13 NOISE AND VIBRATION

13.1 INTRODUCTION

13.1.1 This Chapter addresses the likely significant environmental effects of the construction and operational phases of the Application Site on the noise and vibration climate of the surrounding area.

13.1.2 The Chapter first presents the relevant legislation and policy which has informed the assessment. The methods that have been followed to obtain the baseline information, subsequent assessment of their value and impacts on these are presented. The Chapter then presents a summary of the baseline conditions at the Application Site.

13.1.3 The Chapter then considers the likely significant environmental effects of the existing and future noise climate on the proposed use of the Application Site, the effect of noise from the Application Site on the existing and future noise climate and the effect of construction noise and vibration on existing and proposed noise sensitive receptors.

13.1.4 Appropriate additional avoidance, mitigation or compensation measures necessary to reduce these effects to an acceptable level are identified, and the significance of any residual effects are finally assessed.

13.1.5 This chapter assesses two development scenarios. These include the allocation test which consist of development which has been allocated for the site and the application test which consists of development to be included within this planning application. For consistency, the site will be referred to as “the Application Site” throughout this chapter with additional reference to the development scenario where relevant.

13.2 LEGISLATION AND PLANNING POLICY CONTEXT

National Legislation

13.2.1 There is no national legislation which is directly applicable to the Application Site for both the application and allocation scenarios in terms of the assessment of acoustic and vibration effects.

National Planning Policy

National Planning Policy Framework (2012)

13.2.2 The National Planning Policy Framework (NPPF) was published on 27th March 2012 and outlines the Government’s environmental, economic and social policies for England. The NPPF sets out a presumption in favour of sustainable development which should be delivered with three main dimensions: economic; social and environmental (Paragraphs 7 and 14). The NPPF aims to enable local people and their councils to produce their own distinctive local and neighbourhood plans, which should be interpreted and applied in order to meet the needs and priorities of their communities.

13.2.3 In respect of noise, the document states:

> **“The planning system should contribute to and enhance the natural and local environment by […] preventing both new and existing development from contributing to or being put at unacceptable risk from or being adversely affected by unacceptable levels of […] noise pollution.”**

13.2.4 The NPPF goes on to advise that:

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

13.2.5 The NPPF indicates that the Noise Policy Statement for England (NPSE) should be used to define the "significant adverse impacts".

Noise Policy Statement for England (2010)

13.2.6 The NPSE was published in March 2010. The document seeks to clarify the underlying principles and aims in existing policy documents, legislation and guidance that relate to noise. It also sets out the long-term vision of Government noise policy:

> **"To promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development."**

13.2.7 The NPSE clarifies that noise should not be considered in isolation of the wider benefits of a scheme or development, and that the intention is to minimise noise and noise effects as far as is reasonably practicable having regard to the underlying principles of sustainable development.

13.2.8 The first two aims of the NPSE follow established concepts from toxicology that are applied to noise impacts, for example, by the World Health Organisation (WHO). They are:

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

13.2.9 The NPSE extends these to the concept of a significant observed adverse effect level.

> **SOAEL** – Significant Observed Adverse Effect Level – the level above which significant adverse effects on health and quality of life occur.

13.2.10 The NPSE notes:

> **"It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times."**

Planning Practice Guidance (2016)

13.2.11 The Planning Practice Guidance (PPG) was launched on the 6th March 2014 and provides additional guidance and interpretation to the Government's strategic policies outlined within the NPPF in a web based resource. This is updated regularly.

13.2.12 With regards to noise, the PPG provides guidance on the effects of noise exposure, relating these to people's perception of noise, and linking them to the NOEL and, as exposure increases, the LOAEL and SOAEL.

13.2.13 As exposure increases above the LOAEL, the noise begins to have an adverse effect and consideration needs to be given to mitigating and minimising those effects, taking account of the economic and social benefits being derived from the activity causing the noise. As the noise exposure increases, it will then at some point cross the SOAEL boundary.

13.2.14 The LOAEL is described in PPG as the level above which **"noise starts to cause small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is not alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life."**.

13.2.15 PPG identifies the SOAEL as the level above which **"noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area."**.

Guidance

British Standard 8233:2017 'Guidance on Sound Insulation and Noise Reduction for Buildings'

13.2.16 British Standard 8233, in relation to the Application Site, sets out desirable guideline values in habitable rooms, such as living rooms and bedrooms.

13.2.17 The guideline values relate to steady external noise without a specific character, previously termed 'anonymous noise'. According to the standard, noise has a specific character if it contains features such as a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content, in which case lower noise limits might be appropriate. Examples of noise with a character may include tonal/intermittent plant noise emissions, music playback, and workshop noise. Examples of external steady noise sources may include environmental noise sources such as busy road traffic.

13.2.18 The desirable internal ambient levels for dwellings are presented in **Table 13.1**.

Table 13.1: BS 8233 Desirable Internal Ambient Noise Levels for Dwellings

Activity	Location	07:00 to 23:00 hours	23:00 to 07:00 hours
Resting	Living Room	35 dB $L_{Aeq, 16\ hr}$	-
Dining	Dining Room/Area	40 dB $L_{Aeq, 16\ hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq, 8\ hr}$	30 dB $L_{Aeq, 8\ hr}$
*Note 4 Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL of $L_{Amax, f}$ depending on the character and number of events per night. Sporadic noise events could require separate values.			
*Note 5 If relying on closed windows to meet the guide values, there needs to be an appropriate alternative source of ventilation that dos not compromise the façade insulation or the resulting noise level.			
*Note 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.			

* A selection of the available notes

13.2.19 The standard also provides advice in relation to design criteria for external noise. It states that:

> **"for traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq, T}$ with an upper guideline value of 55 dB $L_{Aeq, T}$ which would be acceptable in noisier environments. However, it is also recognised that these guideline values are not achievable in all circumstances where development might be desirable.**
>
> **In higher noise areas, such as city centre or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited."**

British Standard 7445:2003 'Description and Measurement of Environmental Noise – Part 1: Guide to Quantities and Procedures'

13.2.20 British Standard 7445-1 describes methods and procedures for measuring noise from all sources which contribute to the total noise climate of a community environment, individually and in combination. The results are expressed as equivalent continuous A-weighted sound pressure levels, $L_{Aeq, T}$.

13.2.21 British Standard 7445-1 states that sound level meters that are used should conform the Type 1 (or Type 2 as a minimum) as described in BS EN 61674:2013 Electroacoustics. Sound Level Meters should be calibrated according to the instructions of the manufacturer and field calibration should be undertaken at least before and after each series of measurements.

World Health Organisation, Guidelines for Community Noise (1999)

13.2.22 The World Health Organisation (WHO) Guidelines for Community Noise also sets out guidance on suitable internal and external noise levels in and around residential properties. The following internal noise levels are recommended by the WHO:

- 35 dB $L_{Aeq, T}$ in living rooms over a 16-hour day; and
- 30 dB $L_{Aeq, T}$ in bedrooms during the 8-hour night.

13.2.23 With respect to the night-time maximum noise levels, the WHO guidelines state:

> **"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{AFmax} more than 10 – 15 times per night"**

British Standard 4142 'Methods for Rating and Assessing Industrial and Commercial Sound (2014)

13.2.24 British Standard 4142 describes methods for rating an assessing sound of an industrial and/or commercial nature. The methods described in the standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposed upon which sound is incident.

13.2.25 The standard is used to determine the rating levels for sources of sound of an industrial and/or commercial nature and the ambient, background and residual sound levels at outdoor locations. These levels could be used for the purposes of investigating complaints; assessing sound from the proposed, new, modified or additional source(s) of sound of an industrial and/or commercial nature; and assessing sound at proposed new dwellings or premises use for residential purposes. However, the determination of noise amounting to a nuisance is beyond the scope of the standard.

13.2.26 The procedure contained in BS 4142 assess the significance of sound which depends upon the margin by which the rating level of the specific sound sources exceeds the background sound level and the context in which the sound occurs/will occur.

13.2.27 An initial estimate of the impact of the specific sound is obtained by subtracting the measured background sound level from the rating level considering the following:

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

13.2.28 Where the initial estimate of the impact needs to be modelled due to the context, the following factors should be considered:

- The absolute level of sound;
- The character and level of the residual sound compared to the character and level of the specific sound; and
- The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions such as:
    - Façade insulation treatment;
    - Ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and
    - Acoustic screening.

ProPG; Planning and Noise (2017)

13.2.29 The Professional Practice Guidance on Planning and Noise (ProPG) provides guidance on a recommended approach to the management of noise within the planning system in England.

13.2.30 The scope of ProPG is limited to new residential development that will be predominantly exposed to airborne noise from transport sources.

13.2.31 The guidance is most relevant to new flats and houses, although there may be some relevant content in regards to other types of residential units, such as care homes and residential institutions.

13.2.32 Noise sources other than airborne transport (i.e. industrial, commercial, entertainment, etc) and ground-borne noise and vibration are outside the scope of ProPG.

13.2.33 ProPG uses a two-stage assessment method to determine the suitability of a site for residential development. The stages are as follows:

- Stage 1 – An initial noise risk assessment
- Stage 2 – A systematic consideration of four key elements:
    - Element 1 – demonstrating a “Good Acoustic Design Process”;
    - Element 2 – observing internal “Noise Level Guideline”;
    - Element 3 – undertaking an “External Amenity Area Noise Assessment”; and
    - Element 4 – consideration of “Other Relevant Issues”.

13.2.34 ProPG recommends that noise levels set out in BS 8233 be used for residential development. However, an additional criterion is proposed by ProPG for night-time L_{Amax} levels. ProPG recommends a criterion of 45 dB $L_{Amax,\ F}$ between the hours of 23:00 - 07:00. ProPG states:

> **“[…] In most circumstances in noise-sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45 dB $L_{Amax,\ F}$ more**

than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events."

Local Planning Policy

13.2.35 The Cherwell Local Plan 2011 – 2031 was re-adopted following a Court Order and an associated addendum to the Local Plan Inspector's Report.

13.2.36 Policy ESD 15: The Character of the Built and Historic Environment states:

"New proposals should:

[…] Consider the amenity of both existing and future development, including matters of privacy, outlook, natural lighting, ventilation, and indoor and outdoor space. […]"

13.2.37 Policy Villages 5: Former RAF Upper Heyford states:

"[…] Design and layout should reflect the management and mitigation of noise impacts associated with the development. […]

13.2.38 Consultation with Cherwell District Council (CDC) has concluded that outdoor amenity areas should meet the lower recommendation of 50 $dBL_{Aeq,\ 16\ hr}$.

13.3 ASSESSMENT APPROACH

Methodology

13.3.1 The assessment considers the likely impacts from noise and vibration generated as a consequence of the construction and operational phases of the Application Site for both the allocation and application scenarios. The impacts have been evaluated for both the identified receptors and the various elements of the Application Site itself.

13.3.2 A detailed daytime and night-time fully automated environmental sound and vibration survey has been undertaken in order to establish the existing environmental sound and vibration climate at suitable locations around the Application Site.

13.3.3 An acoustic model of the Application Site for both the allocation and application scenarios was prepared using SoundPLAN v 7.4. The model was based on the results of the environmental sound survey and the traffic flows for the surrounding road network, derived from the Transport Assessment (see ES Chapter 6). Traffic flows were in Annual Average Weekly Traffic (AAWT) 18-hour format and are presented in **Appendix 13.1**.

13.3.4 The existing mapping and topography of the Application Site has been included in all model scenarios.

13.3.5 The results of the environmental sound survey have been used to calibrate/validate the computer noise model.

13.3.6 The following scenarios were modelled in accordance with guidance from the Calculation of Road Traffic Noise (CRTN):

- 2016 Baseline

- 2031 Baseline
- 2031 Allocation Test – This is the 'with development' scenario and includes the total allocated development at Heyford including 1,600 residential dwellings, 1,500 jobs and ancillary uses..
- 2031 Application Test – This is also 'with development' but includes the total development at Heyford proposed to be included within this planning application including 1,111 residential dwellings, 1,500 jobs and ancillary uses..

13.3.7 The assessment has been based on the above scenarios and traffic information supplied in September 2017. Since this assessment was completed, further traffic flows for the above scenarios were modelled but the changes in noise levels would not be considered significant (majority of main roads surrounding the site would remain the same with the maximum increases of around 5% which equates to less than a 0.5 dB change) and therefore updated modelling has not been undertaken.

13.3.8 The results of the environmental sound survey have been used to calibrate the acoustic model. The model calibration results are presented in **Appendix 13.2**.

13.3.9 Assessment of the following elements have been carried out in accordance with relevant standards and guidelines detailed in the associated section:

- External Amenity Noise Levels;
- Internal Ambient Noise Levels;
- Change in Noise Levels due to the Change in Road Traffic Levels;
- Plant Noise Emissions; and
- Proposed Commercial Use.

13.3.10 Mitigation measures have been recommended where the proposed assessment criteria have been exceeded and an adverse impact considered to be likely.

Significance Criteria

13.3.11 In accordance with the NPPF, NPSE, and PPG for noise, Lowest Observable Adverse Effect Level (LOAEL), Significant Observable Adverse Effect Levels (SOAEL), and the No Observable Effect Limit (NOEL) have been proposed for each noise and vibration source under assessment.

13.3.12 In respect to EIA regulations, the positive ('beneficial') and negative ('adverse') effect levels of noise and vibration effects have been related to the significance levels presented in the relevant chapter. Based on the descriptions of the adverse effect levels in the PPG for noise (DCLG, 2014), recommended actions for each significance level have been provided. The noise and vibration significance criteria are presented in **Table 13.2**.

Table 13.2: Noise and Vibration Significance Criteria

Significance Level	Noise and Vibration Adverse Effect Level	Impact and Action (to be applied to potential effects)
Major	SOAEL	Noise causes a material change in behaviour and/or attitude. This level should be avoided.
Moderate		Noise can be heard and causes small changes in behaviour or attitude. Noise should be mitigated and reduced to a minimum.
Minor	LOAEL	Noise can be heard but does not cause a change in behaviour or attitude. No specific mitigation measures are required.
Negligible	NOEL	Noise has no effect. No specific measures required.

13.3.13 A beneficial effect may be considered to occur where noise levels fall below the NOEL, where specified (i.e. for the operational road traffic noise assessment where there is no change or a decrease in noise levels). Beneficial effects are identified using the same significance criteria, although related to a reduction in noise and vibration levels when compared to the baseline.

Assessing Significance

13.3.14 This section describes the methodology that has been used to determine the LOAEL's and SOAEL's for each noise and vibration source under consideration.

Construction Noise and Vibration

13.3.15 British Standard 5228:2009+A1 'Code of Practice for Noise and Vibration Control on Construction and Open Sites' does not provide specific limits for construction noise but does define methods of assessing the significance. The standard also provides practical information on demolition and construction noise and vibration reduction measures promoting a 'Best Practice Means' approach to control noise and vibration. A method for determining the sound levels associated with construction activities is also detailed and considers the numbers and types of equipment operating, their associated Sound Power Level (L_w), and the distance to receptors, along with the effects of any screening.

13.3.16 Based on the guidance detailed in the proposed LOAELs and SOAELs for noise and vibration are given in **Tables 13.3** and **13.4**.

13.3.17 Normal construction hours are assumed to be Monday to Friday between 08:00 to 18:00 and Saturday 08:00 to 13:00. For any construction noise and vibration outside of these times, agreement with the local Environmental Health Officer will need to be obtained.

LOAELs and SOAELs for Construction Noise

13.3.18 With respect to the LOAEL, the noise levels proposed correspond to the 'lower cut offs' identified in Part 15 of the BS 5228-1.

13.3.19 With respect to the SOAEL, the noise levels proposed in the table correspond to the levels identified in BS 5228-1, that if exceeded for 'Significant' periods of time (either continuous or sporadic) could result in **'Widespread community disturbance, or interference with activities or sleep is likely to occur'**.

Table 13.3: Construction Noise Effect Levels for Permanent Residential Buildings

Day	Time (hours)	Averaging Period, T	LOAEL $L_{pAeq,\ T}$ (dB)*	SOAEL $L_{pAeq,\ T}$ (dB)*
Monday to Friday	08:00 – 18:00	10 hours	65	75
Saturdays	08:00 – 13:00	5 hours	65	75

*The measured levels should be monitored in order to ensure that the levels in the table are not exceeded for a period of 10 or more days of working in any 15 consecutive days for a total number of days exceeding 40 in any six consecutive months.

LOAELs and SOAELs for Construction Vibration

13.3.20 With respect to the LOAEL, the vibration level proposed corresponds to a level defined by BS 5228-1 as likely to cause complaint in residential environments, but can be tolerated if prior warning and explanation is given to residents.

13.3.21 With respect to the SOAEL, the vibration level proposed corresponds to a level defined by BS 5228-1 as likely to be intolerable for more than a brief exposure.

Table 13.4: Construction Vibration Effect Levels for Permanent Residential Buildings

Day	Time (hours)	LOAEL PPV mm/s	SOAEL PPV mm/s
Monday to Friday	08:00 – 18:00	1	10
Saturdays	08:00 – 13:00	1	10

Construction Traffic Noise

13.3.22 Construction traffic noise has been assessed by considering the short-term increase in traffic flows during construction works following the principles of CRTN and the Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 7.

13.3.23 The criteria for the assessment of the magnitude of impact due to road traffic noise changes arising from construction works have been taken from Table 3.1 of DMRB and are provided here in **Table 13.5.**

Table 13.5: Change in Noise Levels Due to Construction Traffic Road Noise

Adverse Effect Level	Change in Noise Levels in Short-term due to Construction Traffic (dB)
SOAEL	3.0
LOAEL	1.0
NOEL	0

Operation Stage – LOAELs for Transportation Airborne Noise Affecting Outdoor Amenity Areas

13.3.24 With respect to the daytime noise level, the information used to support the WHO guidelines for Community Noise note that daytime sound levels of less than 50 dB $L_{Aeq, Day}$, cause little or no serious annoyance in the community with an upper limit of 55 dB.

13.3.25 Based on the above, outdoor sound levels of 50-55 dB $L_{Aeq, Day}$ are considered the LOAELs for operational airborne noise.

Operation Stage – SOAELs for Transportation Airborne Noise Affecting Outdoor Amenity Areas

13.3.26 Sound levels of 65 dB $L_{Aeq, Day}$ are considered to be the SOAELs for operational airborne noise from increase in road traffic.

13.3.27 The daytime SOAEL is consistent with the daytime trigger level in the UK's Noise Insulation Regulation.

Operation Stage – LOAEL and SOAEL for Transportation Airborne Noise Affecting Indoor Residential Levels

13.3.28 Incident façade levels should not be considered in isolation of the sound reduction provided by the external building fabric. The guidance within Planning Policy Guidance states that:

> **"Consideration should also be given whether adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time. In both case a suitable alternative means of ventilation is likely to be necessary. Further information on ventilation can be found in the Building Regulations."**

13.3.29 Based on advice within BS 8233:2014, an indoor noise level of 35 dB $L_{Aeq, 16\ hr}$ during the daytime and 30 dB $L_{Aeq, 8\ hr}$ during the night-time may be considered as the LOAEL for transportation noise.

13.3.30 Similarly, we consider an indoor noise level of 50 dB $L_{Aeq, 16\ hr}$ and 45 dB $L_{Aeq, 8\ hr}$ during the night-time may be considered as the SOAEL for transportation noise.

13.3.31 The WHO Guidelines for Community Noise also identify an external noise level of 60 dB L_{AFmax} as the guideline value for sleep disturbance with the windows open. For this reason, an internal noise level of 45 dB L_{AFmax} (allowing for a 15 dB in external sound levels provided by an open window) is considered the LOAEL for maximum noise levels.

13.3.32 The WHO Night Noise Guidelines for Europe note that adverse effects on sleep can be avoided if the maximum noise level inside the bedroom does not exceed 45 dB L_{AFmax} for more than 10 – 15 times per night. **Table 13.6** summarises LOAEL and SOAEL inside the different areas of permanent residential buildings.

Table 13.6: Internal and External Noise Criteria for Habitable Rooms Due to Transportation Noise

Level	**Proposed LOAEL and SOAEL Levels for Transportation Noise Affecting New Residential Premises**	
	Daytime (07:00 – 23:00 hours)	**Night-time (23:00 – 07:00 hours)**
Internal Noise Levels		
LOAEL	35 dB $L_{Aeq, 16\ hr}$	30 dB $L_{Aeq, 8\ hr}$
		45 dB L_{Amax}
SOAEL	50 dB $L_{Aeq, 16\ hr}$	45 dB $L_{Aeq, 8\ hr}$
External Amenity Areas (Free Field Levels)		
LOAEL	50-55 dB $L_{Aeq, 16\ hr}$	N/A
SOAEL	65 dB $L_{Aeq, 16\ hr}$	N/A

Operation Stage – Road Traffic Noise

13.3.33 The impact of the Application Site for both the allocation and application scenarios on the noise climate of the surrounding area is based on the change in noise levels at noise sensitive receptors due to a change in the volumes of road traffic generated by the Development.

13.3.34 The DMRB suggest that an increase in traffic flow of 25 % will result in an increase in noise level of 1 dB, assuming other factors (such as vehicle speed and mix) remain the same, a change of 3 dB is the minimum perceptible under normal conditions and is accepted as the threshold of human perception of a change in noise levels in the long term. Additionally, an increase or decrease of 10 dB is considered to be a doubling or halving of loudness, respectively.

13.3.35 The DMRB provides two magnitude scales of impact for the change in noise levels in the short-term and in the long-term. These are summarised in **Table 13.7** below.

Table 13.7: Change in Noise Levels Due to Operational Road Traffic Noise

Adverse Effect Level	**Change in $L_{A10, 18\ hr}$ Noise Levels in Long-term due to Road Traffic**	**Significance Level**
SOAEL	10+	Major
	5 to 9.9	Moderate
LOAEL	3 to 4.9	Minor
	0.1 to 2.9	Negligible
NOEL	0	No Change

13.3.36 A change in noise level in the short-term is assessed by comparing the completion year 'with development' and completion year 'without development' scenarios. A change in noise level in the long-term is assessed by comparing the future assessment year 'with development' and the opening year 'without development' scenarios.

13.3.37 The road traffic assessment will be in accordance with the supplied traffic flow information.

Operation Stage – Road Traffic Vibration

13.3.38 The DMRB provides broad advice on the assessment of road traffic vibration, noting that ground-borne vibration resulting from road traffic is difficult to accurately predict and that it is extremely unlikely to cause damage to buildings. Notwithstanding this, the DMRB does recognise that ground-borne vibration can cause disturbance to residents where the sub-grade is soft, the road surface is uneven and/or when dwellings are within a few metres of the carriageway.

13.3.39 The DMRB provides guidance on ambient levels of vibration as Peak Particle Velocities (PPV), stating that for traffic vibration a PPV of 0.3 mm/s measured on a floor in the vertical direction is on the threshold of perceptibility. As such, the threshold criterion for traffic induced vibration is a PPV rise to above a level of 0.3 mm/s or where an existing PPV above 0.3 mm/s is predicted to increase. PPVs in the structure of buildings close to heavily trafficked roads rarely exceed 2 mm/s and are typically below 1 mm/s. DMRB states that it is unlikely that structural damage to buildings will occur below 10 mm/s.

13.3.40 DMRB recommends that the effects of vibration should be considered where appropriate. In the case of ground-borne vibration, the likelihood of perceptible vibration being caused is particularly dependent upon the smoothness of the road surface. Research has shown that vibration levels caused by heavy vehicles travelling at 110 km/h over a 25mm hump (i.e. a large discontinuity consistent with a poorly backfilled trench) could cause perceptible vibration at up to 40 m from the road. This would infer that it is unlikely that significant levels of vibration would be generated at distances greater than this. Also, with a newly laid road surface it is a requirement of new highway construction specification that the surface would be smooth and free from any discontinuities of this magnitude. DMRB Vol.11, Section 3, Part 7 HA 213/11 Annex 5, paragraph A5.26 states such vibrations are unlikely to be important when considering disturbance from new roads and an assessment would only be necessary in exceptional circumstance.

13.3.41 The DMRB covers the potential for airborne noise, from heavy goods vehicles, to cause vibration nuisance close to main roads, as an indication of the scale of impact relative to noise effects, the guidance in DMRB paragraph HA 213/11, Annex 6, paragraph A6.21, states that for a given level of noise exposure the percentage of people bothered very much or quite a lot by vibration is 10 % lower than the corresponding figure for noise nuisance. On average traffic vibration is expected to affect a very small percentage of people at exposure levels below 58 dB $L_{A10,\ 18\ h}$. Also, the significance of any change in airborne traffic vibration can be considered proportional to the significance of change in traffic noise. As such the assessment of airborne can be considered to be included within the assessment of airborne noise.

13.3.42 On the basis of the above, our proposed LOAEL and SOAEL values are suggested in **Table 13.8** below for operational road traffic vibration.

Table 13.8: Proposed LOAEL and SOAEL due to Operational Road Traffic Vibration

Lowest Observed Adverse Effect Level PPV mm/s	Significant Observed Adverse Effect Level PPV mm/s
0.3	3

Operation Stage – Existing Industrial and Commercial Sources

13.3.43 British Standard 4142 describes methods for rating and assessing sound of an industrial and/or commercial nature. The methods described in the standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

13.3.44 The standard is used to determine the rating levels for sources of sound of an industrial and/or commercial nature and the ambient, background and residual sound levels at outdoor locations. These levels could be used for the purposes of investigating complaints; assessing sound from proposed, new, modified or additional source(s) of sound of an industrial and/or commercial nature; and assessing sound at proposed new dwellings or premises used for residential purposes. However, the determination of noise amounting to a nuisance is beyond the scope of the standard.

13.3.45 The standard should not be used to assess sound from the passage of vehicles on public roads and railway systems; recreational activities; music and other entertainment; shooting grounds; construction and demolition; domestic animals; people; public address systems for speech and other sources falling within the scopes of other standard or guidance. The standard cannot be applied to the derivation of indoor sound levels from sound levels outside, or the assessment of indoor sound levels.

13.3.46 The procedure contained within BS 4142 assess the significance of sound which depends upon the margin by which the rating level of the specific sound sources exceeds the background sound level and the context in which the sound occurs/will occur.

13.3.47 British Standard BS 4142 establishes a rating penalty for sound based on a subjective assessment of its characteristics. This is appropriate where new sources are unable to be measured as they are in their proposal stages but the characteristics of similar sources can be subjectively assessed.

13.3.48 In terms of corrections, BS 4142 states:

> **"Tonality**
>
> **For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and + 6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.**
>
> **Impulsivity**
>
> **A correction of up to + 9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is**

just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible.

Other Sound Characteristics

Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

Intermittency

When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. This can necessitate measuring the specific sound over a number of shorter sampling periods that are in combination less than the reference time interval in total, and then calculating the specific sound level for the reference time interval allowing for time when the specific sound is not present. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied."

13.3.49 An initial estimate of the impact of the specific sound is obtained by subtracting the measured background sound level from the rating level and considering the following:

- Typically, the greater this difference, the greater the magnitude of the impact.
- A difference of around + 10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around + 5 dB is likely to be an indication of an adverse impact, depending on the context.

13.3.50 The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact, 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.

Operation Stage – Plant Noise Emissions

13.3.51 An assessment of the proposed plant will not be undertaken; however, it would be designed so as to meet the requirements of the local authority.

13.3.52 Proposed LOAEL and SOAEL values are suggested in **Table 13.9** below for plant noise emission criteria.

Table 13.9: Proposed LOAEL and SOAEL due to Building Services and Fixed Plant Emissions

Lowest Observed Adverse Effect Level	Significant Observed Adverse Effect Level
Plant noise emissions do not exceed the typical background noise level	A difference of around + 10 dB above the typical background noise level

Scoping Criteria

13.3.53 The purpose of this assessment is to present the likely impact of the Application Site on the local sound and vibration climate during the construction and operational stages.

Study Area

13.3.54 The Study Area for the construction stage is defined by the noise and vibration sensitive receptors that have the potential to be affected by sound and vibration caused by construction activities.

13.3.55 For the operational stage of the development the Study Area also includes the noise sensitive receptors in the local area that are most likely to be affected by the change in noise levels caused by the operation of the Application Site for both the allocation and application scenarios.

Noise and Vibration Sensitive Receptors

13.3.56 In this context receptors are defined as those aspects of the environment sensitive to changes in the baseline sound and vibration climate. The sensitivity of a particular receptor depends upon the extent to which it is susceptible to such changes.

13.3.57 Due to the size of the development and the surrounding area a selection of noise and vibration sensitive receptors have been identified. **Table 13.10** provides details of noise and vibration sensitive receptors identified. **Figure 13.1** details the approximate locations of the identified receptors along with a reference letter as defined in **Table 13.10** below.

Table 13.10: Noise Sensitive Receptors

Reference	Receptor
A	Dwellings and Existing School along Camp Road
B	Dwellings along Somerton Road
C	Dwellings along Station Road, Lower Heyford
D	Dwellings in Somerton
E	Dwellings along Lower Heyford Road
F	Dwellings in Middleton Stoney
G	Dwellings along Somerton Road (North of Airfield)
H	Dwellings in Ardley

13.3.58 For clarity, individual receptors have been grouped where appropriate; however, in all cases where there are a number of grouped receptors, impacts at the worst case receptor within the group have been considered.

13.3.59 There are receptors further from the Application Site that may experience changes in noise and vibration levels due to changes in road traffic levels. Due to the potential number of receptors they have not been specifically identified but have been considered as part of the wider assessment of the impact of the change in road traffic levels.

13.3.60 Accordingly, the acoustic and vibration assessment considers the following potential effects:

- Demolition and Construction Phase Noise – impact on existing receptors;
- Demolition and Construction Phase Vibration – impact on existing receptors; and
- Operational Phase Noise – impact on existing and proposed receptors.

Limitations to the Assessment

13.3.61 Due to the size of the development and the surrounding area, a limited selection of noise sensitive receptors has been identified to represent the worst case change to the environmental noise climate.

13.3.62 Due to the outline nature of the application, the assessments undertaken are appropriate in the context of available information at the time.

13.3.63 Precise details of the types of construction methods and plant likely to be used during the construction phases have yet to be formulated. Therefore, at this stage in the scheme's design, it is not possible to state precisely where plant will operate and for how long during the working day.

13.3.64 It is assumed that outdoor incident noise levels in external areas used for amenity (i.e. gardens/balconies) are only of concern during the daytime hours, as people are unlikely to make frequent use of the outdoor amenity areas during night-time hours.

13.4 BASELINE CONDITIONS

The Current Baseline

Environmental Sound Survey

13.4.1 An environmental sound survey was undertaken between approximately 10:15 hours on 14th June 2017 and 12:30 hours on 15th June 2017 at eight locations across the Application Site. The environmental sound survey methodology was agreed by the local Environmental Health Officer.

13.4.2 Due to the nature of the unmanned survey, it is not possible to accurately comment on the weather conditions throughout the entire survey period. However, at the beginning and end of the survey period the wind conditions were moderate and the sky was generally clear. It is understood that generally throughout the survey periods the weather conditions were mainly clear with some cloud coverage[1]. These conditions are considered suitable for obtaining representative environmental noise levels.

13.4.3 Measurements of the A-weighted (dBA) L_{10}, L_{90}, L_{eq}, and L_{max} sound pressure levels were taken continuously at 15-minute intervals over a 24-hour period between 14th June 2017 and 15th June 2017.

1 https://www.wunderground.com/history/airport/EGUB/2017/6/14/DailyHistory.html?req_city=&req_state=&req_statename=&reqdb.zip=&reqdb.magic=&reqdb.wmo=

13.4.4 Unattended continuous environmental sound measurements were undertaken at six locations. **Table 13.11** describes the survey locations and **Figure 13.2** presents the approximate locations of the sound survey positions.

Table 13.11: Sound Measurement Locations

Measurement Location	Description	Dominant Noise Source
LT 1	The microphone was located in the north-west corner of the south west land parcel adjacent to Kirtlington Road. The microphone was located in a free field position approximately 8 m from the carriageway edge and 1.5 m from ground level.	Road Traffic Noise from Kirtlington Road
LT 2	The microphone was located to the west of the Application Site along Camp Road. The microphone was located in a free field position approximately 3 m from the carriageway edge and 1.5 m from ground level.	Road Traffic Noise from Camp Road
LT 3	The microphone was located to the east of the Application Site along Camp Road. The microphone was located in a free field position approximately 1.5 m from the carriageway edge and 1.5 m from ground level.	Road Traffic Noise from Camp Road
LT 4	The microphone was located to the centre of the Application Site along Hampton Square. The microphone was located in a free field position approximately 0.5 m from the carriageway edge and 1.5 m from ground level.	No Dominant Source
LT 5	The microphone was located to the north of the Application Site adjacent to the existing car storage area. The microphone was located in a free field position approximately 1 m from the storage area and 1.5 m from ground level.	No Dominant Source
LT 6	The microphone was located to the south east of the Application Site adjacent to the existing substation area. The microphone was located in a free field position approximately 9 m from the substation and 1.5 m from ground level.	Noise associated to the existing substation

13.4.5 Locations LT 1, LT 2, and LT 3, were selected in order to establish the typical incident road traffic noise levels in relation to the Application Site at locations considered representative of the likely proposed residential dwellings. The positions for the other long term unattended measurements were selected in order to establish the incident noise levels considered representative of the existing substation, and to also determine background noise levels across the Application Site to set noise limits for plant associated with the non-residential uses.

13.4.6 A large range of statistical noise parameters was acquired, but the A-weighted sound parameters $L_{Aeq,\,T}$, $L_{A90,\,T}$, $L_{A10,\,T}$, and L_{AFmax} are considered to be the most relevant in the context of planning and noise (these parameters are described in **Appendix 13.3**)

13.4.7 The instrumentation used to measure the environmental sound climate is presented in **Appendix 13.4**.

13.4.8 On-site calibration checks were performed before and after all measurements with no significant deviation being observed. The sound level meters and calibrators have valid laboratory calibration certificates, which are available upon request.

13.4.9 Manufacturer's windshields were fitted over the microphone at all times during the survey periods.

13.4.10 The noise survey was completed in general accordance with the guidance in BS 7445: 'Description and Measurement of Environmental Noise. Guide to Quantities and Procedures'.

Unattended Environmental Noise Survey Results

13.4.11 Results of the environmental noise survey are presented in **Appendix 13.5**. The results have also been plotted on Time History Graphs enclosed in **Appendix 13.6**. These present the 15-minute A-weighted (dBA) L_{10}, L_{90}, L_{eq}, and L_{max}, levels at the measurement positions throughout the duration of the survey. A summary of these results is presented in **Table 13.12** below.

Table 13.12: Summary of Sound Survey Results

Location	Period, T	$L_{Aeq, T}$ (dBA)	Typical $L_{Amax, T}$ (dBA)	Typical $L_{A90, T}$* (dBA)
LT 1	Daytime (07:00 – 23:00)	54	N/A	34
	Night-time (23:00 – 07:00)	48	70	20
LT 2	Daytime (07:00 – 23:00)	65	N/A	35
	Night-time (23:00 – 07:00)	57	80	22
LT 3	Daytime (07:00 – 23:00)	65	N/A	41
	Night-time (23:00 – 07:00)	57	80	22
LT 4	Daytime (07:00 – 23:00)	51	N/A	38
	Night-time (23:00 – 07:00)	44	63	22
LT 5	Daytime (07:00 – 23:00)	49	N/A	34
	Night-time (23:00 – 07:00)	42	61	26
LT 6	Daytime (07:00 – 23:00)	53	N/A	43
	Night-time (23:00 – 07:00)	47	64	43

*Based on an average of the 10th highest measured L_{Amax} level

13.5 ASSESSMENT OF LIKELY SIGNIFICANT EFFECTS

13.5.1 This section identifies the potential effects of the Application Site for both the allocation and application scenarios, factoring in mitigation by design, but in the absence of further mitigation. The effects are identified separately for the construction and post-completion stages.

13.5.2 Following this initial assessment, appropriate mitigation measures are set out to address any significant adverse effects identified.

13.5.3 Once all mitigation measures have been considered, the residual effects are then assessed and detailed.

Construction

Demolition and Construction Noise

13.5.4 Demolition and construction noise has the potential to cause an adverse impact at existing noise sensitive receptors.

13.5.5 Precise details of the types of construction methods and plant likely to be used during the construction phases have yet to be formulated. Therefore, at this stage in the scheme's design, it is not possible to state precisely where plant will operate and for how long during the working day.

13.5.6 In accordance with guidance set out in BS 5228, noise levels have been calculated for a maximum worst case situation over 1-hour assuming that plant will operate at its closest point to each receptor in the absence of mitigation. In practice, noise levels would tend to be lower due to greater separation distances and screening effects, and they would also tend to reduce over a 10 – 12 hour working day due to periods of plant inactivity.

13.5.7 The main demolition phases are likely to include breakers, crushers and site clearance. Any internal stripping out prior to demolition is unlikely to be a significant source of noise or vibration for local receptors.

13.5.8 The main construction phases are likely to include site levelling/clearance, ground excavation/waterway creation, concreting, building construction and road construction. The building construction phase, and the servicing and fitting out of new buildings, is normally not a significant source of noise or vibration for local receptors.

13.5.9 Details of typical demolition and construction plant noise levels at the standard reference distance of 10 m provided by BS 5228 Part 1 (BSI, 2014b), in the absence of noise controls such as screening and operational constraints, are given below in **Table 13.13**. Highest noise levels tend to be associated with plant that will be employed during demolition, earthmoving and concreting.

Table 13.13: Typical Demolition and Construction Plant Noise Levels

Plant	Typical $L_{Aeq,T}$ at 10 m (dB)
Crusher	84
Breaker	92
Earth Moving	84
Supply Vehicles	80
Auger Piling	85
Truck Concrete Mixer	80
Poker Vibrators	84
Crane	74
Vibratory Roller	76
Asphalt Spreader	80
Wheeled Loader	76

Plant	Typical $L_{Aeq, T}$ at 10 m (dB)
Compressors	74
Welding Generators	42

13.5.10 Prior to there being specific details on the phasing and siting of construction activities, this information has been used to derive indicative noise levels at selected distance bands from the Application Site boundary using the data and procedures of BS 5228, and the results are presented in **Table 13.14**.

Table 13.14: Predicted Indicative Demolition and Construction Noise Levels $L_{Aeq, 1 hr}$

Activity	$L_{Aeq, 1 hr}$ Noise Levels (dB) at Various Distances from Demolition/Construction Site (Phase) Boundary						
	10 m	15 m	20 m	30 m	40 m	50 m	100 m
Demolition	93	89	87	83	81	78	73
Earth Moving	85	81	79	75	73	71	65
Concreting	86	82	80	76	74	72	66
Road Pavement	80	76	74	70	68	66	60

13.5.11 Any plant operating along a construction site boundary would have the ability to generate noise levels above the suggested daytime SOAEL of 75 dB $L_{Aeq, 10 hr}$ up to distances of approximately 30 m from the construction site/phase boundary. Therefore, construction plant operating on any particular site will have the potential to affect noise-sensitive dwellings located immediately adjacent to the Application Site boundary, such as noise sensitive receptors located at Position A on Figure 13.1. However, in practice, the main construction activities such as ground excavation works and new build construction will tend to take place slightly further into the Application Site, or only affect a limited number of dwellings for a temporary period at any given time during each construction phase. Plant will only have to progress a relatively short distance away from each existing receptor before noise levels fall below the typical construction noise criterion.

13.5.12 In these assumed worst case circumstances, without mitigation, the effect of construction is likely to be a temporary moderate adverse impact which is not deemed to be significant.

Demolition and Construction Traffic Noise

13.5.13 Construction traffic noise can be assessed by considering the short-term increase in traffic flows during the construction works following the principles of CRTN and the DMRB, Volume 11, Section 3, Part 7.

13.5.14 Construction traffic flows have been predicted based on construction occurring over an 11 year period (2018 – 2028). The flows are then averaged over this build out period. Based on the flows provided it is unlikely that there will be an increase in road traffic flows due to construction traffic of any more than 25 %. In view of the guidance

set out in DMRB this increase in road traffic flow would result in a negligible increase in noise levels of < 1dB during the construction period due to construction traffic.

Demolition and Construction Vibration

13.5.15 British Standard 5228 indicates that construction activities (particularly piling) generate vibration impacts when they are located less than 20 m from noise sensitive locations. The impact depends on the type of piling, ground conditions, and receptor distance.

13.5.16 Based on calculations procedures presented in BS 5228, a vibration sensitive receptor which is located within 20 m of piling activity could be subject to significant impact.

13.5.17 In comparison to the BS 7385 vibration thresholds for cosmetic damage to structures, example vibration levels from piling are below the BS 7385 thresholds for cosmetic damage to structures (i.e. surrounding residential structures). As such, it is considered unlikely that cosmetic damage to the adjacent sensitive structures will occur.

13.5.18 It is worth noting that the above assessment of potential construction vibration effects is based upon a theoretical worst case assessment that driven piles will be required within 20 m of existing nearby sensitive receptors.

Operation

External Noise Levels – Proposed Dwellings – Allocation Test Scenario

13.5.19 It is assumed that outdoor incident noise levels in external areas used for amenity (i.e. gardens/balconies) are only of concern during the daytime hours, as people are unlikely to make frequent use of the outdoor amenity areas during night-time hours.

13.5.20 **Figure 13.3** presents the daytime $L_{Aeq,\ 16\ hr}$ noise level contours across the Application Site at a height of 1.5 m for the 2031 With Development “Allocation Test” scenario. The 2031 With Development “Allocation Test” scenario is considered to be the worst-case scenario due to having marginally higher flows across the network.

13.5.21 The results show that the majority of the Application Site is likely to meet the LOAEL criteria for external amenity areas.

13.5.22 However, for areas of residential development proposed directly adjacent Camp Road, the suggested daytime LOAELs are likely to be exceeded.

13.5.23 The impact is deemed to be negligible, except areas adjacent to Camp Road where there is a minor adverse impact.

External Noise Levels – Proposed Dwellings – Application Test Scenario

13.5.24 **Figure 13.5** presents the daytime $L_{Aeq,\ 16\ hr}$ noise level contours across the Application Site at a height of 1.5 m for the 2031 With Development “Application Test” Scenario. The results are similar to the levels presented for the “ Allocation Test” scenario.

Internal Noise Levels – Proposed Dwellings – Allocation Test Scenario

13.5.25 The calculated incident sound levels provided in **Figures 13.3** and **13.4** have been used to determine the likely internal sound levels in the worst case proposed dwellings, across the Application Site.

13.5.26 Exact construction proposals are yet to be determined, however a preliminary assessment has been undertaken based on typical construction details (brick/block cavity wall/timber frame constructions with conventional double glazed windows, trickle ventilators and tiled roofs).

13.5.27 **Table 13.15** details the approximate reductions that could typically be expected from the assumed building fabric constructions.

Table 13.15: Typical Sound Reductions of Various Building Fabric Constructions

Construction	Typical Attenuation (dB)
Conventional Double Glazing (4/16/4)*	30
Conventional Trickle Ventilator	30
Brick/Block Cavity Wall	50
Timber Frame with Lightweight Cladding	43
Tiles on Timber Joists with Plasterboard Ceilings and Thermal Insulation	40-45

*4mm Glass / 16 mm Air Gap / 4 mm Glass

13.5.28 Based on the results of the noise survey and acoustic modelling and the assumed building fabric constructions, the suggested desirable internal noise levels are likely to be met during both the daytime and night-time periods for the majority of the Application Site. Properties in Parcel 10 and 13 fronting onto Camp Road are unlikely to meet internal noise criteria without further mitigation.

The impact is deemed to be negligible, except areas adjacent to Camp Road where there is a minor adverse impact**.**

Internal Noise Levels – Proposed Dwellings – Application Test Scenario

13.5.29 The calculated incident sound levels provided in **Figures 13.5** and **13.6** have been used to determine the likely internal sound levels in the worst case proposed dwellings, across the Application Site. The results and conclusions are similar to those presented for the “Allocation Test” scenario.

Road Traffic Noise Assessment – Allocation Test Scenario

13.5.30 The assessments of road traffic noise implement the noise prediction procedures as detailed in CRTN. The assessment uses criteria to compare changes between the existing traffic noise levels and the potential future traffic noise levels at nearby noise sensitive receptors.

13.5.31 The noise assessment considers the 18-hour AAWT information provided by the project transport consultant, PBA, as presented in **Appendix 13.1**, and will compare the future baseline traffic flows against the predicted future traffic flows associated with the Application Site.

13.5.32 **Figure 13.9** presents the change in the $L_{10,\ 18\ hr}$ noise levels due to road traffic. The comparison is made between the 2031 Without Development and the 2031 With

Development "Allocation Test" scenario. Both scenarios include committed developments within.

13.5.33 With the Development in place the impact on all of the existing dwellings within the local area around the Application Site remain below the proposed LOAEL criteria and are deemed negligible.

Road Traffic Noise Assessment – Application Test Scenario

13.5.34 **Figure 13.10** presents the change in the $L_{10,\ 18\ hr}$ noise levels due to road traffic. The comparison is made between the 2031 Without Development and the 2031 With Development "Application Test" scenario. Both scenarios include committed developments within.

13.5.35 The results are similar to the levels presented for the " Allocation Test" scenario and are deemed negligible.

Plant Noise Emission

13.5.36 Based on the results of the survey and the requirements set out by the Local Authority, it is proposed that the future plant noise emission limits presented in **Table 13.16** are to be achieved (with all relevant plant operating simultaneously) at 1 metre from the nearest noise sensitive receptors. The limits are set for external fixed plant associated with non-residential uses of the scheme. Due to the scale of the Application Site the plant noise emission criteria have been identified at different receptors related to the environmental sound survey positions.

Table 13.16: Proposed Plant Noise Emission Limits

Receptor	**Cumulative Plant Noise Emission Limits**	
	Daytime (07:00 – 23:00)	**Night-time 23:00-07:00)**
Parcel 16	35	30
Parcel 10	35	30
Parcel 13 and existing dwellings adjacent to Camp Road	41	30
Parcels 11, 12, 19, 21 and existing dwellings in the vicinity of LT4	38	30
Parcel 23	35	30
Parcel 17	35	30

13.5.37 Due to background noise levels being low, reasonable background limits have been set for locations across the Application Site.

13.5.38 It should be noted that the above proposed plant noise emission targets are subject to final approval by the environmental health department of Cherwell District Council.

Proposed Retail/Mixed Use/Medical Centre (Class A1/ /D1) Parcels 20 and 21

13.5.39 The Application Site includes a number of non-residential uses all of which can be seen on Figure 4.1: Composite Parameter Plan within this ES. Some of these uses could generate noise such as through building services plant and impact on residential

uses. Therefore, as details on these uses come forward at the detailed design stage an assessment of building services would be undertaken to minimise the impact from external plant. Without mitigation, the impact could be moderate adverse. Noise generated by the proposed retail units that could potentially include shops (i.e. use classes A1) will adhere to the standards and requirements routinely imposed by Cherwell District Council by way of suitable planning conditions.

Proposed School (Class D1) Parcels 31 and 32

13.5.40 School sites are assessed at the detailed design stage when building and playground/outdoor teaching areas are known. The assessment is based on the guidance provided in Building Bulletin 93 (BB 93). It should be noted that BB 93 is part of the Building Regulations (Approved Document E, Requirement E4).

13.5.41 Advice in relation to the potential noise impact from outdoor play areas and sport pitches is provided in the document Guidance from Planning and Design for Outdoor Sport and Play, Fields in Trust, 2008. It states that:

> **"In order to keep disruption of neighbours to a minimum, outdoor sports facilities (like multi use game areas) should be located at a minimum distance of 30 metres away from nearby dwellings."**

Proposed Close Care Facilities (C2/C3) Parcel 19

13.5.42 The proposed close care facility is a noise sensitive receptor. Noise impacts relating to road traffic are likely to be mitigated by use of the assumed building fabric as detailed in Table 13.15 to allow the internal criteria to be met.

13.5.43 Noise impacts associated with the adjacent car processing area would be reduced to accord with assessments undertaken at the detailed design stage in line with methodology outlined in BS 4142:2014. Noise limits have been suggested in Table 13.16 which are likely to minimise the noise impact at Parcel 19.

Creative City/Commercial Parcel 22

13.5.44 Noise impacts associated with employment area in Parcel 22 could potentially impact on residential land uses in Parcel23. Therefore, it is recommended that any service yards where HGVs are likely to manoeuvre and unload are designed/located such that they do not front onto the residential areas and are screened by the industrial buildings as far as practical. Furthermore, noise emission levels set in Table 13.16 are likely to reduce the noise impact from building services plant associated with this employment area.The layout could also be structured to avoid trucks having to reverse as far as practical to avoid use of reversing alarms

Proposed Core Visitor Destination Area (D1/D2 and A3)

13.5.45 The core visitor destination area may include uses that are generally associated to a greater degree with noise nuisance to nearby noise sensitive receptors. The nearest receptors are located in Parcels 31 and 12.

13.5.46 Noise generated by the proposed uses including, restaurants and cafés (i.e. use classes A3,) would adhere to the standards and requirements routinely imposed by CDC by way of suitable planning conditions. Noise breakout from cafés and restaurants would be controlled by means of a building envelope which would provide adequate sound insulation for most operations. Tenants would be responsible for controlling noise by limiting their activities and/or providing additional attenuation, where required.

13.5.47 The above advice is also applicable to class D uses which are associated with noise generation.

Remaining Build out of the Consented Development at Heyford Park (08/00716/OUT and 10/01642/OUT)

13.5.48 Planning permission has been granted for the development of 562 residential dwellings and 8,841 m^2 of employment within Heyford Park. Traffic flows from this development have been included within our acoustic assessment and as such are unlikely to have a significant impact.

Heyford Park Application for 60 Residential Dwellings (13/01811/OUT / 16/00627/REM)

13.5.49 Planning permission has been granted for the development of 60 residential dwellings within Heyford Park. Traffic flows from this development have been included within our acoustic assessment and as such are unlikely to have a significant impact.

Heyford Park Application for 43 Residential Dwellings (16/00263/F)

13.5.50 Planning permission has been granted for the development of 43 residential dwellings within Heyford Park. Traffic flows from this development have been included within our acoustic assessment and as such are unlikely to have a significant impact.

North West Bicester, Including Anticipated Build out to 2031 of the following (Exemplar/Elmsbury 10/01780/Hybrid); Application 1 (14/01384/OUT); Application 2 (14/01641/OUT) and Himley Village (12/02121/OUT))

13.5.51 Planning permission has been granted for the development of 3,293 residential dwellings and 35,000 m^2 of employment in the Bicester Area. Traffic flows from this development have been included within our acoustic assessment and as such are unlikely to have a significant impact.

Kingsmere (06/00967/OUT)

13.5.52 Planning permission has been granted for the development of up to 1,585 residential dwellings with the addition of employment, community, retail, and new link road between A1 and Middleton Stoney Road/ Howes Lane Junction in the Bicester Area. Traffic flows from this development have been included within our acoustic assessment and as such are unlikely to have a significant impact.

Existing Substation – BS 4142 Assessment

Purpose of Assessment

13.5.53 An existing electricity substation (shown in Figure 13.2)is situated to the south of Camp Road, to the eastern end of Heyford Park. The substation is bound by existing residential properties to the west and east. The substation currently has an approximately 6 m high barrier situated on its northern and western boundaries. The barrier appears to be made of a composite material with an additional layer of insulation.

13.5.54 An assessment of the substation has been undertaken in general accordance with BS 4142:2014 to determine the likely noise impact on the proposed residential uses.

Noise Sensitive Receptors

13.5.55 The nearest proposed noise sensitive receptor (residential development in Parcel 17) is located approximately 18 m to the south of the existing substation.

Assessment Considerations

13.5.56 The assessment of the likely future noise impact associated with the substation is based on the following assumptions and considerations:

- The substation operates over 24-hours;
- Night-time operation has been assumed to represent a worst-case scenario;
- The nearest proposed noise sensitive receptor is located approximately 18 m south of the boundary of the substation;
- The existing 6 m high absorbent noise barrier is situated along the northern and western boundaries of the substation is retained. The assessment has been conducted with the assumption that this barrier will be extended along the southern and eastern boundaries, enclosing the substation;
- Whilst conducting the baseline survey, tonal noise levels from the substation were observed to be audible at the nearest proposed noise sensitive receptor location (parcel 17). However, by including the extension of the 6 m high absorbent noise barrier, the assessment has been adjusted to include this, meaning that tonal noise is likely to be just audible at the proposed receptors.

Measurements & Calculation Procedure

13.5.57 As it is not possible to undertake measurements with and without the substation in operation it is necessary to obtain the background noise levels through measurement at another representative location.

13.5.58 Background measurements are to be obtained in the absence of the specific source under consideration. Therefore, as the substation is on continuously, background measurements at LT 6 are not deemed to be representative. However, as LT 4 is located away from the substation and also subject to similar noise from Camp Road, background measurements from this location were used to inform the assessment. Measurements were taken continuously of the A-weighted (dBA) L_{10}, L_{90}, L_{eq}, and L_{max} sound pressure levels at 15-minute intervals over a 24-hour period between the 14th – 15th June 2017 with audio recordings obtained for the full measurement period.

13.5.59 In addition to determining background noise levels, source data has also been obtained by measuring in close vicinity to the substation at LT6. The microphone was located approximately 9 m from the substation and 1.5 m above ground level with a line of sight to the substation.

13.5.60 During the survey period, the temperature was warm (approx. 18 °C), with no wind, approximately 20 % cloud cover and no precipitation.

Preliminary Results of BS 4142 Assessment

13.5.61 **Table 13.17** presents the preliminary results of the BS 4142 assessment.

Table 13.17: Summary of BS 4142 Assessment - Substation

Description	Sound Level (dB) at Nearest Proposed Noise Sensitive Receptor (Parcel 17)
Specific Sound Level ($L_{Aeq, 15\ mins}$)	42
Residual Sound Level ($L_{Aeq, 15\ mns}$)	44
Propagation Corrections (including distance loss and screening)	-22
Acoustic Feature Corrections	+ 2
Combined Rating Level at Receptor ($L_{Aeq, 15\ mins}$)	22
Background Sound Level at Receptor ($L_{A90, 15\ mins}$) (LT 4)	22
Excess of Rating over Background Level	0
Initial Assessment of Impact	Indication of the specific sound source having a low impact, depending on the context.

Context and Mitigating Factors

13.5.62 It is important to recognise context in the assessment of the likely noise impact on the Application Site site arising from the operation of the substation.

13.5.63 The following factors should be taken into consideration:

- The absolute sound levels;
- The character and level of the residual and specific sound levels; and
- The sensitivity of the receptor and use of mitigation measures.

Absolute Sound Levels

13.5.64 The calculated specific sound level at the worst affected façade of the Application Site is relatively low, falling below the relevant World Health Organisation, BS 8233 guidelines, and Local Authority criteria with respect to noise levels in external amenity areas.

Character and Level of Residual and Specific Sound Levels

13.5.65 It was observed during the site visits that whilst noise associated with the substation was audible, it was not considered to be intrusive. These observations are supported by the results of the initial assessment of impact. With reference to **Table 13.17** residual sound levels are generally higher than the calculated specific sound level at the proposed receptor (parcel 17) implying that the audibility of sound from the substation is primarily a function of the character of the sound rather than the absolute level.

Receptor Sensitivity

13.5.66 The proposed receptor in Parcel 17 is likely to incorporate design measures that should secure good internal and external acoustic conditions. The receptor will be screened from the substation by a 6 m high absorbent noise barrier which will reduce the audibility of tonal intrusion.

Uncertainty

13.5.67 Care has been taken to reduce uncertainty as far as reasonably possible. However, it should be recognised that in any environmental sound survey and assessment process uncertainty exists.

13.5.68 Uncertainty in measured background sound levels can occur due to variation in temporary/non-representative meteorological conditions affecting the survey result. In this instance steps were taken to minimise the risk of meteorological conditions affecting the measurement however it should be recognised that there is a degree of uncertainty inherent in the baseline environmental sound data.

Summary of BS 4142 Assessment

13.5.69 In considering the results of the initial numerical assessment and the context detailed above, levels are unlikely to exceed the LOAEL.

13.6 MITIGATION AND ENHANCEMENT

Additional Mitigation

Construction Stage

13.6.1 British Standard BS 5288: Parts 1 and 2 are to be adopted as the basic code of practice for the management of construction noise for the Application Site.

13.6.2 Construction Environmental Management Plans (CEMPs) will be prepared in advance of construction, as described in Chapter 2 of the ES, that set out measures to manage the construction works. The following advice is based upon guidance provided in BS 5228 and will be applied as appropriate through the CEMPs, which would be secured through a suitable planning condition, in order to minimise noise from the construction activities affecting noise sensitive receptors.

- Appropriate operational hours, likely to exclude work during the night-time and during Sundays and public holidays;
- Ensuring the use of quiet working methods, the most suitable plant and reasonable hours of working for noisy operations, where reasonably practicable;
- Locating noisy plant and equipment as far away from dwellings or sensitive receptors as reasonably possible and where practical, carry out loading and unloading in these areas;
- Screening plant to reduce noise which cannot be reduced by increasing the distance between the source and the receiver (i.e. by installing noisy plant and equipment behind large site buildings;
- Compressors should be fitted with properly lined and sealed acoustic enclosures where environmental noise disturbance may arise and these should be kept closed whenever the machines are in use;
- Orienting plant that is known to emit noise strongly in one direction so that the noise is directed away from dwellings or sensitive receptors, where possible;
- Closing acoustic covers to engines when they are in use or idling;

- Work to keep local residents informed of the proposed working schedule, where appropriate, including the times and duration of any abnormally noisy activity that may cause concern; and

- Lowering materials slowly, whenever practicable, and not dropping them.

13.6.3 Mitigation measures would be reviewed and a further quantitative assessment of construction noise mitigation would be undertaken when a principal contractor has been appointed for each phase of the development and detailed method statements and the detailed construction programme are available.

13.6.4 With appropriate mitigation measures in place, the effect is deemed to be negligible.

Operational Phase

Dwellings – External Amenity Areas

13.6.5 Noise levels have been predicted across the development during the daytime. It shows that the majority of the Application Site for both the allocation and application scenarios would experience noise levels of below 55 dB $L_{Aeq,16hrs}$. However, dwellings overlooking Camp Road are likely to exceed 55 dBA $L_{Aeq,16hour}$. Therefore, mitigation measures are likely to be required for external private amenity areas positioned in these locations.

13.6.6 A detailed assessment of Parcel 10 and 13 of the Application Site would be required to ascertain what mitigation measures would be suitable for residential development directly adjacent to Camp Road. Mitigation measures such as building orientation, acoustic barriers, and set back distances, may be implemented to reduce noise levels in amenity areas.

13.6.7 It is recommended that solid frontages are located adjacent to Camp Road with external private amenity areas situated to the rear. This is likely to result in noise levels approaching the LOAEL criteria at external private amenity areas.

13.6.8 With appropriate mitigation measures in place, the effect is deemed to be negligible.

Dwellings - Internal Noise Levels

13.6.9 Based on the initial assessment for both the allocation and application scenarios, properties fronting onto Camp Road at Parcel 10 and 13 are likely to require uprated acoustic glazing and ventilation.

13.6.10 A detailed assessment would be undertaken during detailed design in order to ascertain the exact acoustic specification requirements for the various elements of the external building fabric. The final design proposals during the detailed stage may differ from the suggested constructions identified in Table 13.15.

13.6.11 Typically, the acoustic performance of double glazing can be improved by increasing the air gap and/or the glass thickness with particular improvements achieved using differing glazing thicknesses for inner and outer panes. Ventilation can be upgraded by introducing acoustic trickle vents or mechanical ventilation systems.

Commercial/Mixed Use Area/Medical Centre (parcels 20 and 21) – Operational Plant Noise

13.6.12 At the detailed design stage an assessment of building services noise impact would be undertaken. Without appropriate mitigation the impact has the potential to exceed the SOAEL. However appropriate and proven mitigation measures are considered to be readily available to ensure that fixed plant noise emissions are suitably controlled. Typical mitigation measures may include conditions imposed by the local authority which require certain criteria to be met by the plant owner

13.6.13 The rating noise level of fixed plant and equipment noise would be controlled through careful design so that local specific target noise levels are achieved. This may require a further detailed noise assessment as more information becomes available on the likely commercial activities on the Application Site. If necessary, further background noise measurements would be undertaken at the detailed assessment stage.

13.6.14 Plant would be selected, located and attenuated so that the local authority's typical planning condition with regards to plant noise, is satisfied. It is likely that a combination of the following environmental noise control techniques would be implemented.

- Enclosing noisy plant within the building envelope;
- Selecting suitably quite 'low noise' plant;
- Positioning air intake/discharge louvres away from noise sensitive receptors;
- Orientating air intake/discharge louvres away from noise sensitive receptors;
- Attenuation of air intake/discharge louvres with duct mounted attenuators; and
- Sound insulating plant housings/enclosures.

13.6.15 With the incorporation of appropriate standard mitigation, it is likely to result in a negligible impact. Typical mitigation measures may include conditions imposed by the local authority which require certain criteria to be met by the plant owner.Existing Substation

13.6.16 The existing substation could impact on residential development in Parcel 17. Mitigation in the form of building orientation may be implemented. Having habitable rooms facing away from the noise source is likely to reduce the impact of noise from the substation.

13.6.17 An existing 6 m high absorbent barrier is in situ along the northern and western boundaries of the substation. This barrier offers shielding to the existing residential properties. The barrier would be extended along the southern and eastern boundaries, resulting in the enclosure of the substation.

13.6.18 In considering the results of the initial numerical assessment and the context detailed above, levels are unlikely to exceed the LOAEL. With appropriate mitigation measures in place it is considered the impact on the nearest proposed noise sensitive receptor is likely to be low and not significant.

13.6.19 A summary of how operational mitigation would be secured is provided below:

Table 13.18: Mitigation

Ref	Measure to avoid, reduce or manage any adverse effects and/or to deliver beneficial effects	How measure would be secured		
		By Design	By S.106	By Condition
1	Layout of External Private Amenity adjacent to Camp Road	X		
2	CEMP to minimise construction noise impacts			X
3	Building façade design to meet internal noise criteria			X
4	Erection of barrier south and east of Electric Substation	X		
5	Building orientation adjacent to Electric Substation	X		

13.7 CUMULATIVE AND IN-COMBINATION EFFECTS

13.7.1 The traffic flow data included within the 2031 acoustic models includes the cumulative sites as set out in Table 2.5 of Chapter 2 of this ES and has therefore already been included within the assessment.

13.8 SUMMARY

Introduction

13.8.1 This assessment addresses the likely significant environmental effects of the construction and operational phases of the Application Site on the noise and vibration climate at noise sensitive receptors around the Application Site for both the allocation and application scenarios.

13.8.2 The assessment also considers the likely significant environmental effects of the existing and future sound climate on the proposed use of the Application Site.

Baseline Conditions

13.8.3 An environmental sound survey was conducted on the 14th and 15th June 2017 to determine the existing noise climate. The dominant noise sources within the area are the surrounding road network, namely Camp Road, and an existing substation located to the south-east of Heyford Park.

Likely Significant Effects

13.8.4 An assessment was conducted on the impact of the future traffic flows on the Application Site for both the allocation and application scenarios to determine if internal and external noise criteria could be met. The assessment concluded that impact on the majority of the Application Site would be not significant, however properties fronting onto busy roads may require further mitigation.

13.8.5 Construction from the development was assessed to determine the impact on existing receptors. With the implementation of a construction environmental

management plan, the level of impact construction noise from the Application Site will have on existing receptors is deemed to be not significant.

13.8.6 Traffic flows from the development have been assessed for both the allocation and application scenarios to determine the impact on the existing road network and the potential increase of noise on existing receptors. The level of impact development traffic will have on existing receptors is deemed to be not significant.

13.8.7 The existing substation has been assessed using guidance from British Standard 4142: '*Methods for Rating and Assessing Industrial and Commercial Sound'.* The level of impact the substation will have on the proposed receptors is deemed to be not significant with suitable mitigation in place.

Mitigation and Enhancement

13.8.8 Proposed residential properties fronting onto Camp Road in Parcel 10 and 13 may require mitigation in the form of building orientation. Gardens should be located to the back of properties, away from roads, so that buildings form shielding for amenity areas.

13.8.9 Properties located near to the substation in parcel 17 should be orientated so that habitable rooms do not overlook the area. The erection of a noise barrier may also provide suitable mitigation.

Cumulative Impact

13.8.10 Construction periods of the proposed development could overlap with neighbouring sites. However, it is envisaged that each development would have its own CEMP and minimise noise break out from its site such that cumulative impacts are likely to be not significant.

13.8.11 The traffic flow data for 2031 incorporates cumulative traffic growth and has already been included within the assessment and is therefore not a significant cumulative effect

Conclusion

13.8.12 The assessment has demonstrated that with the use of appropriate mitigation measures, the Application Site for both the allocation and application scenarios is suitable for development and would not result in any significant noise or vibration effects.

13.9 REFERENCES

- Department for Communities and Local Government (2012) "*National Planning Policy Framework*", HMSO.
- Department for Environment, Food and Rural Affairs (2010) "*Noise Policy Statement for England*", HMSO.
- Department for Communities and Local Government (2014) "*Planning Practice Guidance Noise*", HMSO.
- British Standards Institution (2003) "*BS 7445:2003 Description and Measurement of Environment Noise – Part 1: Guide to Quantities and Procedures*" BSI.
- Department of Transport Welsh Office (1988) "*Calculation of Road Traffic Noise*" HMSO.

- Department for Environment, Food and Rural Affairs (2006) "*Method for Converting The UK Road Traffic Noise Index LA10,18h To The EU Noise Indices for Road Noise Mapping*" TRL, Casella Stanger.
- British Standards Institution (2014) "*BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites Part 1 Noise*" BSI.
- British Standards Institution (2014) "*BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites Part 2 Vibration*" BSI.
- British Standards Institution (2014) "*BS 8233:2014 Guidance on sound insulation and noise reduction for buildings*" BSI.
- World Health Organisation (1999) "*Guidelines for community noise*" WHO.
- The Highways Agency (2011) "*Design Manual for Roads and Bridges Volume 11 Environmental Assessment Section 3 Environmental Assessment Techniques Part 7 Noise and vibration*" HMSO.
- British Standards Institution (2014) "*BS 4142:2014 Methods for rating and assessing industrial and commercial sound*" BSI.

Table 13.19 Summary of Effects

Potential effect	Significance (pre-mitigation)	Mitigation measure	Significance of residual effect
Construction stage			
Demolition and Construction Noise	**Minor - Moderate**	Proposed CEMP	**Negligible**
Demolition and Construction Vibration	**Minor - Moderate**	Proposed CEMP	**Negligible**
Demolition and Construction Traffic Noise	**Minor - Moderate**	Proposed CEMP	**Negligible**
Operational stage			
External Amenity Area Noise Levels	**Negligible - minor**	It is recommended that gardens and external amenity area are placed at the rear of the dwellings such that the dwellings provide shielding from road traffic noise. The layout of the buildings and the orientation should be considered as the masterplan progresses in order to ensure gaps between dwellings are reduced such that no garden area has a line-of-sight/overlooks the roads.	**Negligible**
Internal Ambient Noise Levels	**Negligible (with appropriate design considerations)**	Planning Condition – compliance with required standards at the detailed design stage (with external building fabric calculations undertaken as required) to ensure internal ambient noise levels meet the required levels.	**Negligible**
The Change in Noise Levels due to the Increase in Road Traffic Noise	**Negligible**	None	**Negligible**

Potential effect	Significance (pre-mitigation)	Mitigation measure	Significance of residual effect
Plant Noise Emissions	**Minor**	Planning Condition - Proposed Plant should be designed to meet background noise levels at 1m from the closest noise sensitive receptor	**Negligible**
Noise Associated with Potential Commercial Uses	**Minor**	Planning Condition - Plant would be selected, located and attenuated in accordance with the requirements of the local authority. It is likely that a combination of the following environmental noise control techniques would be implemented: •Enclosing noisy plant within the building envelope; •Selecting suitably quiet 'low noise' plant; •Positioning air intake/discharge louvres away from noise sensitive receptors; •Orientating air intake/discharge louvres away from noise sensitive receptors; •Attenuation of air intake/discharge louvres with duct mounted attenuators; and •Sound insulating plant housings/enclosures.	**Negligible**
Noise Impact on Future Schools	**Negligible**	School sites are assessed at the detailed design stage when location and design of building and playground/outdoor teaching areas are known. The assessment is based on the guidance provided in Building Bulletin 93 (BB 93). It should be noted that BB 93 is part of the building regulations (Approved Document E, Requirement E4) and therefore it is a matter for the building control.	**Negligible**