase

Temporary Noise Effects During Construction

Daytime works

8.1.1 As discussed above, the magnitude of impact scale for construction noise is dependent on the baseline noise level at the representative sample receptor. Table 8-1 presents the appropriate ABC category for each of the sample receptors along with the SOAEL (the level above which significant adverse effects are anticipated). The ambient noise level for Receptor C1 has been determined from the operational noise model as there is not a representative measurement location for this receptor.

Table 8-1 – Determination of ABC category at each receptor

Receptor	ABC Category	Daytime SOAEL, dB $L_{Aeq,T}$
C1 – East Anglia House	B	70
C2 – Brook Farm	A	65
C3 – 44 Norfolk House	A	65
C4 – 26 Chequers Lane	A	65
C5 – High Orchard	A	65
C6 – 22 Orford Place	C	75
C7 – 5 Poplar Road	C	75
C8 – Cranfield	C	75

8.1.2 Noisy activities within the construction areas will 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.

8.1.3 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.

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

8.1.5 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 two of the loudest items of plant for each activity are 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).

8.1.6 Table 8-2 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, together with the magnitude of impact based on the scale presented in Table 1-5, as per the relevant ABC category. Results are only presented where the activity is predicted to occur within 300m of the receptor.

Table 8-2 – Predicted construction noise levels (façade) and magnitude of impact

Receptor	Construction Activity	Predicted WC $L_{Aeq,12h}$ dB	Magnitude of impact	Predicted AVG $L_{Aeq,12h}$ dB	Magnitude of impact
C1	Site clearance and earthworks	69	Negligible	65	Negligible
C1	Road construction	68	Negligible	61	Negligible
C2	Site clearance and earthworks	76	Major	65	Moderate

Receptor	Construction Activity	Predicted WC $L_{Aeq,12h}$ dB	Magnitude of impact	Predicted AVG $L_{Aeq,12h}$ dB	Magnitude of impact
C2	Structure construction	67	Moderate	62	Minor
C2	Road construction	75	Major	61	Minor
C3	Site clearance and earthworks	73	Major	64	Minor
C3	Structure construction (bridge)	67	Moderate	62	Minor
C3	Road construction	72	Major	61	Minor
C4	Site clearance and earthworks	61	Minor	61	Minor
C4	Road construction	58	Negligible	58	Negligible
C5	Site clearance and earthworks	74	Major	64	Minor
C5	Road construction	70	Moderate	61	Minor
C6	Site clearance and earthworks	76	Moderate	64	Negligible
C6	Road construction	75	Moderate	61	Negligible
C7	Site clearance and earthworks	79	Moderate	64	Negligible
C7	Road construction	78	Moderate	61	Negligible
C8	Site clearance and earthworks	80	Moderate	64	Negligible
C8	Road construction	79	Moderate	61	Negligible

8.1.7 It can be seen that impacts of mostly **moderate magnitude (significant adverse effect)** are anticipated during the worst-case scenario. This is unsurprising since the separation distance between the works and nearest noise sensitive receptors is small in most cases. However, as outlined in

section 10.1.1, a significant effect would only occur when the works are of sufficient duration (10 out of any 15 consecutive days or a total of 40 days in any 6 month period). It is unlikely that works at the closest approach would occur for this length of time and more weight is provided to the average case results for this reason.

8.1.8 On this basis, significant adverse construction noise effects (taking into account the embedded mitigation measures) are anticipated at C2 – Brook Farm (site clearance and earthworks) as a result of on-site construction noise during the daytime based on the average scenario.

8.2 Night-time Works

8.2.1 As discussed above, there is the potential for night works to occur for certain critical construction activities. In particular, night works may be required along the A47 upgrades, in order to minimise disruption to traffic along this route. On account of the location of the night-time works, this assessment focusses on receptor C1 – East Anglia House, located at the northern end of the Proposed Scheme.

8.2.2 The ambient night-time noise levels have been determined from the Operational noise model. It has been determined that receptor C1 would be in Category C for the night-time period and the SOAEL would therefore be 55 dB $L_{Aeq,8h}$.

8.2.3 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 8-3 presents the predicted noise levels for both site earthworks and road construction during the night-time along with the associated magnitude of impact.

Table 8-3 – Predicted construction noise levels (façade) and magnitude of impact

Construction Activity	Predicted $L_{Aeq,8h}$ dB	Magnitude of impact
Site clearance and earthworks	59	Moderate
Road construction	56	Moderate

8.2.4 Whilst the magnitude of impact at C1 is **Moderate** for both activities, these noise levels would only result in significant adverse effects if the noise levels exceed the durations outlined in **section 10.1.1** (10 out of any 15 days or 40 days in 6 months).

8.2.5 The predicted noise levels are not particularly high in absolute terms. Given the current uncertainty around the frequency of potential night works, it is not possible to confirm whether the durations in **section 10.1.1** will 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 receptor, C1 – East Anglia House for both activities assessed.

8.2.6 Given the uncertainty around the night works at this stage, residual **significant adverse construction noise effects** are anticipated at C1 – East Anglia House, during the night-time.

Temporary Vibration Effects During Construction

8.2.7 In order to estimate the levels of vibration for vibratory compactors, the prediction method detailed in BS 5228-2 has been used. The following roller has been assumed which is considered to represent a reasonable worst-case:

- A single drum roller with a 1.4m drum width and a vibration amplitude of 0.29mm and 0.59mm, operating at a low and high setting respectively (e.g. a Ingersoll-Rand DD65).

8.2.8 The predictions have been based in steady state operation, and on the assumption that there is a 33% probability of the predicted PPV vibration level

being exceeded (and a 67% probability that it is not), which is a feature of the BS 5228-2 methodology.

8.2.9 'Steady state' and 'start-up and run-down' conditions have been considered for both high and low amplitude settings. This has been done for a single property – Cranfield – as this is the closest sensitive receptor to the works (20m). This receptor is identified as C8 in Figure 12-5 for the construction vibration assessment.

8.2.10 The predicted vibration levels are presented in Table 8-4, together with the relevant magnitude of impact based on the scale presented in Table 1-9. The predicted vibration levels are in terms of the peak particle velocity vibration, in units of mm/s.

Table 8-4 – Predicted vibration levels during use of a dual drum vibratory compactor at receptor C8

Amplitude setting	Steady state PPV vibration level (mm/s)	Magnitude of impact	Start-up and run-down PPV vibration level (mm/s)	Magnitude of impact
Low (1.1mm)	0.3	Minor	0.4	Minor
High (2.1mm)*	0.9	Minor	1.3	Moderate

Note:

* The method is strictly valid up to an amplitude of 1.72mm; so a heightened level of uncertainty would be applicable to this result

8.2.11 A **Moderate** magnitude of impact suggests that the vibratory roller could result in a potential significant effect at C8 Cranfield during start up and run down on the high amplitude setting. However, it is unlikely that the durations in section 1.3.67 (10 out of 15 days or 40 days in 6 months) would be exceeded. Also this is only during start up and run down of the roller which should occur away from the properties. On this basis it is considered that the effect of construction vibration on nearby receptors is **not significant**.

8.3 Monitoring

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

8.4 Operational Phase

Residual Effects

8.4.1 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 (2027) 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 (2042) 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.

8.4.2 Noise predictions have been carried out for 1,366 residential receptors and 14 non-residential sensitive receptors within the Detailed Calculation Area. It should be noted that noise levels at West Winch Primary School have not been assessed during the night-time period.

8.4.3 **Figure 12.6** and **Figure 12.7** show the DM2027 and DS2027 absolute noise levels respectively. The DS2042 contours have not been produced as these follow a very similar pattern to the DS2027 noise contour plots.

8.4.4 **Figure 12.8** and **Figure 12.9** present noise level change contour maps for the short-term and long-term comparisons respectively.

8.4.5 Table 8-5 and Table 8-6 and present the number of residential receptors which exceed the LOAEL and SOAEL for the short-term and long-term comparisons respectively. The number of other sensitive receptors for each category is identified in brackets. The results show that there will be a

significant reduction in the number of receptors that experience noise levels above or equal to the SOAEL.

Table 8-5 – Numbers of receptors compared to LOAEL and SOAEL thresholds in the short-term

Noise Level	DM202 7 day	DM202 7 night	DS202 7 day	DS202 7 night	Day comparison	Night comparison
Below LOAEL	828 (6)	549 (3)	912 (5)	679 (3)	84 (-1)	130 (0)
Greater than or equal to LOAEL and less than SOAEL	395 (5)	671 (7)	416 (7)	646 (8)	21 (2)	-25 (1)
Greater than or equal to SOAEL	143 (3)	146 (3)	38 (2)	41 (2)	-105 (-1)	-105 (-1)

8.4.6 Table 8-5 shows that there is a reduction 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. The number of other sensitive receptors for each category is identified in brackets. The results show that there will be a significant reduction in the number of receptors that experience noise levels above or equal to the SOAEL.

Table 8-6 – Numbers of receptors compared to LOAEL and SOAEL thresholds in the long-term

Noise level	DM202 7 day	DM202 7 night	DS204 2 day	DS204 2 night	Day comparison	Night comparison
Below LOAEL	828 (6)	549 (3)	846 (5)	629 (3)	18 (-1)	81 (0)
Greater than or equal to LOAEL and less than SOAEL	395 (5)	671 (7)	469 (7)	683 (7)	74 (2)	11 (0)
Greater than or equal to SOAEL	143 (3)	146 (3)	51 (2)	54 (3)	-92 (-1)	-92 (0)

8.4.7 Table 8-7 shows that in the long-term the pattern of changes is similar to in the short-term, with a reduction in the number of properties anticipated to exceed the SOAEL as a result of the Proposed Scheme.

8.4.8 Table 8-8 presents the predicted short-term change in noise level for residential and other sensitive receptors within the Detailed Calculation Area, sorted into the magnitude of impact bands as set out within DMRB LA 111.

Table 8-7 – Short-term road traffic noise level changes

Short-term noise level change	Daytime, number of residential receptors	Daytime, number of other sensitive receptors	Night-time, number of residential receptors	Night-time, number of other sensitive receptors
Negligible increase	1	1	6	1
Minor increase	108	2	123	2
Moderate increase	64	1	47	1
Major increase	20	1	18	1
No change	0	0	0	0
Negligible decrease	30	2	37	3
Minor decrease	623	1	696	0
Moderate decrease	307	3	311	2
Major decrease	213	3	128	3

8.4.9 Table 8-8 presents the predicted long-term change in noise level for residential and other sensitive receptors within the Detailed Calculation Area.

Table 8-8 – Long-term road traffic noise level changes

Long-term noise level change	Daytime, number of residential receptors	Daytime, number of other sensitive receptors	Night-time, number of residential receptors	Night-time, number of other sensitive receptors
Negligible increase	183	5	206	4
Minor increase	113	1	101	1
Moderate increase	31	0	21	0
Major increase	3	1	1	1
No change	0	0	0	0
Negligible decrease	671	2	748	4
Minor decrease	266	2	220	1
Moderate decrease	90	3	64	2
Major decrease	9	0	5	0

8.4.10 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 Table 1-13. 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.

8.4.11 DMRB LA 111 describes a framework of contextual factors 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.

8.4.12 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 1-14 have been considered when determining whether the initial assessment of significance is retained or adjusted.

8.4.13 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.

8.4.14 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.

8.4.15 Table 1-25 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. The groups of receptors have been identified in **Figure 12.10**.

Table 8-9 – Operational noise receptor groups

Receptor Group	Number of Properties	Short-term magnitude of impact	Significance	Justification
1	314 Residential Other receptors: ▪ Church Hall, Main Road ▪ Church of St Mary ▪ Winchley Home Rectory Lane ▪ West Winch Primary School	Major and moderate beneficial	**Significant beneficial**	These receptors are located in West Winch along the A10 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 and moderate beneficial magnitude of impact categories and have a noise level during the DM2027 scenario above the LOAEL. On the basis that the noise climate at these properties would be improved by the Proposed Scheme, these receptors will experience a **significant beneficial noise effect**.
2	204 Residential Other receptors ▪ West Winch Bowls Club ▪ William Burt Hall	Major and moderate beneficial (stays below LOAEL)	**Not significant**	These receptors are located in West Winch along the A10 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 and moderate beneficial magnitude of impact categories but the absolute noise level is below the LOAEL in the DM2027 scenario and the DS2027. As the receptors are anticipated to experience noise levels below the LOAEL in the DM2027 scenario, any further decrease in noise level would not reduce any adverse health effects as set out within the NPSE. On this basis, the effect at these receptors is considered **not significant**.
3	653 Residential Other receptors ▪ Brethren Christian Church ▪ Unit 15 on St Hilary Park Road ▪ The Old Bank on Hardwick Road ▪ Dragonfly Hotel	Negligible changes and minor beneficial	**Not significant**	These receptors are located mostly in West Winch and are less affected by noise from the A10 due to distance or shielding from other buildings. One receptor in this group is located in North Runcton, which is screened from the Proposed Scheme by a number of properties. As set out within DMRB LA 111, minor beneficial impacts are not considered likely to be significant, and no contextual factors have warranted altering this initial conclusion. Further, negligible noise level changes are unlikely to be perceptible to residents. On this basis, the effects at these properties are **not significant**.

Receptor Group	Number of Properties	Short-term magnitude of impact	Significance	Justification
4	108 Residential Other receptors ▪ Sports Ground New Road ▪ Yew Cottage on Denmead New Road	Minor adverse (below SOAEL)	**Not significant**	These receptors are mostly located in the east of North Runcton and the easternmost houses in Coronation Avenue and Freebridge Haven. Most of the receptors within this group are anticipated to experience noise levels below the SOAEL. At the remaining receptors the façades where minor adverse impacts are anticipated all experience noise levels well below the SOAEL during the daytime. On this basis, given the balance of noise level increases and decreases, it has been concluded that the effects are **not significant**.
5	3 Residential	Minor adverse (SOAEL)	**Not significant**	These three receptors are located on the A10 where the southern end of the Proposed Scheme will join the existing road. They each have one façade that has a minor increase but is below the SOAEL during the daytime and all other facades have a minor decrease. As the façade that is above the SOAEL is anticipated to experience a noise level reduction as a result of the Proposed Scheme, the effects for these receptors are **not significant.**
6	68 Residential Other receptors ▪ Communal hall Freebridge Haven	Moderate/ major adverse (below LOAEL)	**Not significant**	The receptors within this group are located to the west of North Runcton and are the eastern most houses on Freebridge Haven. As discussed in paragraph 1.2.5, 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 will not occur. The predicted noise levels at these receptors are below the LOAEL in the DS2027 daytime scenario during the daytime and night-time. On this basis it is considered that the effects at these receptors are **not significant**.

Receptor Group	Number of Properties	Short-term magnitude of impact	Significance	Justification
7	7 Residential	Moderate adverse (above LOAEL)	**Significant Adverse**	Four of these receptors are located just off Rectory Lane just out of North Runcton. One of these receptors is located on the A10 where the Proposed Scheme meets the existing road. The noise level increases at these receptors results from additional traffic which is predicted to use the Proposed Scheme. It should be noted that these receptors are already habituated to some noise from roads. However, on balance, as the impacts are moderate and exceed the LOAEL, it is considered that **significant adverse effects** will occur at these receptors.
8	9 Residential Other receptors ▪ Scout hall on Chequers lane	Major adverse (above LOAEL)	**Significant Adverse**	These receptors are located off Rectory Lane and are the closest receptors to the Proposed Scheme alignment. They are predicted to experience major adverse changes and noise levels above the LOAEL. Similar to above, given the setting of these receptors, which is likely to be affected by the Proposed Scheme it is considered that they will experience **significant adverse effects**.

Additional mitigation considered for significant residual effects

8.4.16 It is appropriate to consider whether additional mitigation measures could be adopted where significant adverse effects are predicted in order to reduce those impacts. Mitigation has been considered for the following two areas of the Proposed Scheme.

- Significantly affected receptors that are located to the west of the Proposed Scheme (includes receptors in Group 8); and
- Significantly affected receptors to the east of the Proposed Scheme along Rectory Lane (includes receptors in Groups 7 and 8)

8.4.17 Due to the significantly affected receptors in groups 7 and 8 typically being over 150m from the Proposed Scheme, it is unlikely that a noise barrier would provide a significant reduction in noise levels. In order to identify the viability of this type of mitigation, a 3m noise barrier following the alignment of the road at the highest point of the landscaping east of the Proposed Scheme has been modelled as this would be the most effective location for a noise barrier. This barrier would only reduce impacts at a handful of receptors and not reduce the significance of impact at the majority of receptors where reductions are identified. Installing a noise barrier along the Proposed Scheme closest to receptor groups 7 and 8 would need to be of considerable size and could result in landscape and visual effects and would not be considered good value for money as required by DMRB LA 111. Therefore, the use of noise barriers/earth bunds and has been ruled out as suitable mitigation for the Proposed Scheme.

8.4.18 Receptors to the west of the Proposed Scheme such as those in Freebridge Haven are likely to have noise from road traffic mitigated by the introduction of the housing associated with the Proposed Scheme. Therefore, no additional mitigation measures have been recommended for these receptors.

8.5 Policy Compliance

8.5.1 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.

8.5.2 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).

8.5.3 In this case, mitigation measures beyond those already embedded into the Proposed Scheme design are not considered practical. Where receptors are located too great a distance from the Proposed Scheme, mitigation would not be considered value for money based on the reduction in noise effect due to the barrier. For receptors adjacent to existing roads, any mitigation would need to comprise noise barriers in close proximity to the property potentially resulting in visual and setting effects, loss of views and blocking light for the property and the efficacy of the barrier would be reduced due to the need to maintain access to the property.

8.5.4 On this basis, whilst a number of receptors are anticipated to exceed the LOAEL and SOAEL thresholds, as no further additional mitigation measures would be sustainable, the Proposed Scheme is considered compliant with national noise policy.

8.6 Wider Network Noise Level Changes

8.6.1 In addition to noise level changes within the Detailed Calculation Area, it is also necessary to consider road links further afield, which could experience noise level changes as a result of the Proposed Scheme.

8.6.2 As the traffic model covers a large area it is not appropriate to include all road links in the 3D noise model. Instead, spreadsheet calculations have been undertaken to consider noise level changes based on the BNL for each road link.

8.6.3 The BNL calculation was undertaken adopting the CRTN methodology with the following assumptions:

- Road links have only been considered if their flow is above the minimum threshold within CRTN of 1000 vehicles (below this threshold it is considered unlikely that large changes in traffic flows would lead to a significant adverse effect given the low absolute noise levels); and
- Only road links within the King's Lynn Area of Detailed Modelling and West Winch Area of Detailed Modelling traffic model areas have been considered (as outside of this area traffic flows are considered less reliable).

8.6.4 The purpose of this assessment is to consider where significant effect might occur at receptors along the road links. Receptors experiencing moderate or major impacts are initially considered as potentially significant, and therefore require further consideration.

8.6.5 No road links are anticipated to experience moderate or major short-term impacts. Only one road link is anticipated to experience a moderate or major impact in the long-term. A moderate beneficial impact is anticipated at a filter lane associated with the Southgates roundabout in King's Lynn. Whilst this noise level change could be indicative of a significant effect, as the surrounding noise levels will be dominated by the roundabout and the roads leading to the roundabout, the noise level impact on this link is not considered significant.

8.6.6 On this basis, the operational noise level changes at receptors in proximity to the wider road network (outside of the Detailed Calculation Area) are **not significant**.

Noise Important Areas

8.6.7 Noise Important Areas identified in **Section 10.4** are all located along the A10 which will see an overall reduction in noise level.

Monitoring

8.6.8 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.

8.6.9 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"

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

Noise insulation regulations

8.6.11 The Noise Insulation Regulations (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.

8.6.12 Analysis of the modelled results has been carried out to determine if any properties within the operational calculation area are likely to qualify for compensation under the NIR. The analysis identified that, based on this preliminary assessment, no residential receptors are likely to be eligible for compensation under the NIR.

8.7 Cumulative Effects

8.7.1 A summary of the cumulative developments surrounding the scheme are identified in **Table 17-1** of **Chapter 17: Cumulative Effects**. The traffic flows provided include some committed developments as determined by the project transport consultant. This means that the operational road traffic noise

assessment within this Chapter is inherently cumulative in nature. Given the distance from the Proposed Scheme to each of the cumulative developments is over 300m, cumulative construction noise or vibration impacts are considered unlikely.

9 Opportunities for Environmental Enhancement

9.1.1 No further enhancement measures are appropriate for the Proposed Scheme.

10 Difficulties and Uncertainties

10.1.1 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 and therefore the mitigation measures to be incorporated to minimise these.

10.1.2 The operational noise 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.

11 Summary

11.1.1 Table 11-1 provides a summary of the findings of the assessment.

Table 11-1 – Summary of the findings of the assessment

Receptor	Potential Effects	Significance of Effects Prior to Mitigation/Enhancement	Additional Mitigation	Residual Effects	Monitoring
On-site construction noise daytime Receptors: • C2 – Brook Farm (day) (site clearance and earthworks)	Given the proximity of construction works, disturbance as a result of noise levels from on-site activities could occur at these receptors.	**Moderate adverse (Significant)** T / D / ST	No additional mitigation beyond embedded best practicable means as set out in Section 10.6	**Moderate adverse (Significant)** 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.
On-site construction noise night-time Receptors: • C1 – East Anglia House (night)	Given the proximity of construction works, disturbance as a result of noise levels from on-site activities could occur at these receptors.	**Moderate adverse (Significant)** T / D / ST	No additional mitigation beyond embedded best practicable means as set out in Section 10.6	**Moderate adverse (Significant)** 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.
On-site construction vibration Receptors at Cranfield (and other properties at an equivalent distance) within 20m of Proposed Scheme carriageways	Disturbance due to vibratory road rolling	**Minor adverse (Not significant)** Twin drum roller has been utilised for the assessment T/D/ST	No additional mitigation beyond embedded best practicable means as set out in Section 10.6	**Minor adverse (Not significant)** (Not significant provided a twin drum roller with low amplitude setting is used at the closest approach) 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 314 residential receptors, 4 other sensitive receptors (group 1)	Beneficial impacts due to reduced traffic flows on the A10	Moderate or major beneficial (**Significant**) P/D/LT	None required	**Significant** beneficial effect P/D/LT	None required
Operational Phase 857 residential receptors, 6 other sensitive receptors (Groups 2 and 3)	No significant impact from the scheme	Minor beneficial and negligible change (**Not significant**) P/D/LT	None required	Negligible effect (**Not significant**) P/D/LT	None required
Operational Phase 179 residential receptors, 3 other sensitive receptors (groups 4-6)	Adverse impacts as a result of road traffic noise from the Proposed Scheme.	Minor/moderate adverse (**Not significant**) P/D/LT	None	Minor adverse (**Not significant**) P/D/LT	None required

Receptor	**Potential Effects**	**Significance of Effects Prior to Mitigation/Enhancement**	**Additional Mitigation**	**Residual Effects**	**Monitoring**
Operational Phase 16 Residential receptors, 1 other sensitive receptor (groups 7 and 8)	Significant adverse impacts as a result of road traffic noise from the Proposed Scheme.	Moderate/major adverse (**Significant**) P/D/LT	None	Moderate/major adverse (**Significant**) P/D/LT	None required

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

12 References

- **Reference 10.1**: 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
- **Reference 10.2**: The European Commission (2014) Environmental Impact Assessment Directive 2014/52/EU
- **Reference 10.3**: The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017
- **Reference 10.4**: HM Government, The Noise Insulation Regulations 1975 (as amended 1988)
- **Reference 10.5**: HM Government (1974). Control of Pollution Act 1974
- **Reference 10.6**: Department for Communities and Local Government (2023). National Planning Policy Framework (NPPF)
- **Reference 10.7**: Department for Environment, Food and Rural Affairs (2010). Noise Policy Statement for England (NPSE)
- **Reference 10.8**: Department for Transport (2014). National Policy Statement for National Networks (NPS NN)
- **Reference 10.9**: Regional Assembly (2010). East of England Plan >2031 (Draft Revision to the Regional Spatial Strategy for the East of England)
- **Reference 10.10**: Norfolk County Council (2021). Local Transport Plan 4 Strategy 2021-2036
- **Reference 10.11**: Borough Council of King's Lynn & West Norfolk (2016). Site Allocations & Development Management Policies Plan

- **Reference 10.12**: National Highways, Design Manual for Roads and Bridges, Sustainability & Environment Appraisal, LA 111 Noise and Vibration, Revision 2, May 2020 (DMRB LA 111)
- **Reference 10.13**: Calculation of Road Traffic Noise (CRTN) (1988). Department of Transport and Welsh Office.
- **Reference 10.14**: 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.
- **Reference 10.15**: 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).
- **Reference 10.16**: 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).
- **Reference 10.17**: Department for Communities and Local Government (Published 29 November 2016, last updated 1 October 2019). Planning Practice Guidance: Department for Communities and Local Government

Figure 12-1 – Construction noise and vibration study area

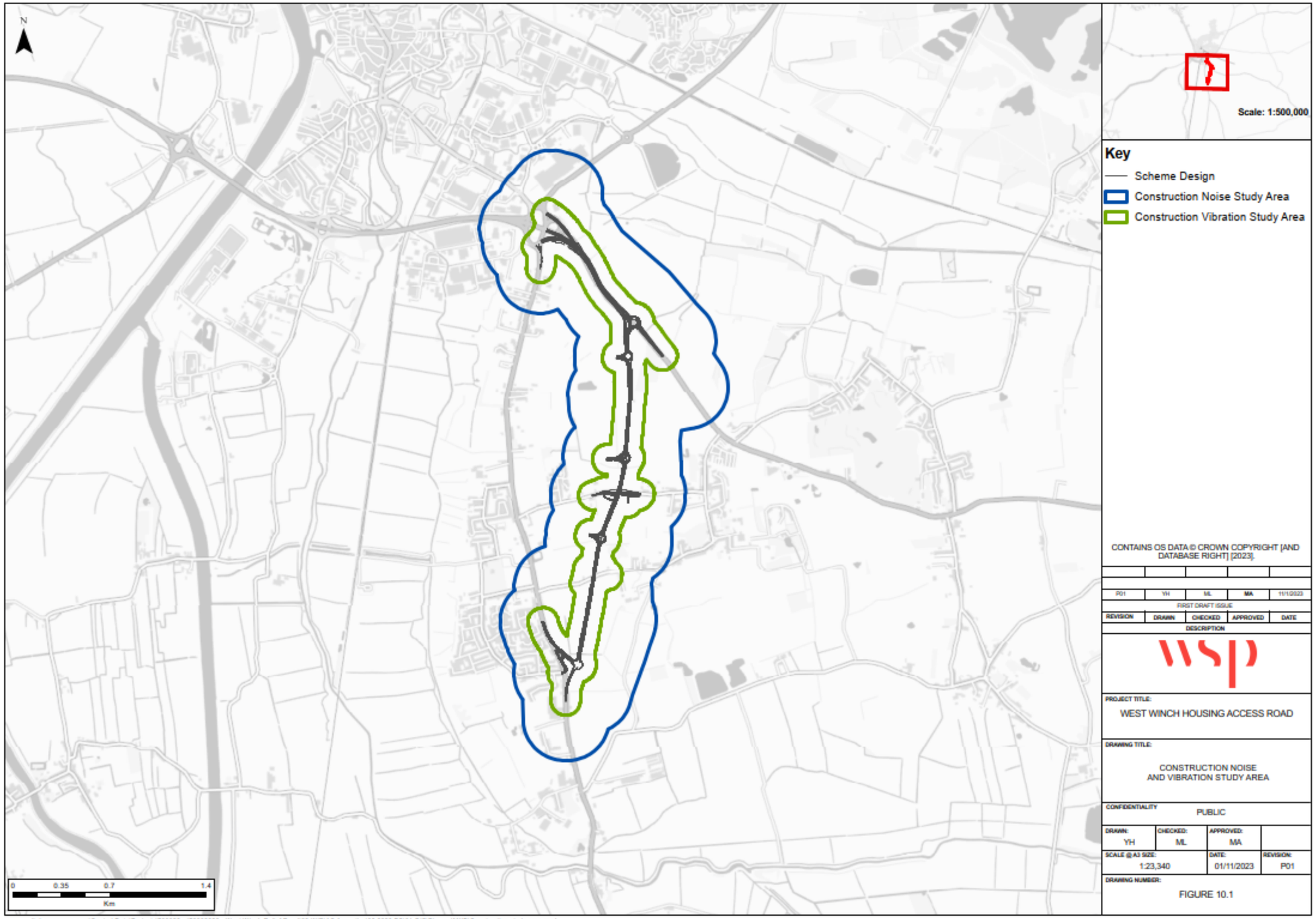

Figure 12-2 – Operational noise study area

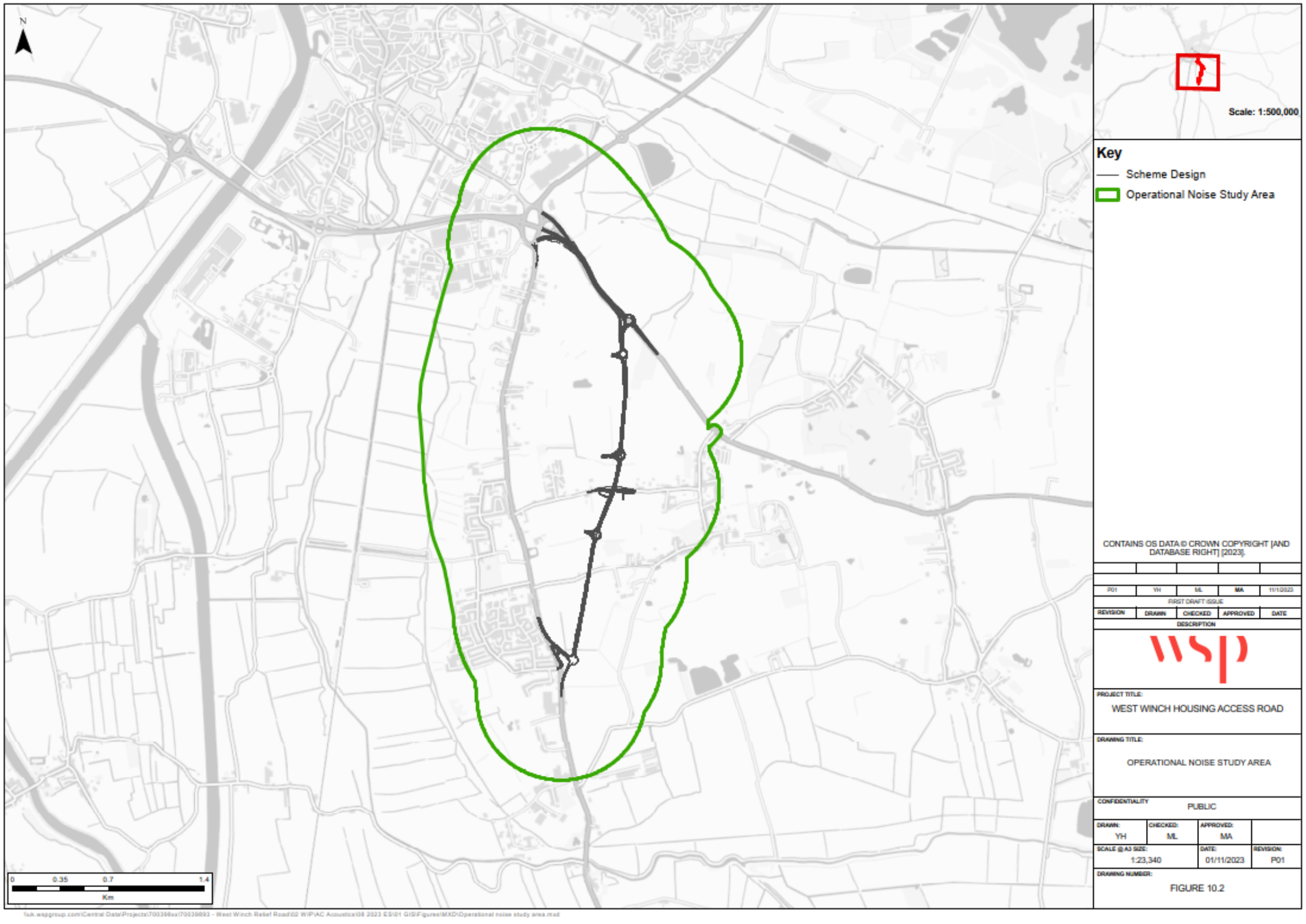

Figure 12-3 – Detailed calculation area

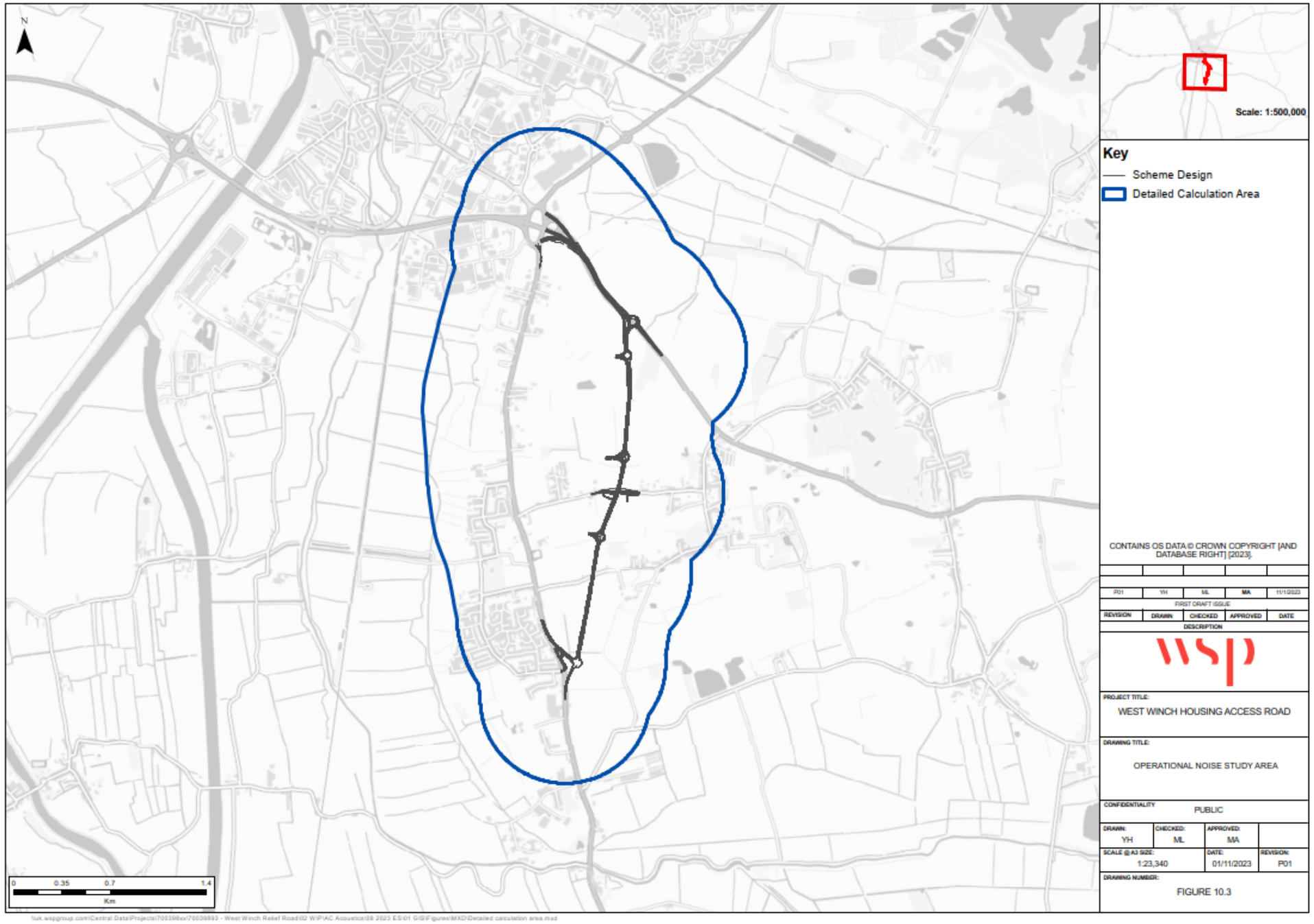

Figure 12-4 – Noise important areas

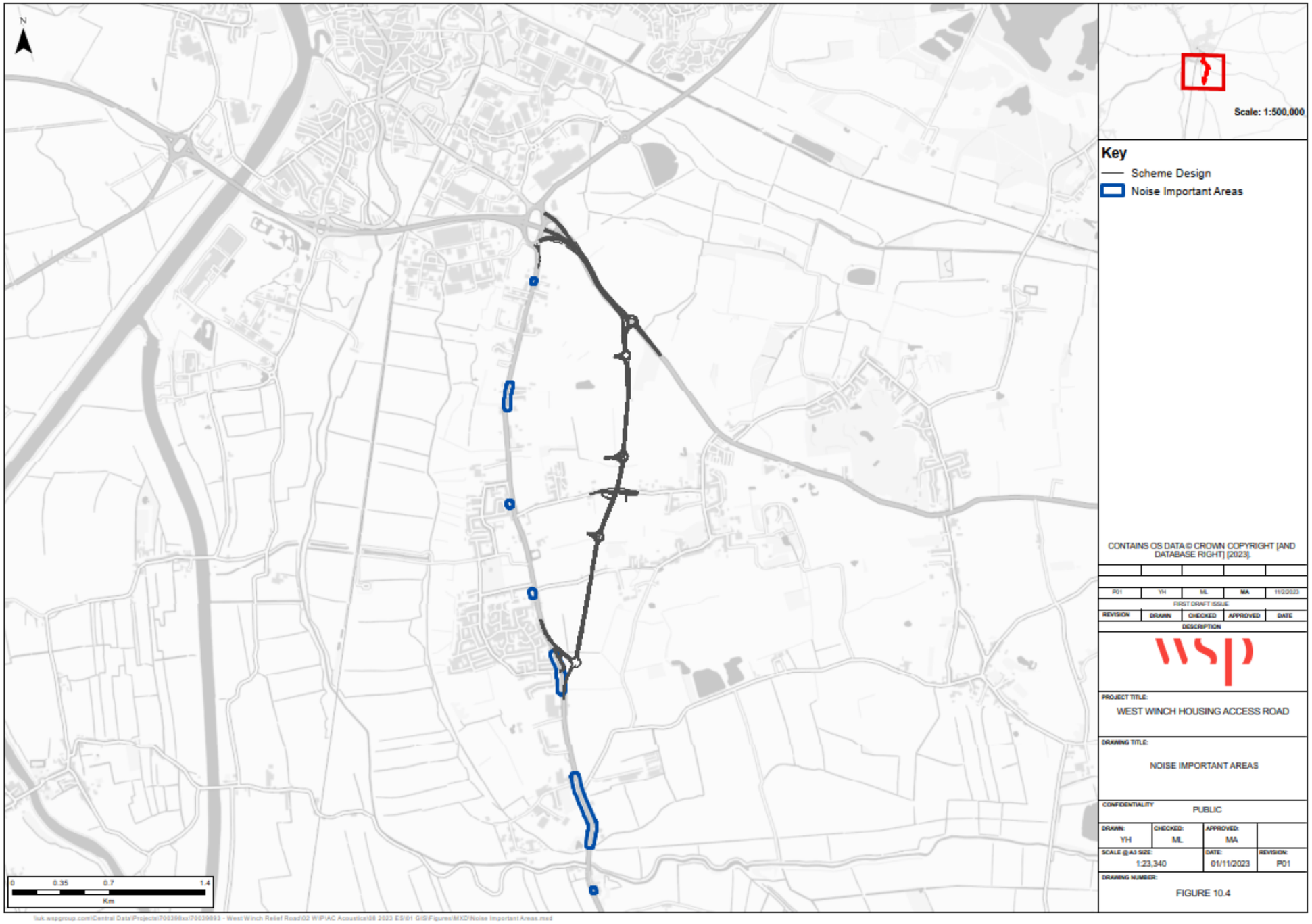

Figure 12-5 – Construction receptors

Figure 12-6 - Do-minimum 2027 noise contours

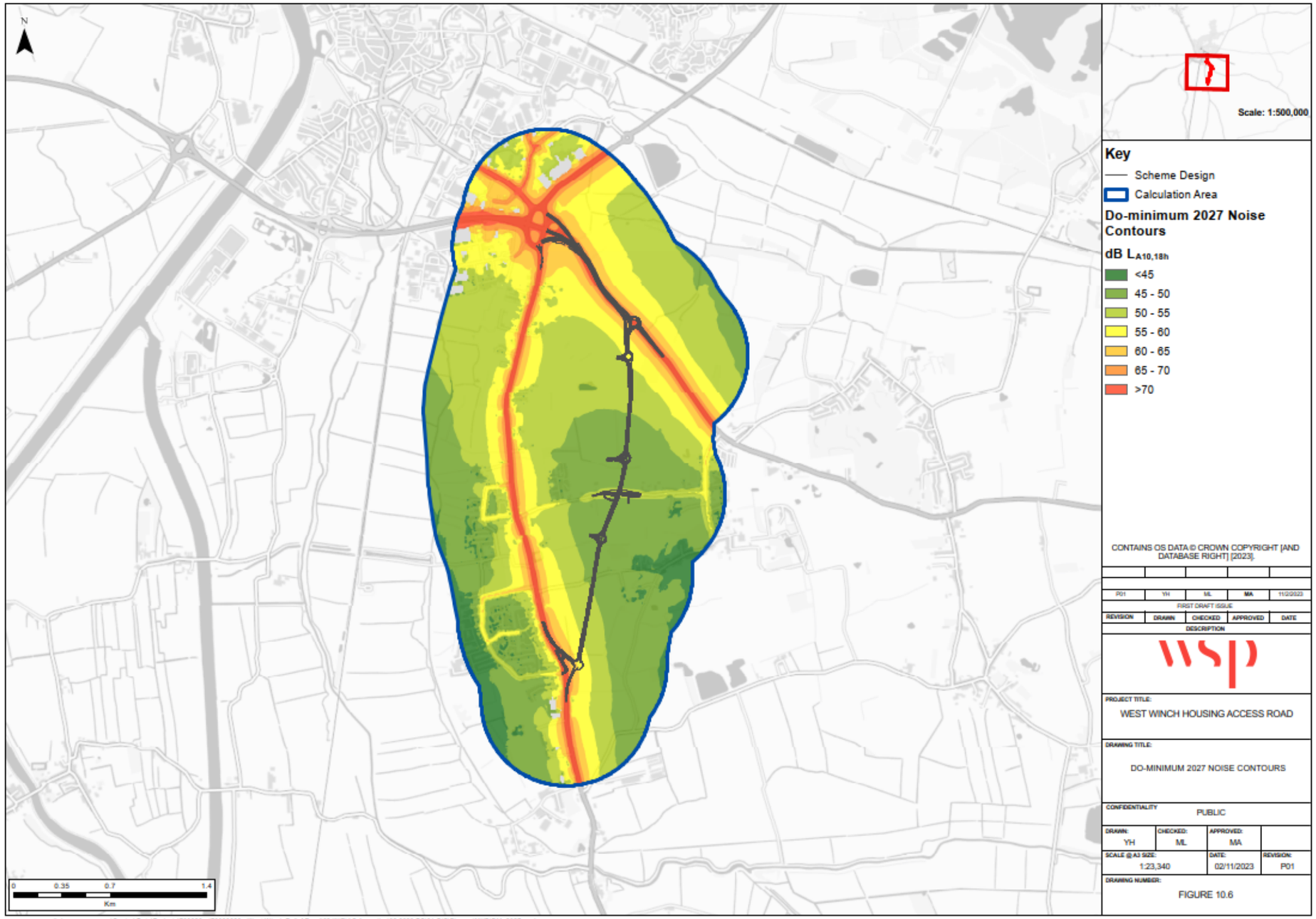

Figure 12-7 – Do-something 2027 noise contours

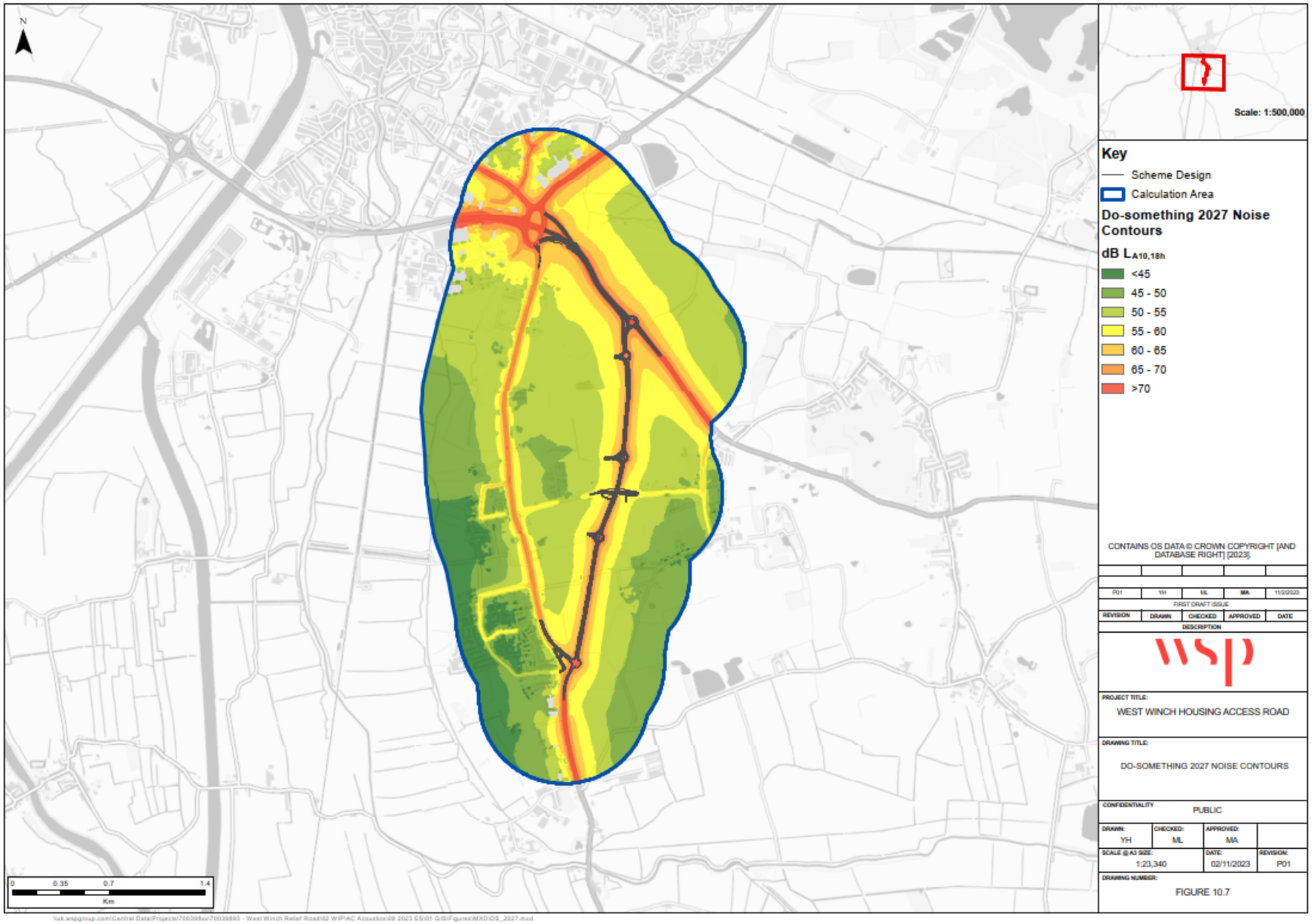

Figure 12-8 – Short term noise level change

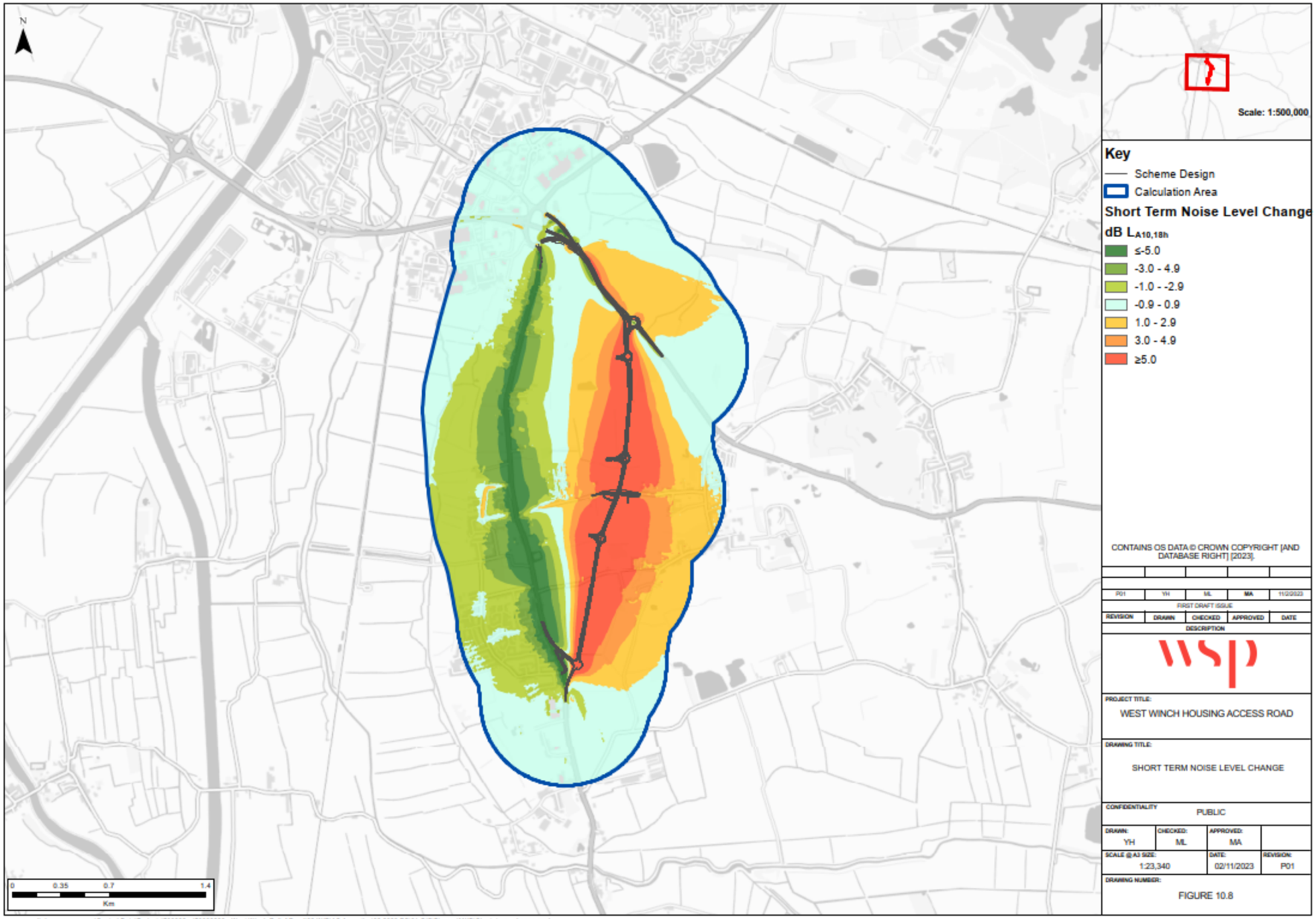

Figure 12-9 – Long-term noise level change

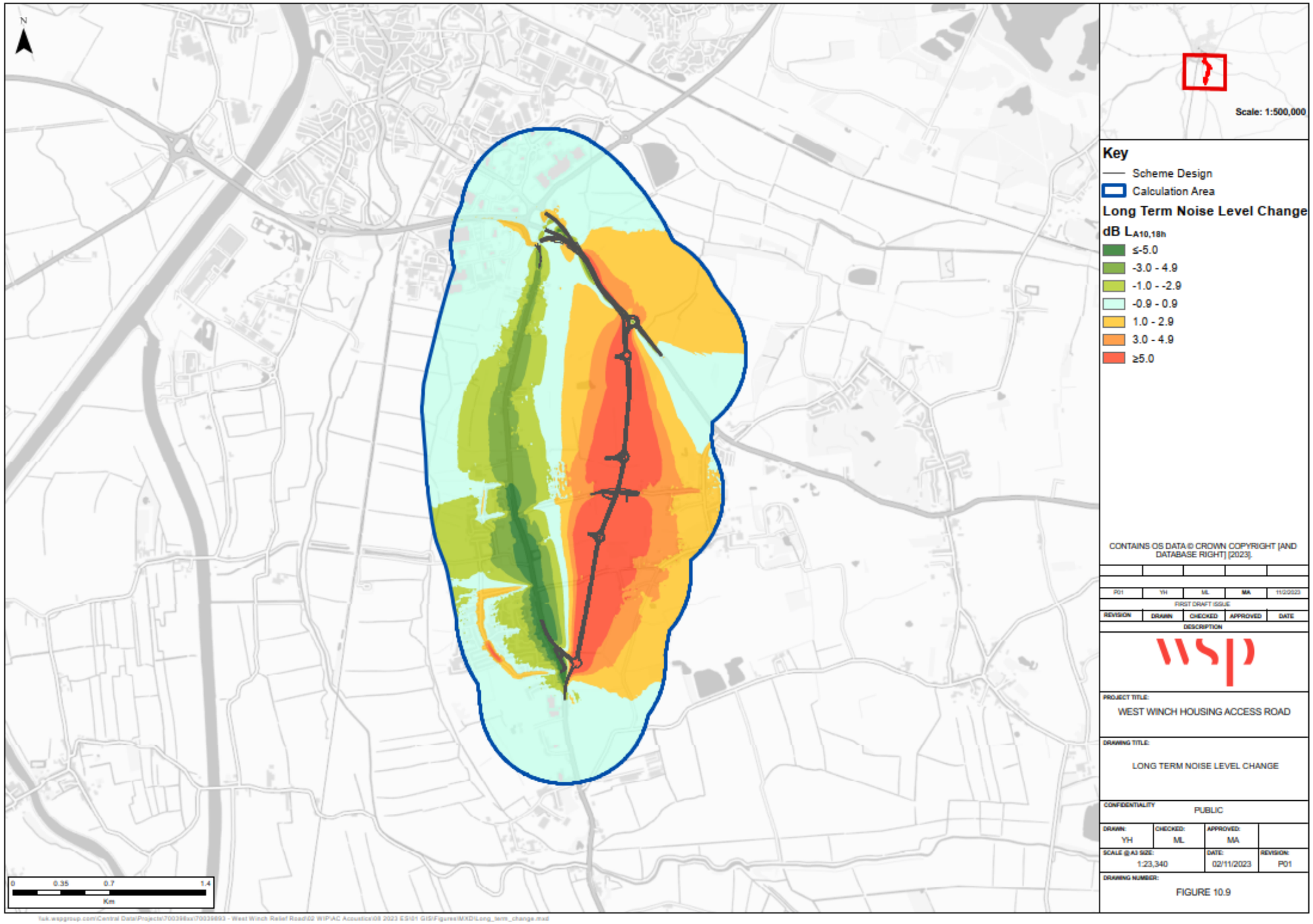

Figure 12-10 – Receptor groups

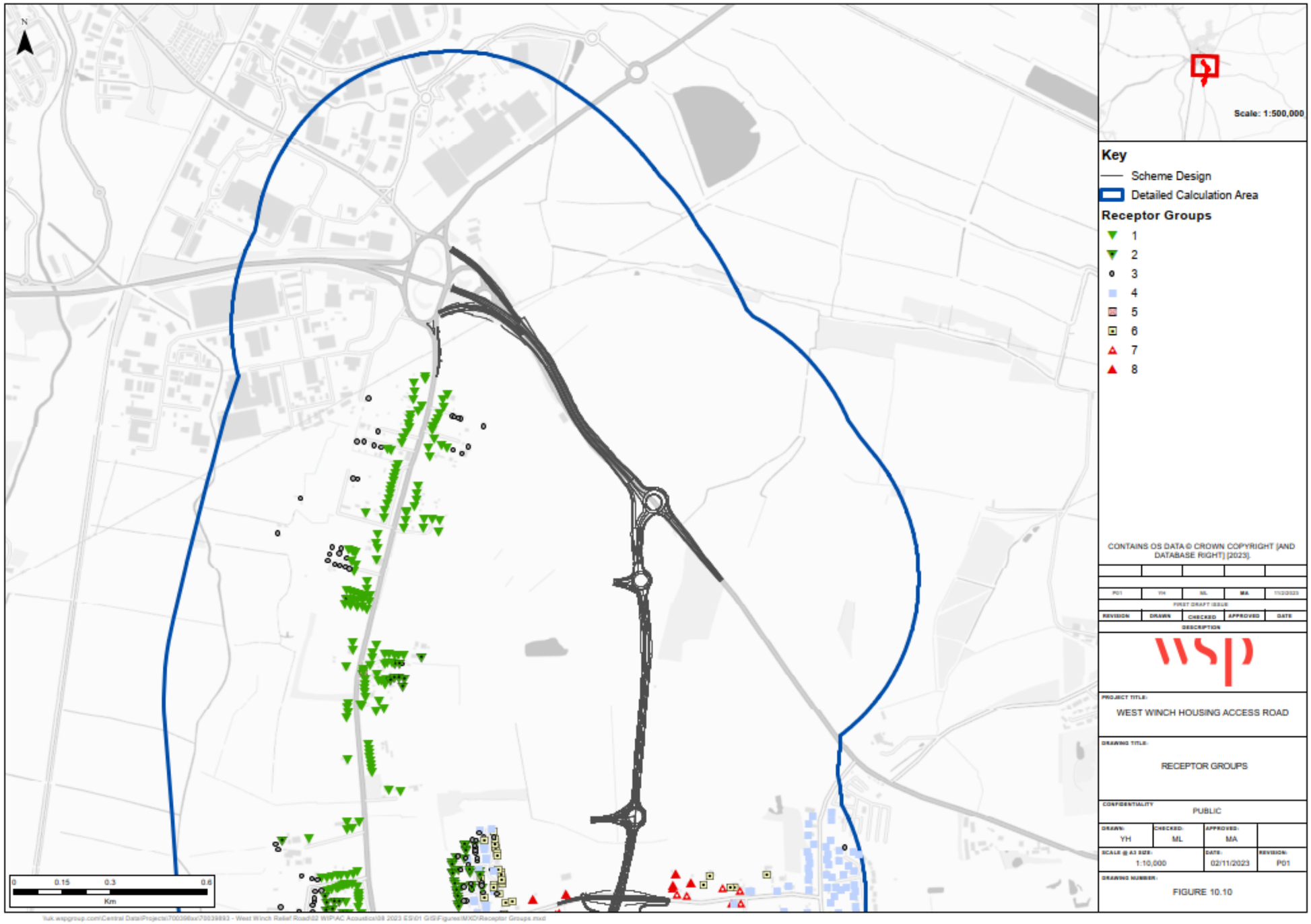

Figure 12-11 – Receptor groups