Chapter 11

NOISE AND VIBRATION

11 Noise and vibration

Introduction

11.1 ACCON UK was appointed to identify noise-sensitive receptors in the vicinity of the application site and establish the baseline noise environment at these receptors. This information was then used to assess the significant noise effects arising from the proposal. This chapter summarises the findings of ACCON UK's assessment. The full report is included as technical appendix I. The references and data sources used in the assessment are set out in table 11.1.

British Standards Institution, 2014, BS5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise and Part 2: Vibration
British Standards Institution, 2014, BS4142:2014 Methods for rating and assessing industrial and commercial sound
Burglund, B., Lindvall, T. and Schwela, D. (Eds), 1999, Guidelines for Community Noise. World Health Organization
Defra, 2010, Noise Policy Statement for England
Department for Communities and Local Government, 2012, National Planning Policy Framework
Department for Communities and Local Government, 2014, National Planning Practice Guidance: Noise
Department for Transport, 1988, Calculation of Road Traffic Noise
Department for Transport, 1994, Design Manual for Roads and Bridges. Volume 11, section 3, part 7: Traffic Noise and Vibration
Institute for Environmental Management and Assessment, 2014, Guidelines for Environmental Noise Impact Assessment
South Cambridgeshire District Council, 2007, Development Control Policies Development Plan Document
South Cambridgeshire District Council, 2013, Proposed Submission Local Plan
Table 11.1: References and data sources

The nature, measurement and effect of noise

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

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

11.4 When related to change in noise, an increase of 10 dB(A) would represent a doubling in 'loudness'. Similarly, a decrease of 10 dB(A) would represent a halving in 'loudness'. A change of 3 dB(A) is generally considered to be just perceptible. Table 11.2 gives an indication of the level of some common sounds on the dB(A) scale.

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

Table 11.2: Typical noise levels

11.5 Measured noise levels can be expressed in a variety of ways. There are four noise indices that will be referred to in this chapter:

- $L_{Aeq,T}$: The equivalent steady sound level in dB containing the same acoustic energy as the actual fluctuating sound level over the given time period T. T may be as short as one second when used to describe a single event, or as long as 24 hours when used to describe the noise climate at a specified location. This is a unit commonly used to describe construction, industrial and activity noise
- L_{A10}: The 'A'-weighted sound pressure level of the residual noise in decibels exceeded for 10% of a given time. It is often used to describe the levels of road traffic noise at a particular location
- L_{A90}: The 'A'-weighted sound pressure level of the residual noise in decibels exceeded for 90% of a given time. It is often used to describe the background noise levels at a particular location
- L_{Amax}: The 'A'-weighted maximum sound pressure level measured over a measurement period

Legislation and policy

National policy guidance

11.6 Paragraph 123 of the National Planning Policy Framework (NPPF; 2012) states that planning policies and decisions should aim to:

- Avoid noise giving rise to significant adverse impacts on health and quality of life as a result of new development
- Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new developments, including through the use of conditions
- Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established
- Identify and protect areas of tranquillity that have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason

11.7 The *Noise Policy Statement for England* (Defra, 2010) aims to *"through the effective management and control of environmental, neighbour and*

neighbourhood noise within the context of government policy on sustainable development:

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

11.8 The Department for Communities and Local Government's online National Planning Practice Guidance: *Noise* (2014) provides advice on how to determine the noise impact of development and states that *"local planning authorities' plan-making and decision taking should take account of the acoustic environment and in doing so consider:*

- *whether or not a significant adverse effect is occurring or likely to occur;*
- *whether or not an adverse effect is occurring or likely to occur;*
- *whether or not a good standard of amenity can be achieved"*

Local policy

11.9 Policy NE/15 of South Cambridgeshire District Council's adopted Development Control Policies Development Plan Document (2007) relates to noise pollution and states that planning permission will not be granted for development that has an unacceptable adverse impact on the acoustic environment of existing or planned development or countryside areas of tranquillity that are important for wildlife and countryside recreation, or that would be subject to unacceptable noise levels from existing noise sources.

11.10 Emerging policy is provided by the council's Proposed Submission Local Plan (2013). Policy SC/11 Noise Pollution is similar to the adopted policy NE/15 discussed above. Policy CC/6 Construction Methods requires constructors to be considerate to neighbouring occupiers, including by restricting the hours of noisy operations and by locating storage compounds and using plant to avoid noise.

Noise guidance

11.11 There is a range of existing guidance available on noise. A brief summary of the guidance most relevant to the assessment is provided below and further details are given in technical appendix I.

11.12 British Standard 5228:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites* gives recommendations for basic methods of noise and vibration control relating to construction sites where work activities may generate significant noise and / or vibration.

11.13 The *Calculation of Road Traffic Noise* (CRTN; Department for Transport, 1988) describes the procedure for calculating road traffic noise at a given receptor location.

11.14 British Standard 4142:2014 *Methods for rating and assessing industrial and commercial sound* describes the methods for determining, at the outside of a

building, noise levels from factories, industrial premises, fixed installations and sources of an industrial nature in commercial premises.

Methodology

Introduction

11.15 Consultation was undertaken with the environmental health department of South Cambridgeshire District Council and the proposed survey and assessment methodologies were agreed.

Baseline

11.16 The existing noise environment around the application site was determined through a detailed noise measurement survey undertaken by ACCON UK in November 2015. The monitoring locations are shown on figure 11.1. Three semi-permanent noise monitoring locations were used, together with satellite measurements to assist in characterising the noise environment across the site. Details of the equipment used in the surveys are provided in technical appendix I.

11.17 Noise measurements were carried out on 25 and 26 November 2015. During this period, the weather conditions were dry with light wind and were suitable for noise surveying. It was noted during the survey that a section of the A505 between the A505 / A1301 'McDonalds' roundabout and the junction with the A11 was partially closed between 22:00 and 06:00 for ongoing resurfacing works. A diversion was in place directing any traffic for this section of the A505 along the A1301 and A11. It is likely that road traffic along the A11 increased due to this road closure, which has slightly increased the noise measurement results during the night time period. This has been reflected in the noise model, where the preliminary road traffic data obtained from Department for Transport counts was increased during the night time period to compare the noise measurement results with the noise model output.

Impact assessment

Construction noise and vibration

11.18 Noise generated during the construction phase has been considered qualitatively using best practice means as set out in BS5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites Part 1* to minimise the noise impacts of construction activities on nearby receptors. BS5228 provides guidance on noise limits for construction noise based on the pre-existing noise environment. Day, evening and night time periods are defined, with limits provided as set out in table 11.3.

Assessment category and threshold value period	Threshold value ($L_{Aeq,T}$) (dB)		
	Category A[A)]	Category B[B)]	Category C[C)]
Night time (23:00-07:00)	45	50	55
Evenings and weekends[D)]	55	60	65
Day time (07:00-19:00) and Saturdays (07:00-13:00)	65	70	75
Note 1: A significant effect has been deemed to occur if the total L_{Aeq} noise level, including construction, exceeds the threshold level for the category appropriate to the ambient noise level. Note 2: If the ambient noise level exceeds the threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total L_{Aeq} noise level for the period increases by more than 3 dB due to construction activity. Note 3: Applied to residential receptors only. A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values. B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values. C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values. D) 19:00-23:00 weekdays, 13:00-23:00 Saturdays and 07:00-23:00 Sundays.			
Table 11.3: BS5228 recommended construction noise limits			

11.19 A qualitative construction vibration assessment has been carried out, based on the distances between construction activities and the nearest sensitive receptors. Typical maximum distances at which construction activities may give rise to a just perceptible[1] level of vibration, based on historical field measurements, are provided in table 11.4.

Construction activity	Maximum distance from activity when vibration may just be perceptible (m)
Excavation	10-15
Vibratory compaction	25-40 (depending on weight of drum and specific equipment used)
Heavy vehicles (e.g. dump trucks)	5-15
Hydraulic breaker	15-20
Auger piling (e.g. continuous flight auger piling)	5-10
Vibratory piling	30-40
Table 11.4: Distances at which construction vibration may just be perceptible	

Post-construction traffic noise

11.20 In order to establish the traffic-related noise impact of the proposed development, it was necessary to consider the changes in traffic flows that will occur on the existing highway network as a result of the development. The predicted flows were inputted into CadnaA, a noise modelling software program, to predict the noise levels at the nearest sensitive receptors both with and without the development.

Post-construction plant noise

11.21 Noise impacts from deliveries and plant associated with the proposed development, such as air conditioning, ventilation and refrigeration, have been examined using BS4142. Precise information on the location and nature of

[1] With reference to guidance provided in BS5228, it is generally accepted that, for the majority of people, vibration levels in excess of between 0.14 and 0.3 mm/s peak particle velocity are just perceptible, depending on the receiving environment.

plant is not available at this outline stage, so noise limits have been set based on the guidance in BS4142.

Assessment of significance

11.22 Effect significance is derived from measures of the magnitude (or scale) of the impact and the sensitivity of the receptor affected. To determine these measures for noise effects, reference was made to a range of criteria relating to the nature of the receptors, expected duration of exposure, the predicted increase in noise levels over and above the baseline conditions, and absolute noise levels. The significance of the potential noise effects was determined using a two-stage process, in line with the approach identified in the Institute of Environmental Management and Assessment's (2014) *Guidelines for Environmental Noise Impact Assessment*.

11.23 The first stage involved determining the sensitivity of the potentially affected receptors and the magnitude of change. The categories of receptor sensitivity are defined in figure 11.2 and the magnitude of change is defined in figure 11.3. The magnitude categories used in the assessment are based on criteria provided by the Design Manual for Roads and Bridges and the World Health Organization.

11.24 The second stage involved the use of the degree of effect matrix shown in figure 11.4. The levels of sensitivity and magnitude were fed into the matrix to determine the degree of the potential effect, which was then used to determine whether the effect was significant. Effects that are moderate or above are considered to be significant in EIA terms.

Baseline

Noise monitoring results

11.25 The results for the measured noise levels at the semi-permanent and satellite positions are summarised in table 11.5.

Monitoring location	Period	L_{Aeq} (dB)	L_{Amax} (dB)	L_{A10} (dB)	L_{A90} (dB)
MP1	Day time (14:25-23:00 on 25.11.15 and 07:00-12:25 on 26.11.15)	50	64	50	47
	Night time (23:00-07:00)	46	56	47	42
MP2	Day time (07:00-23:00)	63	70	65	59
	Night time (23:00-07:00)	59	68	62	49
MP3	Day time (07:00-23:00)	67	82	71	53
	Night time (23:00-07:00)	61	80	62	43
MP4	10:20-11:20	44	54	44	42
MP5	11:25-12:25	43	64	45	41
MP6	13:40-15:10	51	63	57	49
MP7	13:58-14:58	56	65	58	54
MP8	11:38-14:38	63	85	64	60
MP9	10:07-11:20	53	76	55	50
	15:16-15:46	56	75	57	53

Table 11.5: Baseline noise levels

11.26 Measurement positions MP1, MP4 and MP5 were located to the east of the pumping station compound, approximately 420 m to the north of the main site. The dominant noise source at these locations was distant road traffic from the A1301 and A505. Road traffic noise from the A11 is screened by the intervening topography of the land to the east. The pumping station emits a quiet but continuous tone from the electrical components within the compound. Night time noise levels were dominated by pumping station noise during the quietest periods of the night.

11.27 Measurement positions MP2 and MP6 were located in the south east of the main site, approximately 105 m and 155 m from the A11 respectively. The dominant noise source at both locations was road traffic on the A11. Measurement position MP3 was located in the south west corner of the main site, around 10 m from the nearest carriageway of the A1301. Road traffic on the A1301 was the dominant noise source at this location. Measurement position MP7 was located approximately 140 m to the east of the main site and approximately 90 m from the A11. Road traffic on the A11 was the dominant noise source at this location.

11.28 Measurement position MP8 was located approximately 30 m south of the A1301 / A505 'McDonalds' roundabout and 12 m from the A1301. The dominant noise source was road traffic. Measurement position MP9 was located along Mill Farm Lane at the northern end of the bus / cycle interchange site, approximately 70 m west of the A1301. The dominant noise source was road traffic on the A1301 and A505.

11.29 Other noise sources that were noticeable during the survey included aeroplanes and helicopters, train movements on the West Anglia main line (approximately 800 m from the main site), bird song, bird scarers and emergency sirens. There was no discernible noise from any of the existing buildings to the east of the main site, with the exception of infrequent deliveries to the Mighton Products Ltd premises. Sources of noise during deliveries included reversing alarms, doors slamming and banging from the loading and unloading activities.

Future baseline

11.30 Noise levels at sensitive receptors around the application site in the absence of the proposed development were modelled using CadnaA software. The locations of the receptors are shown in figure 11.1 and the future baseline day time noise levels are summarised in table 11.6.

Receptor location	**$L_{A10, 18hr}$ dB (day time)**
North End Lane	52.1
Cottages at Hinxton Grange	46.5
Mill Farm Lane	56.6

Table 11.6: Future baseline noise levels at sensitive receptors (2030)

11.31 All of the receptors are residential dwellings and are therefore of medium sensitivity with reference to figure 11.2.

Effects during construction

Noise

11.32 Any major development will give rise to some noise disturbance for receptors in the vicinity of a site during the construction phase. However, disruption due to construction is generally more localised than post-construction effects and is temporary and short term in nature.

11.33 The exact construction plant types and programme are not known at this outline stage. Until the types and numbers of machines and the percentage on-time and locations of fixed plant are known, a detailed noise impact assessment cannot be carried out. However, an initial assessment of the likely noise levels at the nearest noise-sensitive receptors has been undertaken using typical construction plant items and an assumed construction programme.

11.34 Three main construction stages have been assumed: enabling works and site preparation, ground works, and construction. These stages use many of the noisiest construction plant and machinery and, to provide a robust worst case assessment, it was assumed that one item of all the types of plant used in the three stages could be operating simultaneously across the site. Potential construction noise levels from these activities were predicted based on the source noise levels provided in BS5228 for typical machinery used during these stages. Full details of the assumptions made regarding construction activities are provided in technical appendix I.

11.35 The receptors likely to be most affected in each area of noise-sensitive receptors have been selected to represent a robust worst case assessment. The noise model has been used to determine the baseline day time noise levels and identify the significant effect thresholds at these receptors, based on the criteria in table 11.3. These thresholds are applicable during weekdays and on Saturday mornings. There will be no external working in the evenings or on Sundays or Bank Holidays. The noise model was also used to make preliminary predictions of noise levels at these receptors during the three construction stages (table 11.7).

		Hinxton Grange and Cottages	North End Lane	Mill Farm Lane
Existing ambient noise level $L_{Aeq,T}$ (dB)		46-49	56	53-56
Rounded ambient noise level (dB)		45-50	55	55
ABC category		A	A	A
Significant effect threshold (dB)		65	65	65
Predicted construction noise level $L_{Aeq,T}$ (dB)	Site preparation and enabling works	63	57	53
	Ground works	53	47	47
	Construction	39	33	33

Table 11.7: Construction noise assessment

11.36 Table 11.7 shows that the noise levels during each of the modelled construction stages are unlikely to lead to significant adverse effects at the receptors closest to the site, as all of the predicted construction noise levels are below the applicable significant effect thresholds. The magnitude of change is therefore considered to be negligible at all the receptors, leading to a negligible effect that will not be significant.

Vibration

11.37 The nearest vibration-sensitive receptors to the site are the dwellings at Hinxton Grange and Cottages. The closest dwellings are approximately 160 m from the nearest area of proposed built development. With reference to table 11.4, this is beyond the distance at which vibration from construction activities is likely to be perceptible. No significant vibration effects are therefore predicted.

Effects post-construction

Road traffic noise

11.38 The proposed development has the potential to affect the overall noise climate along the local road network by altering the contribution from road traffic noise. The 'with development' noise levels for 2030 were modelled and the results are set out in table 11.8, which also shows the increase in road traffic noise levels as a result of the proposed development by comparing the 2030 'with development' scenario with the 2030 future baseline.

Receptor	$L_{A10,18hr}$ (dB)	Increase as a result of proposed development (dB)
North End Lane	52.5	+0.4
Cottages at Hinxton Grange	46.8	+0.3
Mill Farm Lane	56.8	+0.2

Table 11.8: 'With development' noise levels and increase as a result of the proposed development (2030)

11.39 The increase in noise levels as a result of the proposed development will be less than 0.5 dB for all the receptors, which is a change of negligible magnitude, and there will be no significant adverse effects.

Plant noise

11.40 BS4142 sets out a methodology for predicting the likelihood of complaints related to noise from commercial or industrial development. This is assessed by comparing the measured background noise level with the 'rating level' (the noise level of an industrial source that includes an adjustment for the character of the noise). BS4142 states that the following should be considered:

- The greater the difference, the greater the magnitude of the impact
- A difference of +10 dB or more is an indication of a significant adverse effect, depending on the context
- A difference of around +5 dB is likely to be an indication of an adverse effect, depending on the context
- The lower the rating level is relative to the background sound level, the less likely it is that the specific sound source will have an adverse effect or a significant adverse effect. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context

11.41 At this outline stage, the precise locations and types of plant and delivery / services areas are not known. The nearest noise-sensitive receptors are the residential dwellings at Hinxton Grange and Hinxton Grange Cottages. The background noise level at these dwellings has been modelled as 46 dB(A)

during the day and 35 dB(A) at night. These therefore represent the maximum rating levels possible to achieve a low impact.

11.42 Noise from plant and deliveries will be subject to a further assessment at the detailed design stage to ensure that they will not cause an adverse impact. As a result, noise effects on sensitive receptors from both plant and deliveries are likely to be negligible and not significant.

Mitigation

11.43 While no significant adverse effects are predicted, the following best practicable means will be used where possible during the construction phase to minimise noise and vibration:

- Ensure that each item of plant used on the project complies with the noise limits quoted in directive 2000/14/EC and The Noise Emission in the Environment by Equipment for Use Outdoors Regulations 2001 (as amended)
- Adopt the recommendations set out in section 8 of part 2 and annex B of BS5228 with regard to noise and vibration mitigation options. Where alternative authoritative guidance and procedures are thought to be more reasonable and have been agreed in advance with the council, these may be adopted instead
- Locate plant and equipment liable to create noise and / or vibration while in operation as far as reasonably practicable away from sensitive receptors. Use barriers to absorb and / or deflect noise away from noise-sensitive areas where required
- Maintain all plant and equipment and noise control measures applied to plant and equipment in good and efficient working order and operate them to minimise noise emissions. Where possible, any plant, equipment or items fitted with noise control equipment found to be defective will not be operated until repaired
- Where reasonably practicable, fixed items of construction plant should be electrically powered, in preference to diesel or petrol driven
- Vehicles and mechanical plant employed for any activity associated with the construction works will, where possible, be fitted with effective exhaust silencers and shall be maintained in good working order and operated in a manner such that noise emissions are controlled and limited
- Machines in intermittent use should be shut down or throttled down to a minimum during periods between works. Static noise-emitting equipment operating continuously will be housed within a suitable acoustic enclosure, where appropriate

11.44 These measures will be implemented through a noise control plan, which will form part of the construction environmental management plan. Checks may be made to ensure that best practicable measures are being adopted and, for example, that acoustic screening is effective, working hours are adhered to and plant on-times are realistic.

11.45 No significant noise effects from post-construction traffic were predicted, so no mitigation measures are required. Noise from any plant or deliveries will be

subject to a further noise assessment at the detailed design stage to ensure that there will be no adverse impacts when assessed in line with BS4142. Mitigation will therefore be 'built in' at the detailed design stage.

Residual effects

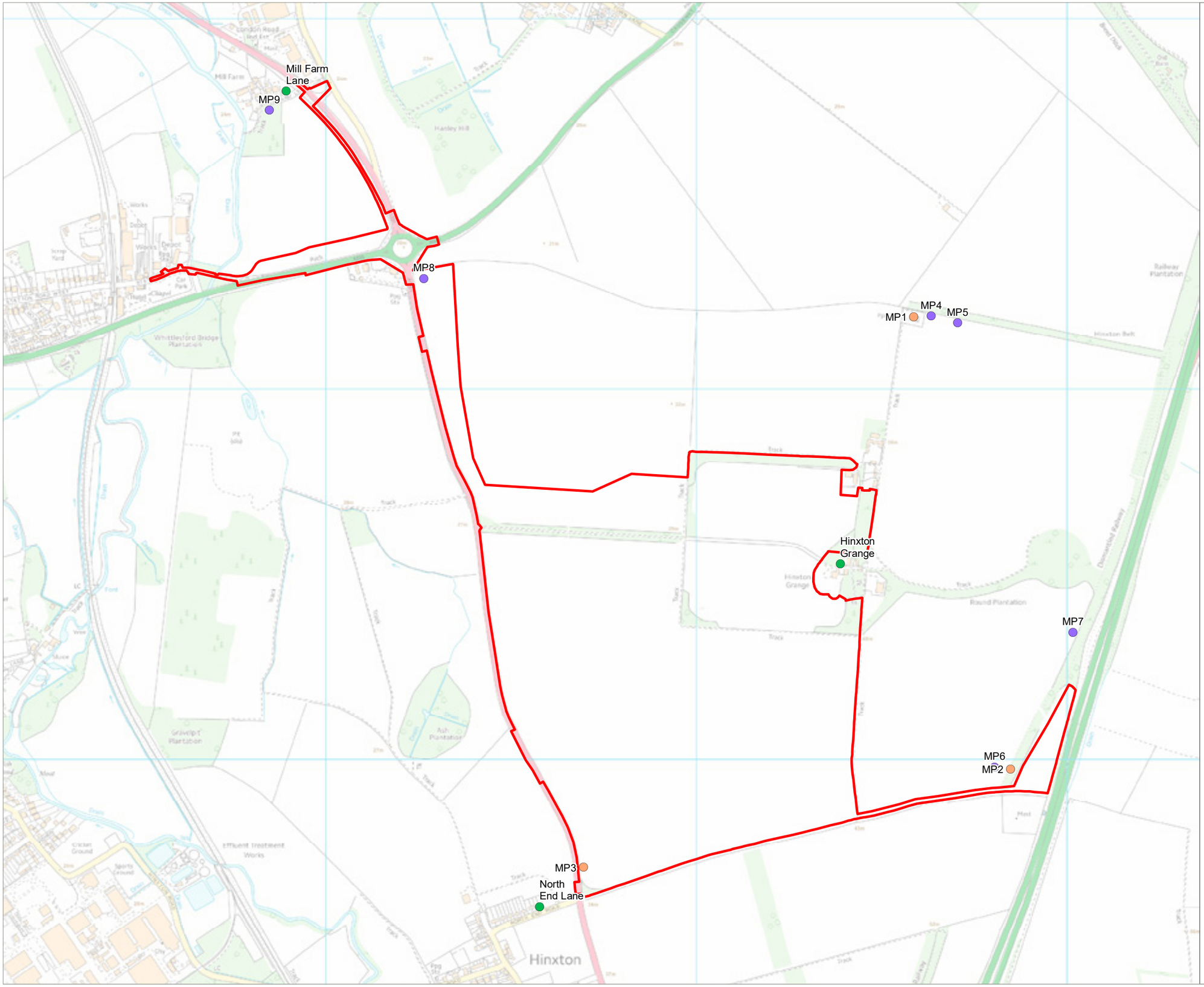
11.46 No significant residual effects are predicted.

Cumulative effects

11.47 As set out in chapter 3, the potential for cumulative effects with a number of consented and proposed developments in the area needs to be assessed. It is possible that the construction periods of the proposed development and other developments in the area may overlap. However, it is likely that these developments will also implement best practice construction methods as set out in BS5228. Given this, and the distance between the nearest sensitive receptors to the site and the other developments, no significant cumulative construction noise and vibration effects are predicted.

11.48 The traffic data used in the post-construction modelling included traffic arising from committed developments in the vicinity of the site. Therefore, the potential cumulative post-construction effects are included in the modelling results and no additional cumulative effects are envisaged.

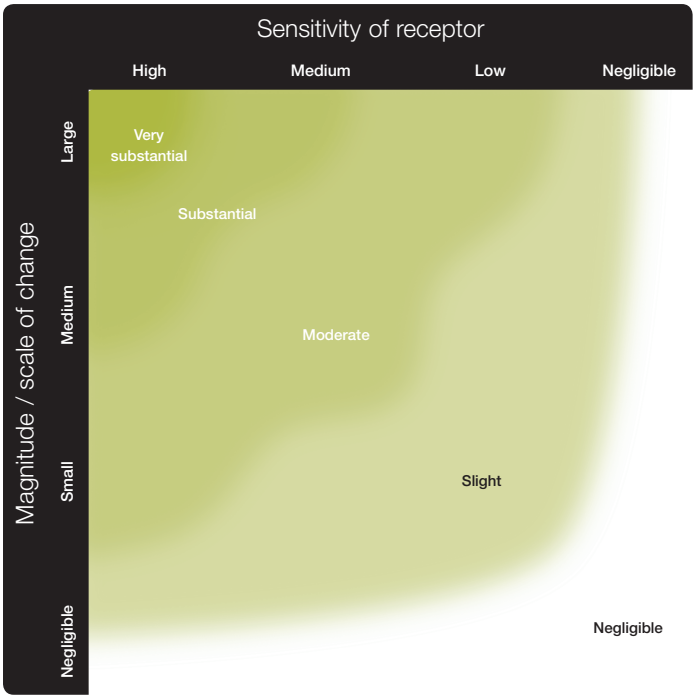
11.49 Noise relating to the electricity supply connection to the Fulbourn sub-station and the possible off site wastewater rising main will be associated with the construction phase; there is no potential for significant noise generation post-construction. The potential for significant construction noise is likely to be greatest where the routes pass close to residential areas. However, standard and proven construction techniques will be used to control noise levels and working hour restrictions will be imposed, particularly where works are in close proximity to dwellings. As a result, no significant cumulative construction noise effects are predicted.



Sensitivity of receptor – Noise

Magnitude of change – Noise

Determination of significance matrix – Noise



Professional judgement can be used to vary the category where specific circumstances dictate, for example due to the vulnerability or condition of the receptor.

For example, schools would normally be considered sensitive to construction noise, but would not be so if all works were undertaken outside school opening times. The reason for and nature of any variation will be made clear in the assessment.

Degrees of effect

Very substantial:
Greater than 10.0 dB LAeq change in sound level perceived at a receptor of great sensitivity to noise.

Substantial:
Greater than 5.0 dB LAeq change in sound level at a noise sensitive receptor, or a 5.0 to 9.9 dB LAeq change in sound level at a receptor of great sensitivity to noise.

Moderate:
A 3.0 to 4.9 dB LAeq change in sound level at a sensitive or highly sensitive noise receptor, or a greater than 5.0 dB LAeq change in sound level at a receptor of some sensitivity.

Slight:
A 3.0 to 4.9 dB LAeq change in sound level at a receptor of some sensitivity.

Negligible:
Less than 2.9 dB LAeq change in sound level and / or all receptors are of negligible sensitivity to noise or marginal to the zone of influence of the proposals.

Significance

If the degree of effect is moderate or above, then the effect is considered to be significant.