10 Noise and Vibration

10.1 Introduction

10.1.1 This chapter of the ES was prepared by Buro Happold and presents an assessment of the likely significant effects of the Proposed Development from Noise and Vibration. Mitigation measures are identified, where appropriate, to avoid, reduce or offset any significant adverse effects identified and/or enhance likely beneficial effects. The nature and significance of the likely residual effects are reported.

10.1.2 An assessment of the suitability of the Site for the proposed noise and vibration sensitive uses has also been undertaken and is included in an Appendix to the chapter. A summary of the findings reported at the end of this ES Chapter (Section 10.9).

10.1.3 The chapter is supported by the following appendices:

- Appendix 10.1: Glossary of Terms;
- Appendix 10.2: Noise Policy Review;
- Appendix 10.3: Site Suitability;
- Appendix 10.4: Noise & Vibration Survey Details;
- Appendix 10.5: Construction Plant Assumptions & Noise Predictions; and
- Appendix 10.6: Traffic Data and Predictions.

Competence

10.1.4 This assessment has been prepared by Anne Thompson. Anne has over 10 years of experience working on noise and vibration assessments (including ES chapters) for a range of residential commercial and mixed-use developments for planning and supporting Development Consent Order applications for Nationally Significant Infrastructure Projects. Her educational background includes a 1st Class BSc in Environmental Science (University of Greenwich) and the Institute of Acoustics Diploma in Acoustics and Noise Control. She is a Corporate Member of the Institute of Acoustics.

10.1.5 This work has been supported by Spencer Mason. Spencer has 3 years' experience undertaking noise and vibration assessments. He has a MSc in Sound and Vibration from Chalmers University of Technology and is an Associate Member of the Institute of Acoustics.

10.1.6 The chapter has been reviewed by Stephen Turner (MA, MSc, HonFIOA), an associate with over 45 years' experience working in the field of acoustics and noise control in both the public and private sector. That has included 15 years providing technical advice to noise policy officials at Defra, including 4 years as a civil servant. He is a member of the European Commission's Noise Expert Group and is an Honorary Fellow of the Institute of Acoustics.

10.2 Legislation, Planning Policy and Guidance

Legislation Context

10.2.1 The following legislation is relevant to the noise and vibration effects of the Proposed Development:

- The Environmental Protection Act (1990)[1;] and
- The Control of Pollution Act (1974)[2].

Planning Policy Context

10.2.2 The following national, regional and local planning policy is relevant to the Proposed Development:

National

- National Planning Policy Framework (2021)[3] (NPPF); and
- Noise Policy Statement for England (2010)[4] (NPSE).

Regional

- Oxfordshire County Council Local Transport and Connectivity Plan 2022-2050 (2022)[5]

Local

- The Cherwell Local Plan (2011-2031)[6];
- Cherwell Local Plan 1996 Saved Policies (CLP 1996)[7]; and
  - Cherwell Local Plan 2011 – 2031 (Part 1) Partial Review – Oxford's Unmet Housing Need (PR2020)[8].

10.2.3 A review of the relevant noise policy is contained in Appendix 10.2.

Guidance

10.2.4 The following guidance is also relevant to the Proposed Development:

- Cherwell Planning and Noise Guidance (undated)[9];
- National Planning Practice Guidance: Noise (2019)[10];
- Calculation of Road Traffic Noise (CRTN), 1988[11];
- Calculation of Railway Noise (CRN), 1995[12];

- Design Manual for Roads and Bridges (DMRB)[i], LA111 Noise and Vibration May 2020 Revision 2[13];
- BS 4142:2014+A1:2019 Method for rating and assessing industrial and commercial sound[14];
- BS 5228:2009+A1:2014 (Parts 1 and 2) Code of Practice for Noise and Vibration Control on Construction and Open Sites[15];
- BS 8233:2014 Guidance on sound insulation and noise reduction for buildings[16];
- BS 6472-1:2008 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting[17];
- BS 7385-2:1993 Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from ground-borne vibration[18];
- ISO 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors part 2: General method of propagation[19];
- World Health Organisation, Guidelines for Community Noise (1999)[20];
- Institute of Environmental Management and Assessment Guidelines for Environmental Noise Impact Assessment (2014)[21];
- Cherwell District Council's 'Planning and noise guidance' on glazing and ventilation requirements[22];
- Oxfordshire County Council Design Guide for Primary and Secondary Schools (October 2020)[23];
- Acoustics of Schools: a design guide (November 2015), Institute of Acoustics and Association of Noise Consultants[24];
- Building Bulletin 93, BB93: acoustic design of schools – performance standards (2014), Department for Education[25];
- Professional Practice Guidance on Planning & Noise: New Residential Development (ProPG 2017)[26];
- Building Regulations Approved Document Part O – Overheating[27]; and
- Acoustics Ventilation and Overheating – Residential Design Guide[28].

[i] Although strictly only applicable to scheme promulgated by National Highways for the Strategic Road Network

10.3 Assessment Methodology

Consultation

Pre-Application Consultation

10.3.1 Table 10.1 summarises the one key comment raised by consultees of relevance to the noise and vibration assessment during pre-application meetings and/or communication exchanges and how the assessment has responded to it.

Table 10.1: Consultation Response Summary

Consultee and Comment	Response
Cherwell District Council (13th December 2022)	
A description of the measurement locations and durations for baseline noise and vibration survey were provided to the CDC for comment. The Council agreed with the methodology but queried whether more measurements at location LT2 as only one hour of data was captured and not 24 hours as planned.	A further set of measurements were undertaken at location LT2 in February 2023 to provide a more comprehensive data set.

EIA Scoping Opinion

10.3.2 A request for a Scoping Opinion was submitted by the Applicant to CDC on 9th December 2022. An EIA Scoping Report (the 'Scoping Report') accompanied the request (Appendix 3.2). A Scoping Opinion was issued by the CDC on 23rd January 2023 (Appendix 3.3) which included comments from statutory consultees.

10.3.3 Table 10.2 summarises key comments raised by consultees of relevance to this assessment by the EIA Scoping Opinion and how the assessment has responded to them. If the comment has been raised by a consultee and then picked up in CDC's response, it is listed under their comments rather than the individual consultee response.

Table 10.2: EIA Scoping Opinion Response

Consultee and Comment	Response
Cherwell District Council (27 January 2023) Cherwell District Council	
Consider the need for the canal corridor, users of the towpath and occupants of moored boats to be included as a sensitive receptor for pollution.	Receptor locations have been selected representing these potential noise sensitive receptors (R1 and R2 in Table 10.13).
The proposed schools will generate noise and disturbance to surrounding uses once operational which may be early in the development process.	At the outline stage it is difficult to have certainty about the details of the school site layouts and location. However, an indicative assessment has been undertaken of the potential impact from school areas based on the

Consultee and Comment	Response
	number of pupils. This would be considered further at subsequent stages of consent (Tier 2 and 3).
Airport movements were provided showing a general trend of growth and a spike in flying hours in 2021 following lost flying hours during the COVID-19 pandemic. It was also noted that policy ENV6 – Development at Oxford Airport, Kidlington likely to increase noise nuisance is applicable to the development.	Assumptions regarding Oxford Airport (current and future) operations is discussed in paragraphs 10.4.16 and primarily affects the evolution of the baseline and the site suitability (Appendix 10.3) rather than the impacts of the Proposed Development on surrounding receptors.
Impact of noise from the railway should be fully understood and form part of the EIA with appropriate mitigation. It is also noted that there is anticipated to be an increase in rail noise.	Noise from the railway has been taken into account in the assessment. This is discussed further in paragraph 10.4.14, which confirms that an uplift in rail traffic has been assumed based on information supplied by Network Rail.
The noise impacts of a potential future railway station at Begbroke should be understood.	The Proposed Development only includes land safeguarded for a railway station. Should proposals come forward in the future, they would be subject to a separate planning application and EIA. The EIA Regulations require that the future impacts of existing and or approved/committed developments are considered. At this time, there is no certainty that these proposals will come forward. In the event that they do, there is the potential for additional noise from the stopping and starting of trains at the station. However, this cannot be known at this stage and potential noise effects would be determined at a later date, by those promoting the scheme, once more certainty and details emerge.
Noise will directly impact education delivery and is one of the reasons why a school must not be located adjacent to the railway line. The school location must meet the specified permitted noise level stated above unless otherwise agreed.	Throughout the application process, discussions have been held with OCC to determine appropriate locations for each of the school sites informed by a number of factors, including analysis of likely external and internal noise levels. Further details are provided in Chapter 4: Alternatives, Section 10.5 of this chapter and Appendix 10.3.
The impact of the A44 should be accounted for in its current position but also the impact of future growth, investment in bus infrastructure on the A44 and the proposed development of the Oxford Airport	The impact of the A44 in its current position and also future growth are accounted for through the baseline noise survey and the future traffic scenarios modelled. With regard to the proposed development of the Oxford Airport Travel Hub, a planning application has not yet been submitted. However, it is considered that this will

Consultee and Comment	Response
Travel Hub should also be documented and factored into the development appraisal.	encourage mode shift onto public transport and therefore would be likely to reduce road traffic noise on the surrounding network. Therefore, the scenarios assessed are worst case.
Impact to Begbroke Village and Yarnton Village residents and first residents of the development: The impact on existing residents from construction activity should be accounted for and included.	Construction noise has been predicted and assessed at the nearest residential receptors. The locations of the first residents of the Proposed Development are not yet known, however consideration has been given to the distances at which significant adverse and adverse effects may arise and appropriate mitigation measures.
Begbroke Parish Council (6th February 2023)	
Problems reported when there is southerly airflow with noise from the science park. Sound recordings of this source weren't undertaken at night when noise at its peak.	The relevant equipment at Begbroke Science Park is understood to operate at the same duty day and night, therefore the measurements obtained are representative of the worst-case. The noise may be more noticeable at night due to lower levels of ambient sound. In addition to shorter term measurements during the day, the longer-term measurement at LT4 measured plant noise during the night-time period as well. The Proposed Development buildings may also offer some screening attenuation to existing residential dwellings affected by this source.

Summary of Assessment Scope

10.3.4 As outlined within the EIA Scoping Report (Appendix 3.2), and as agreed with CDC via the EIA Scoping Opinion (Appendix 3.3), the scope of the noise and vibration assessment within this chapter is limited to the following assessment of effects:

Construction

10.3.5 The assessment considers the potential for the following temporary effects during the construction phase:

- Construction noise from works within the Site boundary;
- Construction traffic travelling along the surrounding road network; and
- Construction vibration where piling or vibratory ground compaction will occur within 100m of sensitive receptors.

Completed Development

10.3.6 The assessment considers the potential for the following permanent effects during the operational phase:

- Changes in road traffic noise on the local road network resulting from the Proposed Development; and

- An indication of the potential noise impact from the proposed schools, due to noise from outdoor play/sport areas.

10.3.7 The Scoping Report also identified potential for noise effects associated with the following activities:

- Noise from fixed building services plant serving the various Proposed Development buildings;
- Noise from deliveries and servicing for the uses within the Proposed Development; and
- The impact of cars and other vehicles using the internal access roads (where this is likely to have a significant effect on surrounding offsite receptors).

10.3.8 Due to the outline nature of the Proposed Development, a full assessment of the aspects listed above is to be undertaken at the reserved matters application stage. For a full assessment, the locations and specifications of the fixed building services plant would be required, the location and size of commercial buildings would need to be identified along with the orientation of service yards, the vehicles servicing each unit and the location of all internal access roads as well as flows of vehicles travelling along them.

10.3.9 Should outline planning consent be granted, the Chapter sets out the approach that will be undertaken for predicting and assessing noise from fixed building services plant and other commercial noise sources (including operational activities and delivery and servicing noise). As identified in the scoping report, this includes the setting of target sound levels that have been derived in line with the guidance in BS 4142:2014+A1:2019. Should consent be granted, the requirement for the impact of noise from these sources to be assessed as part of the reserved matters applications will be secured by condition.

10.3.10 Additionally, the impact of cars and other vehicles using internal access roads cannot be predicted at this stage as the only flow provided is the total number of vehicles that will travel into and out of the Begbroke Hill entrance. Should consent be granted, this would be considered within the reserved matters assessments when details are available about the traffic likely to travel along side roads and how the flows will vary along Begbroke Hill. This requirement would be secured by condition.

10.3.11 The suitability of the Site for the proposed noise sensitive uses being introduced as part of the Development is assessed in Appendix 10.3. Any consent should include a requirement to submit a noise impact assessment detailing the acoustic design strategy and proposed mitigation measures required to achieve the internal ambient and maximum noise levels so that adverse impacts on the future occupants of the dwellings are kept to a minimum.

Non-Significant Effects

10.3.12 All other potential noise and vibration effects were scoped out of further assessment within this ES, with the justification set out in Section 8 of the EIA Scoping Report (Appendix 3.2). This includes the assessment of construction vibration effects if piling or vibratory ground compaction is undertaken at distances of greater than 100m from sensitive receptors and the assessment of any operational vibration effects associated with the completed Proposed Development.

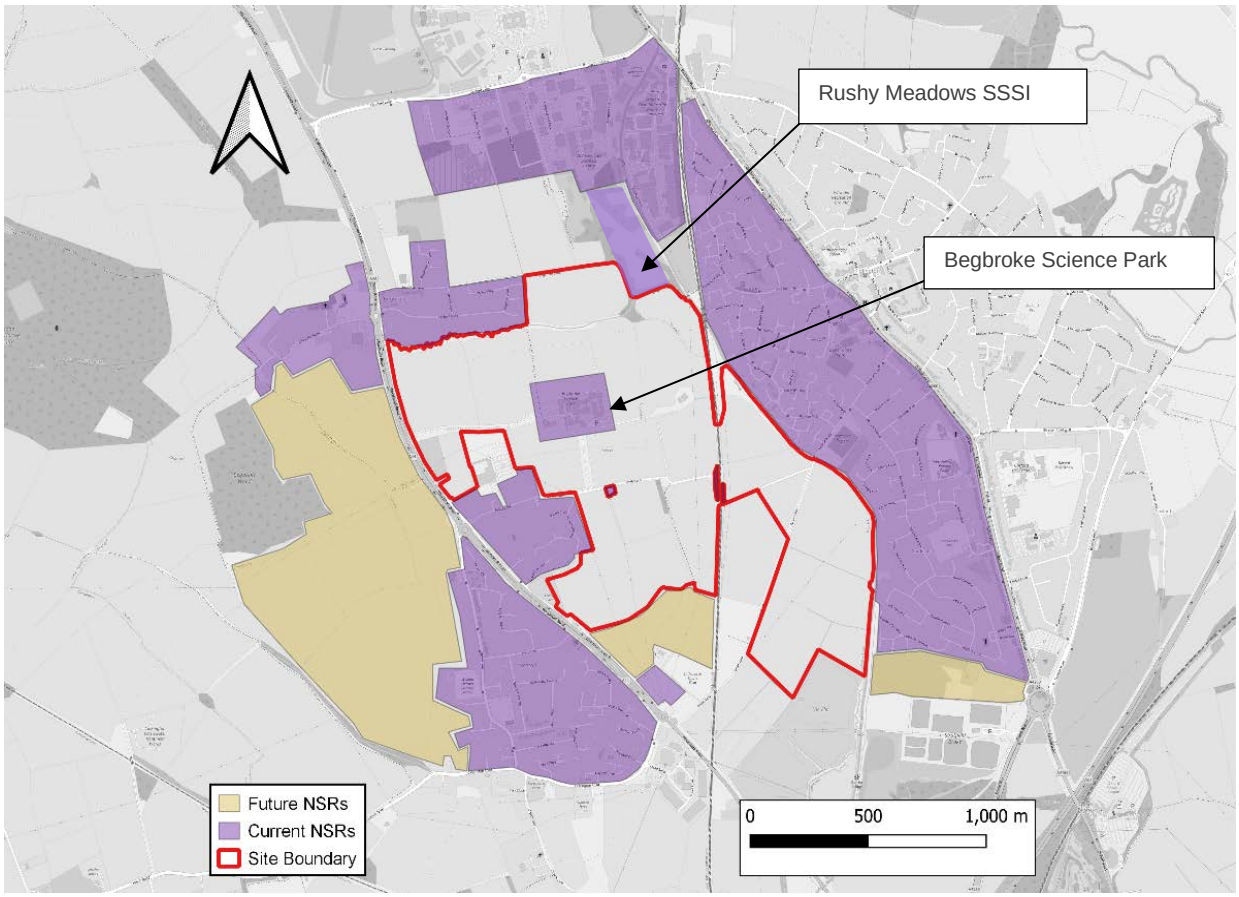
Study Area

10.3.13 With regard to noise and vibration effects (outside of road traffic noise), the study area is not determined by a given distance, but instead includes the Nearest Sensitive Receivers (NSRs) located outside of the red line boundary, which are summarised in Figure 10.1. These comprise both existing offsite receptors (i.e. those outside of the red line boundary) and nearby proposed future offsite receptors. Further details regarding the receptors and individual receptor locations are identified later in this Chapter.

10.3.14 The majority of these NSRs are residential and border the Site boundaries. However, there is also the Rushy Meadows SSSI ecological receptor located to the north of the Site. Due to the proximity of the receptors to the Proposed Development, they are expected to represent those worst affected. The effects at offsite receptors located at greater distances from the Proposed Development boundary would generally be lower or no worse than at the identified receptors. The study area also encompasses the Oxford Canal and its associated users.

10.3.15 As can be seen in Figure 10.1, Begbroke Science Park (located in the centre of the site) has been identified as an existing sensitive receptor, although it is noted that it falls within the red line boundary of the site. The Proposed Development includes the demolition and redevelopment of part of this campus. One of the campus buildings (Begbroke Hill Farmhouse) is a Grade II listed building, which is understood to currently be used as a cross departmental research facility and Science Park including office and laboratory space, as well as a conference venue and a business centre.

It is also noted that the Proposed Development will also introduce new sensitive receptors within the Study Area. Where appropriate, the effects of construction noise and vibration at these receptors will be considered in the Chapter, while effects during the operational phase



of the development will be considered as part of the outline site suitability assessment in Appendix 10.3

10.3.16 For road traffic noise, the geographical scope of effects is based on the extent of the road network covered by the Transport Assessment and the scoping criteria set out in DMRB LA111 Noise and Vibration document, which is detailed below.

10.3.17 For construction traffic DMRB states that *"the study area should be defined to include a 50m with from the kerb line of public roads with the potential for a increase in baseline noise level (BNL)ii of 1 dB(A) or more as a result of the addition of construction traffic to existing traffic levels".* Therefore is the change is anticipated to be less than 1 dB, a detailed assessment is not considered necessary as the impact will be negligible.

10.3.18 For operational road traffic the criteria set out in DMRB LA111 to determine whether a detailed assessment is required is based on; the likely magnitude of change in the BNL, whether a new link will be constructed within 600m of sensitive receptors, or if there would be a reasonable expectation of a detailed assessment being undertaken. The most pertinent criteria to this assessment states that a detailed assessment would be required where *"the project is likely to cause a change in the BNL of 1dB $L_{A10,18hr}$ in the do-minimum opening year (DMOY) compared to the do-something opening year (DSOY)".*

Establishing Baseline Conditions

10.3.19 To determine the prevailing noise conditions, a baseline noise survey was undertaken between the 20th to 22nd September 2022 following the principles of BS 7445:2003[29]. Noise measurements were undertaken at four unattended (LT1 to LT4) and six attended (ST1 to ST6) monitoring positions. These monitoring locations are shown on Figure 10.2 in Section 10.4.

10.3.20 One of the unattended meters (LT2) was tampered with and only recorded data for a 1-hour period during the original survey. Following consultation with CDC a further measurement was undertaken at this location between the 2nd to 3rd February 2023. During this second survey, further supplementary attended and unattended noise monitoring were undertaken at another measurement position close to the railway line (LT5) to capture a longer and more representative 24-hour sample of levels in proximity to the railway.

10.3.21 During the February 2023 survey, attended vibration measurements were also undertaken in proximity to the railway line (LT5) to determine the existing levels of vibration adjacent to the railway.

10.3.22 Further details of the survey are presented in the Baseline Conditions section (Section 10.4) of this Chapter and Appendix 10.4 which contains details of the instrumentation used for the noise and vibration surveys as well as the meteorological conditions during the surveys.

[ii] The BNL refers to the Basic Noise Level which is the noise level at a reference distance of 10m away from the nearside carriageway edge, it is obtained from the traffic flow, speed of traffic, composition of traffic i.e., % HGVs, and can include the gradient of the road and the road surface.

10.3.23 A 3D noise model of the baseline noise conditions has been produced in CadnaA modelling software based on a combination of the monitoring data and the current and future baseline traffic data provided by the project transport consultant (KMC Transportation).

Identifying and Assessing Likely Significant Effects

10.3.24 In general, the assessment methodology used for each type of source in the ES chapter is different in terms of how the potential noise and vibration impact is predicted and how the effect is assessed. In line with government policy and where practicable, threshold levels have been defined for Lowest Observed Adverse Effect Level (LOAEL)[iii] and Significant Observed Adverse Effect Level (SOAEL)[iv] for the different noise sources considered in the assessment.

10.3.25 The magnitude of the impact and the resulting significance of the effect is dependent upon several factors, including:

- the existing sound environment;
- the noise level generated from the particular activity;
- the change from the baseline (existing sound environment) or future baseline (i.e., the 'do minimum' situation) as a result of the new noise source;
- the duration, timing and character of the different noise sources; and
- in some situations, the number of dwellings affected.

10.3.26 The assessment methodologies for each element of the assessment are described below.

Noise Model

10.3.27 To aid in the assessment of the prediction of likely significant effects from construction and operational sources of noise, a 3D model of the site has been constructed in CadnaA noise modelling software. The models use the prediction methodology contained in ISO 9613 - 2:1996 which assumes moderate downwind propagation from the source.

10.3.28 The assumptions that have been applied to the modelling of the various sources are set out below. It is estimated that the model has an uncertainty of ± 3dB.

Construction

Construction Traffic Noise

10.3.29 As stated within Chapter 9: Transport and Access, given that Network Rail is currently progressing an application to close the Sandy Lane level crossings to traffic and that policy within the Partial Review Local Plan requires Sandy Lane to be for walk and cycle access only, it is considered reasonable to assume that Sandy Lane will be closed to traffic during peak construction of the Proposed Development. All construction traffic will access the Site via Begbroke Hill (the existing entrance to the Science Park).

[iii] The level above which adverse effects on health and quality of life can be detected.
[iv] The level above which significant adverse effects on health and quality of life occur.

10.3.30 The project traffic consultant has provided traffic data for the peak year of construction activity (2028) as well as the 2028 Reference Case (with Sandy Lane closed)[v]. These are Scenario 5 and Scenario 2 from the dataset and are considered to represent the worst-case scenario for the assessment of construction phase traffic impacts. This is because Sandy Lane is assumed to be closed to traffic during the peak construction year and the distribution of traffic on the network is anticipated to change between the 2019 baseline and the 2028 peak construction year. Therefore, a comparison against the 2019 baseline would not be representative of what is likely to occur in practice.

10.3.31 The relevant traffic data for these scenarios is presented in Appendix 10.6, which includes a figure showing the locations of all the links. The impact arising from construction traffic on the highway network is determined from the change in the BNL caused by the additional construction traffic on the road network compared to the reference case scenario (i.e., Scenario 5 minus Scenario 2). The BNL corrected for flow, speed and percentage of HGVs on each link has been predicted for each scenario following the principles of the CRTN methodology and the relevant advice in DMRB.

10.3.32 When the BNLs are compared (as set out in Table 1 of Appendix 10.6), the impact on the road links surrounding the Site (and therefore any receptors along them) is at worst a maximum increase 0.8 dB, with many links experiencing no change in noise level because of construction traffic. Consequently, no significant adverse construction traffic noise effects are expected to arise from construction traffic on the surrounding highway network. As stated in paragraph 10.3.17, a detailed assessment of construction traffic noise is only considered to be required if the screening assessment indicates that a change of 1 dB(A) or more was expected from additional construction traffic on the network.

10.3.33 There is only one road link where an increase of more than 1 dB(A) on the link is anticipated, which is Begbroke Hill (a private road serving the Science Park), the route taken by all construction and (in due course) operational development traffic. With regard to the nearest sensitive receptors outside of the red line boundary, once the relative contribution from traffic on Begbroke Hill is considered in the context of the contribution from the A44 (which is the dominant noise source) the effect at any residential receptor locations is anticipated to be less than 0.5 dB. Therefore, this is not considered further in this Chapter.

Demolition and Construction Noise

10.3.34 In relation to demolition and construction noise impacts, prior to the appointment of a contractor, detailed information regarding the type, number and size of construction equipment that would be employed for each activity is not available. However, to determine whether there are likely to be any significant noise effects, indicative estimates and assumptions have been made of the likely plant and equipment that will be used and their likely usage, or 'on-time', for a typical working day. These estimates are based on reasonable worst-case assumptions from the team, based on experience of similar projects and the constraints present at this Site.

10.3.35 As stated within the Outline Construction Environmental Management Plan (CEMP) (see Appendix 6.1), which is to be secured by planning condition, the normal Site working hours are anticipated to be:

[v] As discussed in the assumptions and limitations section this is the same as the 2033 reference case.

- 08:00 – 18:00 hours Monday to Friday;
- 08:00 – 13:00 hours on Saturdays; and
- No planned working on Sundays and Bank Holidays.

10.3.36 To maintain these working hours, the contractor(s) will require a period of 30 minutes before and at the end of the working shift (i.e., the times stated above) to start up and close-down the works activities. No noisy works should be carried out outside of these hours.

10.3.37 However, there may be some works which need to be undertaken outside of the normal working hours – for example completion of concrete pours if there are batching plant/traffic delays, delivery of abnormal or large loads, and potentially some highway works. Should this occur, the duration of works will be subject to consultation and agreement with CDC.

10.3.38 An assessment has been undertaken of the potential noise effects during the following works activities:

- Demolition;
- Earthworks and Infrastructure;
- Groundworks/Foundations;
- Piling (where applicable);
- Superstructure; and
- Paving.

10.3.39 The assumptions and source terms for these works are set out in Appendix 10.5. Predictions have been undertaken for the works occurring in each area of the Site (i.e., Begbroke Hill, Begbroke Science Park, Parkers Farm and Foxes Cover) as defined by the Parameter Plans (Appendix 5.1) and the principles in the Development Specification (Appendix 5.2). For demolition, the noise levels arising from these works has been considered with regard to the specific location of the buildings which are proposed to be demolished.

10.3.40 Ground conditions at the Site dictate that any larger buildings are likely to require piled foundations. These works are expected to be confined to the area defined in the Development Areas and Land Use Parameter Plan as Begbroke Science Park. However, it could also extend to tall buildings immediately to the north of this Development Zone where the maximum heights are up to 22m as indicated the Maximum Building Heights Parameter Plan. It is understood from the project team that the most likely piling method at this Site would be the use rotary bored piles (augering) as opposed to driven piling methods.

10.3.41 The noise prediction methods described in Annex F of BS 5228-1:2009+A1:2014 have been used to determine an overall noise level for each activity. The propagation of construction noise has been predicted using CadnaA noise modelling software and the principles contained in the ISO 9613-2:1996 methodology, which assumes there is moderate downwind propagation between the source and receptors.

10.3.42 The predictions do not take account of any screening, nor do they take account of any specific mitigation adopted to prevent noise break out from construction activity (i.e., they are unmitigated noise levels).

Construction Vibration

10.3.43 From a review of the works that are likely to be undertaken during the construction phase, only piling and vibratory ground compaction have been identified as activities having the potential to generate levels of vibration which could adversely affect sensitive receptors.

10.3.44 The anticipated locations of piling activities are indicated in paragraph 10.3.40. It is understood that vibratory ground compaction is likely to be undertaken across the Site as part of both the 'earthworks and infrastructure' and 'groundworks/foundations' construction activities which will take place across the site. It is also noted that there will be vibratory ground compaction within the former landfill site located in the centre of the Site to the south of Sandy Lane. This area is defined as Central Park in the Parameter Plans (Appendix 5.1). All vibratory ground compaction will be undertaken using the same method i.e., vibratory rollers.

10.3.45 The propagation of vibration from construction activity to a receptor depends upon the methods and equipment used, as well as the intervening distance, soil and geology type.

10.3.46 It is understood that the likely method of piling will be rotary bored piling which typically produces minimal levels of vibration. Part 2 of BS 5228:2009+A1:2014, which contains guidance on predicting, controlling and minimising construction vibration, does not contain a prediction methodology for this type of piling. Annex D of the standard does provide some historical measurement data for this type of piling on different soil types. The levels of vibration are stated using peak particle velocity (PPV) in mm/s.

Table 10.3: Measured Data for Augering at Different Distances in Various Soil Conditions from Annex D of BS 5228-2:2009+A1:2014

Distance between Augering and Measurement Location (m)	Measured PPV (mm/s)	Soil Description
5.5	0.13	Fill including pockets of gravel over London clay
9	0.20	Fill/ wet sand/ lias clay
10	0.38	Fill clay
10	0.40	Fill/ sand/ clay
15	0.10	Fill clay
20	0.05	Fill/ dense ballast/ London clay
20	0.30	Fill clay
26	0.02	Fill/ sand/ London clay
30	0.03	Fill clay

10.3.47 Table 10.3 indicates that the magnitude of measured vibration generally decreases as the distance from the augering process increases. To provide an indication of the potential for

adverse construction vibration effects to arise from piling activities, the distance between the receptor and the nearest anticipated piling location has been compared with the historic data presented in Table 10.3 and used to provide an estimate of whether an adverse or significant adverse effect might occur.

10.3.48 The standard (Part 2 of BS 5228:2014+A1:2019) does not provide measured data for vibratory ground compaction undertaken by vibratory rollers. However, Annex E of the standard does provide an empirical method which can be used to estimate the vibration level arising from vibratory compaction. The calculation is based on several parameters such as the maximum amplitude of the drum, the drum width and the distance to the receptor. It should be noted that there is a high degree of uncertainty in these empirical calculation methods.

10.3.49 Using this empirical method, indicative predictions have been undertaken of the potential levels of vibration from this activity arising at given distances between the source and the receptor and this is discussed with regard to existing offsite receptors and those within the red line boundary i.e., Begbroke Science Park. The prediction assumptions (e.g., drum width, vibration amplitude) are set out in 'Assumptions and Limitations' section of this Chapter.

10.3.50 In general, there are not anticipated to be any significant effects from construction vibration on introduced receptors (i.e., proposed future receptors within the red line boundary of the Proposed Development). This is because piling and vibratory ground compaction works will occur early in the construction programme and are anticipated to be completed prior to the occupation of any buildings in very close proximity. Furthermore, other introduced receptors (in adjacent phases of the Proposed Development) would typically be at least 30m away from the proposed works and therefore no adverse effects would be expected. If this strategy is amended once a contractor is appointed, the risk to Proposed Future onsite receptors should be reassessed, and relevant mitigation measures identified.

Completed Development

Road Traffic Noise

10.3.51 An initial screening assessment of the potential noise effects arising from the change road traffic flows on the local road network arising from the Proposed Development has been undertaken using the principles of the methodology contained in CRTN/DMRB LA111 and using traffic data provided by the project transport consultant. This included the Annual Average Weekday Traffic (AAWT) flows, the percentage of HGVs and the average speed. Further details of the survey information and highway modelling used to produce these flows are provided in Chapter 9: Transport and Access and Appendix 9.1: Transport Assessment.

10.3.52 As set out in paragraph 10.3.18, DMRB LA111 states that a detailed assessment would be required where *"the project is likely to cause a change in the BNL of 1dB $LA_{10,18hr}$ in the do-minimum opening year (DMOY) compared to the do-something opening year (DSOY)".*

10.3.53 The BNL (taking account of flow, speed and percentage HGVs) has been calculated for the following scenarios:

- 2033 Reference Case (with Sandy Lane closed) – Scenario 2, i.e., the Do Minimum Opening Year (DMOY); and

- 2033 Do Something Opening Year +OUD (DSOY) – Scenario 3 – this is the 2033 Reference Case, plus the Proposed Development traffic, assuming the Proposed Development is fully occupied.

10.3.54 It is noted that both scenarios include the flows associated with a number of committed developments as agreed with OCC at the outset of the traffic modelling. Further details of the schemes can be found in Chapter 9: Transport and Access and Appendix 9.1: Transport Assessment. The DS scenario does not include the flows associated with the other PR sites; this is considered later in this Chapter as part of the consideration of cumulative effects.

10.3.55 When the BNLs for the DMOY and DSOY scenarios are compared (as set out in Table 2 of Appendix 10.6), the maximum increase on any link on the surrounding highway network is 0.6 dB, indicating that a detailed assessment of road traffic noise impacts is not required. Consequently, no significant adverse road traffic noise effects are likely to arise on the surrounding highway network and therefore the impacts are not considered further in this ES Chapter. There are also some links which experience a beneficial change (such as link DA and DD on the A44 Woodstock Road where the speed limit is proposed to reduce from 50 mph to 40 mph.

10.3.56 The only link with a change higher than this is Begbroke Hill, which currently serves the Science Park and will be the main access for all operational traffic. The nearest offsite residential receptors are at least 250m away from this source. Once the relative contribution from traffic on Begbroke Hill is considered in the context of the contribution from the A44 (which is the dominant noise source), the effect at any offsite residential receptor locations is anticipated to be less than 0.5 dB, which also does not allow for any screening that may be provided by buildings introduced as part of the Proposed Development. Therefore, road traffic noise travelling along Begbroke Hill is not expected to result in any significant adverse effects at offsite receptors and is not considered further in this chapter. As part of the detailed site suitability assessment (once further information is known regarding flows around the development), consideration will be given to how noise from vehicles travelling along the roads within the development would affect introduced noise sensitive receptors and what mitigation measures are required.

Completed Development – Noise from Schools

10.3.57 There is no standard methodology for predicting or determining the extent of the potential impact of noise from school playgrounds during break times or outdoor teaching. The main sources of noise from these activities are essentially the same – raised voices/shouting. The noise level at the receptor locations has been predicted using an area source which represents a number of pupils talking in raised voices simultaneously spread across the relevant area (e.g., a playground).

10.3.58 At this outline stage there is very limited information regarding the design, layout, and capacity of each of the school's playgrounds or outdoor pitches. An indicative assessment has been undertaken; however, the requirement for a detailed noise impact assessment to be undertaken as part of the detailed design for each school sites should be secured by planning condition.

10.3.59 To provide an indicative assessment, the maximum pupil numbers for each school have been provided by the design team. For playgrounds it has been assumed that while all pupils could use the playground at the same time, only half would be talking/shouting, with

the other half of the pupils listening. This is a typical assumption applied to predicting noise from outdoor areas where people would be talking (even at raised voice level). For pitches, the primary schools are expected to have one pitch per school and the secondary school is anticipated to have two pitches in use at any one time.

10.3.60 The locations of pitches and playgrounds have been assumed based on the latest information from the design team and the OCC Guidance for Primary and Secondary Schools.

Table 10.4: School Assumptions

School	Maximum Pupil Numbers	Assumed Number of Pupils Speaking in Playground[1]	Assumed Number of Pitches[2]
Primary School 1 (3 Form Entry)	708 (630 primary, 78 nursery)	354	1
Primary School 2 (2 Form Entry)	472 (420 primary, 48 nursery)	236	1
Secondary School (6 Form Entry)	1000 (900 secondary, 100 6th Form)	500	2

Note:

[1] half the maximum number of pupils assumed to be speaking.

[2] number of pitches assumed to be in use at any one time.

10.3.61 To predict the noise levels arising at the receptors from playground noise, the noise model has been populated with area sources which represent the relevant number of people shouting simultaneously across each relevant area. A source level has been applied to each area source based on the voice spectrum with a sound power level of 75 dB(A) for 1 child[30] and then corrected for the number of pupils identified in Table 10.4.

10.3.62 For the noise levels arising from the sports pitches, the source term has been derived from the Sport England Guidance[31], which indicates that a typical free field source level for artificial pitches of 58 dB $L_{Aeq,1hour}$ at a distance of 10m from the side line halfway marking. Although the proposed pitches may not be artificial, the dominant noise source (voices/shouting) is not expected to be different for a grass pitch.

Completed Development - Noise from Fixed Building Services Plant and Commercial Sources

10.3.63 Sound emissions from any mechanical plant associated with the Proposed Development and the operational activities of any non-residential uses (e.g., commercial units B2/B8 floorspace and their associated deliveries and servicing which could generate noise) are components of operational sound which may be generated by the Proposed Development.

10.3.64 Given the outline nature of the application, no specific information is available to undertake an assessment of these noise sources. Instead, the baseline noise survey data has been analysed to determine typical representative background sound levels and target levels for noise from mechanical plant and commercial uses have been identified at the various existing receptor locations (see Table 10.14).

10.3.65 It is proposed that should planning consent be granted, a planning condition attached to any consent would require that, prior to the installation of any fixed building services plant, a noise assessment will be submitted to and approved by the relevant planning authority. Furthermore, prior to the commencement of the development of any non-residential units (e.g., commercial, or B2/B8 floorspace), a noise impact assessment is undertaken to identify the levels of noise arising at the nearest receptors and whether any mitigation is required to comply with Government and local policy. These noise assessments will follow the principles of the methodology set out in BS 4142:2014+A1:2019 and reference the background sound levels and target sound levels presented in this Chapter.

10.3.66 Items of plant will be selected and located to minimise operational sound at nearby receptors as far as reasonably practicable, with further options being available for standard mitigation including local screening, enclosures and in-duct attenuators.

Cumulative Effects

10.3.67 It is understood that the traffic flows used in the completed development road traffic noise assessment (i.e., the 2033 Reference Case - Scenario 2 or the 2033 Do Something +OUD-Scenario 3) include the traffic associated with relevant committed developments in the area as agreed with OCC. Further details of these schemes can be found in Chapter 9: Transport and Access and Appendix 9.1: Transport Assessment. It is considered that this includes all the schemes which are likely to have a material impact on road traffic noise on the highway network surrounding the Site, and the impact of traffic associated with any committed developments not agreed to be included by OCC would be negligible.

10.3.68 Scenario 3 does not include flows from the other PR sites. These flows are included in Scenario 4 (2033 Do Something Cumulative). To assess the cumulative effects of the development in combination with the traffic that would be generated by other PR sites, a comparison has been undertaken between Scenario 4 (2033 Do Something Cumulative) and Scenario 2 (2033 Reference Case with Sandy Lane closed). This is presented in Table 3 of Appendix 10.6: it can be seen that there are no increases on any links outside of the red line boundary of more than 0.8 dB. As such, the effects of road traffic noise associated with these cumulative PR schemes and the Proposed Development will be the same as those reported in paragraph 10.3.55 of this Chapter i.e. no significant adverse effects are likely to occur.

10.3.69 Cumulative effects from other noise sources during construction and operation of the Proposed Development (i.e., from construction activities and occupation of commercial buildings and the associated operational activities including deliveries and servicing) will take into account other cumulative schemes which are located in very close proximity to the Site (i.e., within a 200m radius). Beyond this distance, noise attenuation is considered to be sufficiently high such that cumulative effects would not be expected to occur.

10.3.70 The cumulative schemes that fall within this 200m radius of the Site are set out below:

- Former Piggery and Land North of Woodstock Road, Yarnton (CDC 21/00758/SCOP);
- PR9 Site OS Parcel 3673, Adjoining and West Of 161 Rutten Lane, Yarnton (CDC 21/03522/OUT); and

- Yarnton Lane Level Crossing and Sandy Lane Level Crossing (22/03054/SO) & OS Parcel 7917 Adjoining Green Lane Yarnton (CDC 23/00524/SO).

10.3.71 There are no known construction dates for these development schemes, and therefore it is not possible to assess quantitatively the cumulative effect of these schemes alongside the Proposed Development. A qualitative assessment has been undertaken.

10.3.72 The noise impacts of a potential future railway station at Begbroke have not been assessed. At this time, there is no certainty that these proposals will come forward. In the event that they do, there is the potential for additional noise from the stopping and starting of trains at the station. However, this cannot be known at this stage and potential noise effects would be determined at a later date, once more certainty and details emerge for that scheme. The applicant for a new station would also need to demonstrate how any adverse noise and vibration effects would be mitigated on any existing or committed developments.

Determining Effect Significance

Sensitivity of Receptor

10.3.73 Sensitive receptors are identified as locations where a human or ecological habitat could be exposed to increased levels of noise and/or vibration due to the Proposed Development.

10.3.74 Regarding the sensitivity of the receptors, Table 10.5 summarises the sensitivity of different types of receptors to noise and vibration.

Table 10.5: Receptor Sensitivity Descriptors

Value (Sensitivity)	Descriptor
High	Receptors where people, flora, fauna or operational activities are extremely susceptible to effects from noise and vibration. For example, residential accommodation, hospital operating theatres/high dependency units, care homes etc.
Medium	Receptors where people, flora, fauna or operational activities are moderately susceptible to noise and vibration. For example: offices, schools and universities, hospital wards, temporary holiday accommodation and hotels, places of worship, private gardens, and outdoor areas used for recreation and designated wildlife sites.
Low	Receptors with a low susceptibility to disturbance from noise and vibration. For example: sports grounds bars, cafes, restaurants.

10.3.75 With regard to listed buildings, the sensitivity of these receptors very much depends on their condition, the reasons why they are listed and the vulnerability of the structure and is therefore assessed on a case-by-case basis.

Assessing Significance

10.3.76 The implementation of Government noise policy primarily requires the determination of whether the impact is likely to cause a significant adverse effect or an adverse effect. As

identified Appendix 10.2, these thresholds are defined as the SOAEL and the LOAEL respectively. Whilst the term 'level' is used, the definition of these thresholds can take account of not only the noise level, but other factors including the number of times it occurs, when it occurs and the sensitivity of the receptor experiencing the noise impact.

10.3.77 Consequently, as it states in the NPSE with reference to SOAEL:

"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."

10.3.78 Therefore, the thresholds for LOAEL and SOAEL are set by the assessor, based on prevailing evidence regarding the impact of that source on the relevant receptors. They might reflect what has been used elsewhere but should not be used simply because they have been used previously – a tailored approach is required.

10.3.79 Across the various government policy and guidance documents, the requirements are the same:

- Impacts above SOAEL are to be avoided in the context of Government policy on sustainable development; and
- Impacts above LOAEL but below SOAEL are to be mitigated and reduced to a minimum, again, in the context of Government policy on sustainable development.

10.3.80 As mentioned above, for impacts between LOAEL and SOAEL, the NPSE explains that:

"all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur."

10.3.81 In any situation, whether or not a significant adverse effect is occurring depends on the final exposure and not just the change that brought it about. Consequently, the terminologies of major, moderate or minor impact, in themselves, have no bearing on whether the resulting effect is significant. However, they can be helpful in giving a non-numerical indication of the size of the change in noise environment that might occur.

10.3.82 It should be noted that if the resulting exposure is below SOAEL, then regardless of the size of the change, any resulting effect would not be considered significant for the purposes of EIA. However, in order to comply fully with policy, reasonable steps must be taken to mitigate and reduce to a minimum those receptors exposed to noise from the source between LOAEL and SOAEL.

10.3.83 The LOAEL and SOAEL thresholds are typically set out for residential receptors as these have the highest sensitivity of the receptors being assessed. Receptors of medium sensitivity are generally less sensitive and would usually warrant higher threshold values of LOAEL and SOAEL.

10.3.84 The significance criteria for each element of the assessment are set out below.

Assessing Significance

Construction Activity Noise

10.3.85 The significance of potentially adverse demolition and construction noise effects will be determined using the thresholds set out in Table 10.6. The values are based on the guidance within Annex E of BS 5228-1:2009+A1:2014 and the effects that construction noise can have on those exposed to it. The thresholds are expressed in terms of current Government policy (i.e., LOAELs and SOAELs).

Table 10.6: Threshold of potential effects of construction noise at residential receptors

Effect	Time Period	Threshold Value ($L_{Aeq,T}$)[a]
LOAEL	Day (07:00 – 19:00)	65 dB
	Evening (19.00 – 23.00)	55 dB
	Night (23.00 – 07.00)	45 dB
SOAEL	Day (07:00 – 19:00)	75 dB
	Evening (19.00 – 23.00)	65 dB
	Night (23.00 – 07.00)	55 dB

Note:

[a] These effects are expected to occur if the programme of works indicates that the relevant threshold values are likely to be exceeded over a period of at least one month. The values apply to a location one metre from a residential building façade containing a window, ignoring the effect of the acoustic reflection from that façade.

10.3.86 The predicted demolition and construction noise levels for activities in each area of the Site will be presented for all the receptors where the LOAEL will be exceeded for those activities.

10.3.87 Where necessary, specific additional measures to avoid any significant adverse effects on health and quality of life, and to mitigate and reduce to a minimum any adverse effects, are identified.

Construction Vibration

10.3.88 Although the concepts regarding LOAEL and SOAEL in Government policy refer only to noise exposure, it is helpful to adopt the same principles when assessing vibration impact and effect. Table 10.7 sets out the construction vibration exposure thresholds based on the guidance within Annex B of BS 5228-2:2009+A1:2014.

Table 10.7: Threshold of potential effects of construction vibration (cosmetic damage) at residential receptors

Effect	Threshold Value (Peak Particle Velocity PPV, mm/s)[a]
LOAEL	0.5
SOAEL	1.0[b]

Notes:

[a] This is the level at a residential receptor.

[b] Guidance in BS 5228-2:2009+A1:2014 states that this level of exposure can be tolerated by those affected if prior warning and explanation has been given. It goes on to state that a level of 10 mm/s is likely to be intolerable in most building environments for any more than a very brief exposure.

10.3.89 BS 5228-2 states that damage to structures as a result of construction vibration is rare, and whilst it provides guide values for transient vibration above which cosmetic damage may occur (starting at 15mm/s), this type of vibration would not be expected from rotary bored piling. However, vibratory ground compaction could give rise to greater levels of transient vibration. Furthermore, the guide values for potential cosmetic damage stated in BS 5228-2 are significantly lower than the thresholds for structural damage. With regard to listed buildings and heritage assets, consideration must be given to the assets condition, susceptibility to damage/vulnerability of the structure/décor. As such a detailed condition survey and subsequent assessment should be undertaken prior to any works that may give rise to vibration within 75m of such receptors. Where appropriate this would include development of bespoke criteria.

Completed Development – Fixed Plant and Other Commercial Noise Sources

10.3.90 Noise from fixed building services plant and other commercial noise sources is proposed to be subject to a planning condition requiring that a noise assessment will be undertaken following the principles of the methodology set out in BS 4142:2014+A1 2019 and reference the background sound levels and target sound levels identified in this chapter. No local policy or criteria relating to noise from these sources have been identified.

10.3.91 The methodology presented in the standard provides an initial estimate of impact based on the difference between the sound from the source being assessed (including any corrections for acoustic features of the sound that would be present at the receptors and may increase the extent of the impact i.e. the rating level), and the existing background sound level at the receptor location. The greater the difference the greater the magnitude of the initial impact estimate. BS 4142 states that:

- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context (see below);
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context (see below);
- 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 (see below); 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.

10.3.92 The standard states that while the difference between the rating level and background sound level provides an initial estimate of the impact, other factors should be considered in terms of the context, such as the absolute noise levels and how the character and level of the specific sound source relates to the existing sound environment.

10.3.93 Regarding consideration of the absolute levels of sound, the relevant guideline values provided in BS 8233:2014 can be used. Table 4 of that standard sets out desirable internal levels to be achieved in new dwellings from external sources. Information is also provided

regarding desirable levels of sound for external amenity spaces associated with dwellings. The various values from BS 8233:2014 are summarised in Table 10.8.

Table 10.8: Summary of Guideline Sound Values from BS 8233:2014

Location (activity)	Time Period	Desirable Sound Level not to be exceeded (dB)
Inside Bedrooms and Living Rooms (resting)	Day (07:00 – 23:00)	35 - 40 dB $L_{Aeq,T}$
Inside Bedrooms (sleeping)	Night (23:00 – 07:00)	30 - 35 dB $L_{Aeq, T}$
Inside Dining Room/ Area (dining)	Day (07:00 – 23:00)	40 - 45 dB $L_{Aeq,T}$
External Amenity Space	Day (07:00 – 23:00)	50 - 55 dB $L_{Aeq,T}$

10.3.94 The lower values shown in Table 10.8 are generally regarded as the LOAEL for steady external sound, i.e., no adverse effect due to the impact of the sound would be expected below these values. If the sound has certain characteristics, it could be appropriate to consider a lower value as the LOAEL. Alternatively, a correction for those characteristics could be applied to the predicted levels (i.e., use of the rating level including any corrections for acoustic features rather than use of the specific level).

10.3.95 Any proposed future onsite receptors have not been exposed to the existing baseline noise levels, and therefore it is not necessarily appropriate to consider the impact in terms of the difference from the background sound level arising from fixed plant and commercial sources. For proposed onsite receptors the predominant consideration would be the absolute noise levels at the receptor in the context of the desirable levels in Table 10.8 and consideration of the impact of any acoustic characteristics of the source that would be present at the receptor location. This should be considered as part of the detailed site suitability assessments that would be undertaken in the Reserved Matters Applications for each phase of the development. Should any commercial uses be developed in advance of the surrounding future noise sensitive development, consideration should be given to good acoustic design and layout of the receptor and the commercial uses and achieving the internal ambient noise level requirements at likely locations of proposed dwellings i.e., mitigation at source to minimise noise emission to future onsite receptors.

Completed Development – School Playgrounds and Pitches

10.3.96 Although the Government's overall policy on noise would apply to the assessment of recreational activities, there are no recognised guidance documents which set out numerical significance criteria to assess noise specifically from these source types. Therefore, significance of noise effects associated with the school playgrounds and sports pitches have been assessed by following the fundamental principles of the NPSE, with specific reference to the guidance given in the PPG:N and the accompanying noise exposure hierarchy table (see Table 1 of Appendix 10.2).

10.3.97 For existing receptors, account has been taken of the pre- and post-development acoustic environment both by comparing the predicted operational noise levels (L_{Aeq}) with the existing background ($L_{A90,T}$) and ambient ($L_{Aeq,T}$) noise levels between the hours of 08:00 – 19:00, and by considering the absolute noise level produced at the receptor locations by activities on the Site.

10.3.98 Where operational noise levels do not exceed the background level, this has been taken as an indication that the LOAEL has not been exceeded, since it is unlikely that the resulting change to the ambient noise level will cause any discernible change in behaviour, attitude, or other physiological response (see the noise exposure hierarchy table in Table 1 of Appendix 10.2).

10.3.99 For new receptors within the Site, the impacts of sound from playgrounds and pitches will need to be considered as part of the site suitability assessment (contained in Appendix 10.3) and the subsequent detailed assessments that will be undertaken as part of the Reserved Matters Applications when the respective locations are determined.

10.4 Assumptions and Limitations

10.4.1 The assumptions used for each assessment have been identified within this ES chapter and its supporting appendices. The limitations and uncertainty in the assessment are discussed below.

10.4.2 Throughout the assessment process, measures have been taken to minimise as far as possible any uncertainty in the consideration of the potential noise and vibration impacts and effects that may arise as a result of the Proposed Development.

Baseline Surveys

10.4.3 With regards to the baseline surveys, the noise monitoring equipment used conformed to the Class 1 specification described in BS EN 61672-1:2003, with all sound level meters within 2 years of laboratory calibration, and all acoustic calibrators within 1 year of laboratory calibration. Monitoring equipment underwent field calibration before and after every unattended survey and every set of attended measurements. In all cases, no significant drift in calibration was observed. From the original survey, one noise meter was tampered with and therefore additional measurements were obtained in February 2023.

10.4.4 Traffic flows during the surveys were considered representative of normal flows and the airport was operating normally throughout the survey period.

Future Baseline and Evolution

10.4.5 The baseline conditions will continue to be governed by changes in the dominant noise and vibration sources affecting the site. There is not expected to be any material increase in road traffic noise due to investment in sustainable transport measures and mode shift (for further details see Chapter 9 Transport and Access).

10.4.6 Based on information provided by Network Rail about the increase in train paths per hour could double, it was not clear whether this would apply to every hour however as a worst-case scenario it is considered that it could. Consequently, a 3 dB uplift on the measured ambient noise levels has been incorporated into the assessment.

10.4.7 The analysis of the likely growth in aircraft activity at Oxford Airport indicates that a 21% growth in activity is a reasonable worst case. This would not result in a material change to the noise environment compared to existing aircraft activity.

Construction

10.4.8 Prior to the appointment of a contractor, detailed information is not yet available regarding the type, number and percentage on-time of construction equipment that will be employed from each activity. Consequently, the assessment has been based on assumptions of the likely plant and equipment and their expected typical use over a working day. These assumptions are set out in Appendix 10.5.

10.4.9 There are similar limitations regarding prediction of construction vibration; the propagation of vibration is complex and heavily dependent on local ground conditions, and it is extremely difficult to predict accurately. There is some historical data in the standard (Part 2 BS 5228:2014+A1:2019) for piling, however there are no reference datasets for vibratory ground compaction using rollers. Therefore, an empirical calculation has been undertaken – the calculation method is considered precautionary. It is assumed that the historic piling data listed in Table 10.3 provides a reasonable proxy for the likely levels of vibration that would be experienced at a receptor at a similar distance. This includes the assumption that the type of ground at the Site is sand/gravel and clay with some mudstone.

10.4.10 The distances between where piling activities may take place and the receptors are based on the closest point between the receptors and the locations where piling is anticipated to occur. The exact locations of the piling are unknown at this stage and may even result in the distance being greater than assumed in the predictions. It is also assumed that there is no vibration sensitive equipment that requires further consideration within the existing laboratories at Begbroke Science Park.

10.4.11 The predictions from vibratory ground compaction have been undertaken assuming the length of the drum is 2.1m, that only 1 drum is vibrating, and the maximum amplitude of drum vibration is 1.7mm. The predictions have also been undertaken for a 50% level of probability i.e., there is a 50% chance that these levels will be exceeded. As indicated above, this empirical calculation method is considered to have a high degree of uncertainty and also tends towards the worst case.

Fixed Building Services Plant and Other Commercial Noise Sources

10.4.12 Detailed information regarding the type or number of building service equipment units is not yet available. It is anticipated that should consent be granted, a planning condition would require that prior to installation a plant noise assessment would be submitted to and approved by the relevant planning authority. As part of this process, sound from the proposed plant installations will be assessed and, if required, mitigated to demonstrate compliance with national and local noise policy.

10.4.13 For other commercial sources of noise, there is not yet any certainty about the layout of these units and where the areas for any deliveries and servicing would be located. It is therefore recommended that should consent be granted, this is controlled by a planning condition which requires a noise assessment to be submitted for any B2 and B8 uses in order to demonstrate compliance with Government and local policy and with any required mitigation identified.

Schools

10.4.14 With regard to the impact from school playgrounds and pitches, there is no certainty regarding where these will be located within the zones identified in the parameter plans for

these uses. The predictions are based on information supplied by the project team and are considered indicative.

Traffic Data

10.4.15 Traffic data for the assessment were based on model outputs provided by the project traffic consultant and are subject to the limitations and assumptions which are outlined in detail in Chapter 9: Transport and Access. A summary of the most salient points is set out below:

- 2033 Reference Case includes traffic generated by the committed developments as agreed with OCC and an agreement that there would be no growth in background traffic.
- For construction traffic, the model is only available for 2018 Baseline and 2033 Reference Case (which is assumed to have the same background traffic as 2028). The only difference between the 2028 and 2033 scenarios would be the level of committed development built out. However, the committed developments which would have the most effect on roads surrounding the development would be largely built out by 2028.
- Construction traffic generation has been manually assigned to the 2033 Reference Case based on fixed HGV routes and construction workers travel based on Census distribution.
- A package of sustainable transport measures is proposed to be jointly funded by the PR sites. If only the Proposed Development comes forward, there would be less sustainable transport measures funded, which may affect the mode share of the Proposed Development (i.e. less mode shift if the Proposed Development is delivered without the other PR sites and the associated package of sustainable transport infrastructure).

10.4.16 While it is not feasible to remove all uncertainty when assessing the possible impact of a proposed development, it is considered that the approaches taken are considered to have resulted in a technically robust outcome based on the data available to inform the assessment at the time of writing.

10.5 Baseline Conditions

Baseline Noise Survey

10.5.1 A baseline noise survey was undertaken between the 20th and 22nd September 2022 to establish the existing sound environment at the Site and at locations representative of nearby noise sensitive receptors.

10.5.2 This was supplemented by further monitoring undertaken between the 2nd and 3rd February 2023. The results of the surveys will be used to calibrate the acoustic model, set target noise levels for mechanical services plant, and inform the acoustic design of the Site.

10.5.3 The September 2022 survey comprised 4 static monitoring locations (LT1 to LT4) which were intended to be installed for a period of 24 hours, and 6 short term monitoring locations (ST1 to ST 6). The supplementary February 2023 survey included a repeat of the measurement at position LT4 and additional attended and unattended monitoring at ST2a/LT5. Table 10-9 below presents a description of the monitoring locations and what they represent. Each monitoring location is identified in Figure 10-2.

Figure 10.2: Noise Monitoring Positions

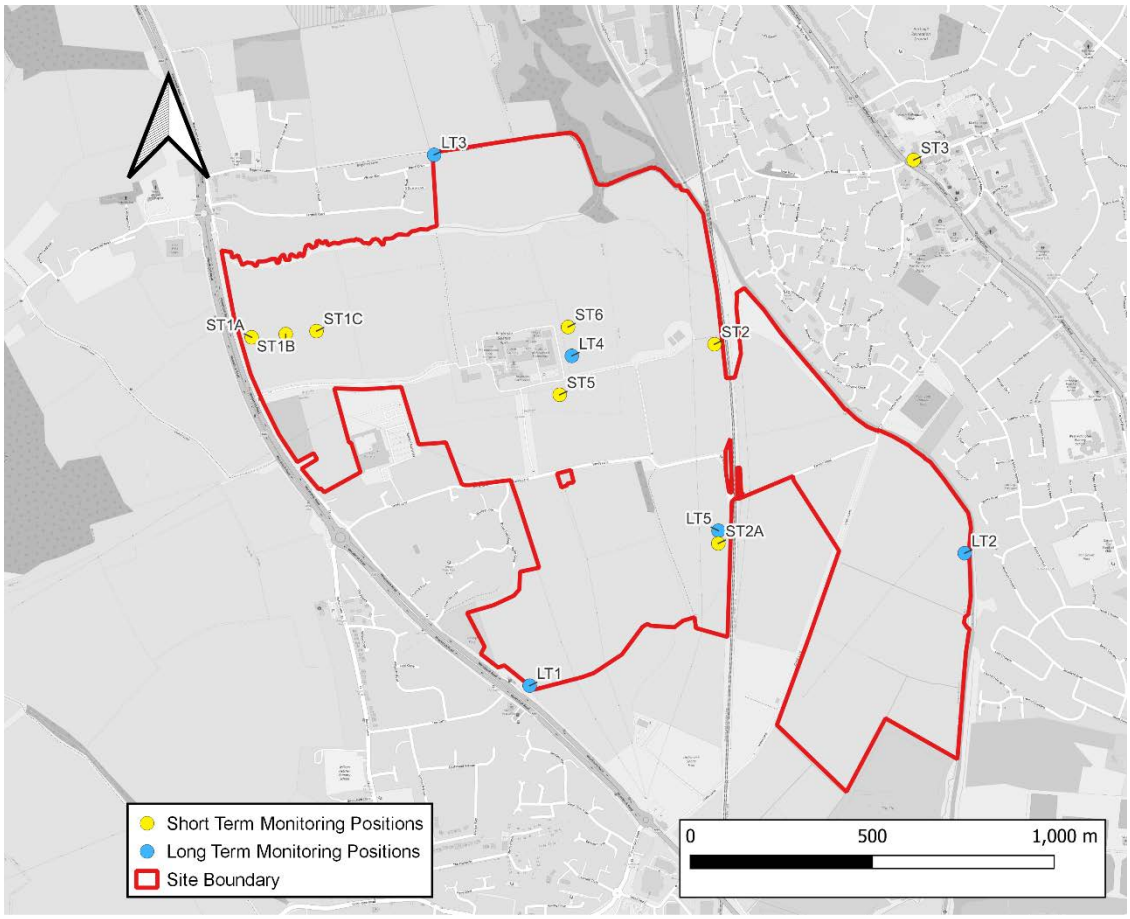


Table 10.9: Baseline Noise Survey Locations

Monitoring Location	Location Details	Dominant Sources
LT1	South western boundary of development site. Approximately 30m from the A44.	Road traffic noise from the A44 and some contribution from the Shell petrol garage
LT2	Eastern boundary of the development site near existing receptors and the canal.	Distant road traffic noise and railway passbys.
LT3	Northern boundary of development site, approximately 20m from nearest existing receptor.	Road traffic noise from A44.
LT4	Eastern side of the Begbroke Science Park to capture levels from existing mechanical services plant. Approx 30m from the Impact and Shock Mechanics Lab.	Mechanical services noise from Science Park.
LT5/ST2a	Boundary of the western parcel of the site with the rail line to capture noise	Railway noise with some distant road traffic noise.

Monitoring Location	Location Details	Dominant Sources
	levels from railway incident on the Site. 15 m from rail line	
ST1	North west boundary of the development site at varying distances from the A44 (50m 100m and 200m) to capture road traffic noise.	Road traffic noise from the A44. When aircraft were departing from Oxford Airport (OXF), aircraft noise was dominant.
ST2	Boundary of the western parcel of the site with the rail line.	Railway noise with some distant road traffic.
ST3	Capturing noise levels in Kidlington, approximately 10m from the A4260.	Road traffic noise. Some distant aircraft noise from aircraft associated with Oxford Airport (OXF).
ST4	Less than 1m from the A4260, capturing levels from southern roads (A4260, A44 and A34)	Road traffic noise.
ST5	To the south east of Science Park, capturing levels from rooftop plant (10m off the ground). Measurement location approximately 40m away.	Plant noise.
ST6	To the north east of the Science Park capturing levels from the extract fan located at a height of approximately 6m off the ground. The monitoring position was approximately 16m from the extract fan.	Plant noise when the plant is operational.

10.5.4 All measurements were undertaken at a height of approximately 1.5m above ground level and in free-field conditions.

10.5.5 A summary of the results of the surveys are presented in Table 10.10 for the long-term measurements and Table 10.11 for the short-term measurements.

Table 10.10: Summary of Long-Term Measurements

Location	Time (T)	Average $L_{Aeq,T}$ (dB)	Average $L_{A90,T}$ (dB)	Average $L_{A10,T}$ (dB)	Representative $L_{Amax,T}$ (dB)*
LT1	Day (07:00 – 23:00)	57	49	60	N/A
	Night (23:00 – 07:00)	53	35	57	68
LT2	Day (07:00 – 23:00)	53	46	54	N/A
	Night (23:00 – 07:00)	49	39	50	69
LT3	Day (07:00 – 23:00)	51	42	52	N/A
	Night (23:00 – 07:00)	44	35	46	62

Location	Time (T)	Average $L_{Aeq,T}$ (dB)	Average $L_{A90,T}$ (dB)	Average $L_{A10,T}$ (dB)	Representative $L_{Amax,T}$ (dB)*
LT4	Day (07:00 – 23:00)	49	43	50	N/A
	Night (23:00 – 07:00)	46	42	45	63
LT5	Day (07:00 – 23:00)	64	48	57	N/A
	Night (23:00 – 07:00)	64	43	56	88

Note: The representative $L_{Amax,F}$ noise levels used in the assessment are the 10th highest $L_{Amax,\ 1\ minute}$ levels recorded during the night time period (23:00 – 07:00) - see Appendix 10.3 for more details.

Table 10.11: Summary of Short-Term Measurements

Location	Date	Time (T)	Duration	Average $L_{Aeq\ 15\ mins}$ (dB)	Average $L_{A90,T,\ 15\ mins}$ (dB)	Average $L_{A10,15mins}$ (dB)	$LA_{max,15mins}$ (dB)
ST1A	21/09/ 2022	11:51-12:06	15:00	59	49	59	69
	22/09/2022	14:03-14:18	15:00	65	53	64	76
ST1B	21/09/ 2022	12:07-12:22	15:00	57	46	57	68
	22/09/2022	14:20-14:35	15:00	64	52	62	75
ST1C	21/09/ 2022	12:26-12:41	15:00	60	47	58	75
	22/09/2022	14:36-14:51	15:00	61	52	59	75
ST2	21/09/ 2022	09:07-10:16	69:00	73	45	55	101
	21/09/ 2022	10:17-11:03	46:00	51	37	49	70
ST2a	02/02/2023	12:30–12:45	15:00	61	53	65	74
	02/02/2023	12:45–13:00	15:00	66	50	62	89
	02/02/2023	13:00–13:15	15:00	69	52	66	91
	02/02/2023	13:15–13:30	15:00	63	52	64	89
	02/02/2023	13:30 – 13:45	15:00	58	50	61	70
	02/02/2023	13:45 – 14:00	15:00	68	50	61	89
	02/02/2023	14:00 – 14:15	15:00	64	48	57	88
	02/02/2023	14:15 – 14:30	15:00	70	49	60	93
	02/02/2023	14:30 – 14:45	15:00	68	50	62	92
ST3	21/09/2022	14:32-14:47	15:00	69	54	69	77
	22/09/2022	10:09-10:24	15:00	73	54	69	90
	22/09/2022	12:14-12:29	15:00	77	55	69	97
	22/09/2022	15:59-16:14	15:00	68	55	68	80
ST4	21/09/2022	13:51-14:06	15:00	81	66	78	93
	22/09/2022	10:43-10:58	15:00	81	67	78	91
	22/09/2022	11:32-11:47	15:00	82	66	78	93

Location	Date	Time (T)	Duration	Average $L_{Aeq\ 15\ mins}$ (dB)	Average $L_{A90,T,\ 15\ mins}$ (dB)	Average $L_{A10,15mins}$ (dB)	$LA_{max,15mins}$ (dB)
	22/09/2022	15:20-15:35	15:00	82	67	79	91
ST5	20/09/2022	16:09-16:26	15:00	51	49	51	57
ST6	20/09/2022	16:34-16:49^	15:00	52	45	54	56
	22/09/2022	09:32-09:47*	15:00	63	59	61	78

10.5.6 The short-term measurements supplement the long-term data and will be compared against the noise levels at the nearest or most representative long term monitoring location. Based on these measurements, the use of the long-term monitoring data is either determined to be valid for that location or where appropriate a suitable correction factor or offset applied. Where these levels have been used in the assessment of impacts from various sources or in the setting of target levels in the chapter, the relevant tables within the chapter clearly identify which monitoring location has been used to represent which receptor.

10.5.7 Important Areas are those exposed to high levels of road traffic and railway noise identified by DEFRA through Strategic Noise Mapping. It is noted that there is a Noise Action Plan Important Area on the A44 at Yarnton and three smaller areas located on the A44 north of the site access. This is due to the impact of high levels of existing road traffic noise along the A44 and the proximity of the affected receptors to the road.

Baseline Vibration Survey

10.5.8 To characterise and quantify the existing levels of vibration resulting from the Cherwell Valley Rail Line which is frequently used by both passenger and freight trains, Vibration Dose Value (VDV) measurements of train passes were undertaken at ST2a (shown on Figure 10-2) The measurements were carried out following the principles of BS 6472-1:2008.

10.5.9 Measurements were undertaken using a transducer mounted on top of a ground spike which was pushed into soft ground approximately 15m back from the railway line.

10.5.10 A measurement was started as a train approached the monitoring position and was stopped as it moved away. The measurements indicated that the weighted acceleration in the vertical axis was the dominant direction of vibration. In accordance with BS 6472-1:2008, only this axis has been considered further.

10.5.11 The number and type of measured train passes together with the average and maximum VDV_b results for each train type are summarised in Table 10.12.

Table 10.12: Summary of Measured Vibration Dose Values for train passes

Train Type	No of passes	Average VDV_b (z axis)	Max VDV_b (z axis)
Passenger	6	0.014	0.020
Freight	4	0.021	0.022

10.5.12 The observation of the surveyors was that vibration from the trains was not perceptible at the measurement locations. The relatively low levels of recorded vibration reinforce this observation.

Future Baseline

10.5.13 In the absence of the Proposed Development, the future sound environment is likely to continue to be dominated by road traffic, aircraft, and rail noise. Most nearby committed developments are for new dwellings which are not expected to materially change the noise environment (although they may generate additional road traffic noise).

10.5.14 It is understood that there are emerging proposals for National Rail upgrades to the rail line which would be likely to increase the number of train movements using the train line. Information provided to the transport consultant by Network Rail has indicated the number of train paths per hour could double. At this stage, it is unclear whether this is likely to be the case for every hour; however, it has been assumed that this could happen as a worst case scenario. Therefore a 3 dB uplift in railway noise has been assumed compared to the levels measured during the baseline noise survey. Note that unlike passenger trains, freight trains the trains only run when needed; consequently, there are often occasions where freight train paths are booked but the trains do not run.

10.5.15 The screening exercise undertaken to consider the impact of operational road traffic associated with the Proposed Development (and reassignment of traffic on the network) indicated that where increases in road traffic noise were predicted, these would be below the threshold at which a detailed assessment of road traffic was required. This is primarily due to OCC's transport strategy promoting sustainable methods of transport at preventing growth in background traffic. On this basis is it not anticipated that there would be any material increase in traffic noise on the surrounding road network in the future, and on some links a decrease is predicted, however as a worst-case scenario it will be assumed that the existing level of traffic noise prevails.

10.5.16 Oxford Airport has experienced considerable growth in recent years, particularly since 2019 – a 53% increase in flights was recorded between 2019 and 2022. This is primarily as a direct result of new aviation businesses being established at the airport and could also be an after effect of COVID lockdowns, the lack of commercial flights and reductions in cost of business aviation to buoy the market. It is unlikely the airport will continue to grow at this pace and the Airport expects growth rates in training activity and business aviation to grow by 1-2% and 3 to 5% respectively between 2020 and 2025. Training activity has seen a higher level of growth (20%) between 2020 and 2022 but this is considered unlikely to be representative of longer-term trends. Following, a review undertaken by the project aviation consultant (York Aviation)[32], it is estimated that the level of growth in airport activities between 2022 and 2040 is likely to be 21% as a worst-case scenario. On this basis it is not expected that the growth in aviation would materially change the baseline noise conditions from those measured during the surveys, especially given the sectors drive towards more environmentally friendly and quieter aircraft engines and the replacement of older noisier aircraft with newer quieter counterparts.

Summary of Receptors and Sensitivity

10.5.17 It would not be proportionate to predict the noise levels at every receptor that may be affected by noise from the Proposed Development. Receptor locations are selected that generally represent the closest existing sensitive receptors to the Site, on the basis that this would usually represent the worst affected receptors. This would mean that the impact at other locations would be no greater, and in many cases lower than at the receptors included in the assessment.

10.5.18 Two future offsite receptors have also been included to give an indication of the likely effects on receptors that are not yet constructed but may be either constructed or in the process of construction during the construction or operational phase of the Proposed Development. Table 10.13 lists the various receptors used in the assessments for the different noise sources along with an indication of the receptor type e.g., residential, commercial and education, and the associated sensitivity of the receptor. The receptor locations are identified in Figure 10.3.

Figure 10.3 Noise Sensitive Receptor Plan (existing receptors and proposed offsite receptors)

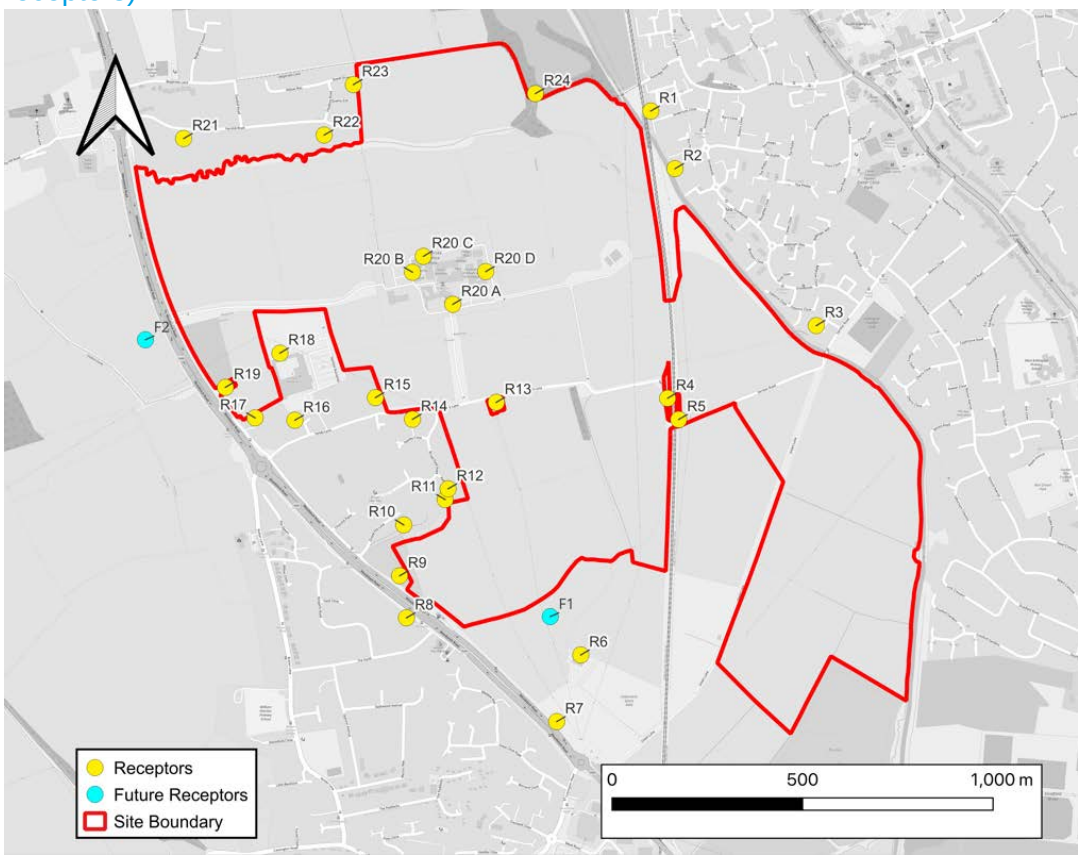


Table 10.13: Summary of Receptors, Type and Sensitivity

Receptor	Type	Sensitivity (Value)	Inside Red Line Boundary?
Existing			
R1 18 Andersons Close	Residential	High	No

Receptor	Type	Sensitivity (Value)	Inside Red Line Boundary?
R2 26 The Homestead/ Canal users 1	Residential	High*	No
R3 10 Newport Close/ Canal users 2	Residential	High*	No
R4 Crossing Caravans	Residential	High	No
R5 Crossing Cottage	Residential	High	No
R6 Littlemarch Playing Fields	Sports and recreation	Medium	No
R7 Rose Cottage	Residential	High	No
R8 105 Woodstock Road	Residential	High	No
R9 128 Woodstock Road	Residential	High	No
R10 Gravel Pits Lane	Residential	High	No
R11 4 Ryder Close	Residential	High	No
R12 3 Ryder Close	Residential	High	No
R13 88 Sandy Lane	Residential	High	No
R14 Stanley Close	Residential	High	No
R15 31 Sandy Lane	Residential	High	No
R16 Poppy Close	Residential	High	No
R17 204 Woodstock Road	Residential	High	No
R18 Garden Centre	Commercial	Low	No
R19 226 Woodstock Road	Residential	High	No
R20a Science Park 1 (Begbroke Farm House - Grade II listed)	Education	Medium	Yes
R20b Science Park 2	Education	Medium	Yes
R20c Science Park 3	Education	Medium	Yes
R20d Science Park 4	Education	Medium	Yes
R21 14 Fernhill Road	Residential	High	No
R22 74 Fernhill Road	Residential	High	No
R23 14 Rowel Drive	Residential	High	No
R24 Rushy Meadows SSSI	Ecological	Medium	No
Future (offsite)			
F1 Former Piggery and Land North of Woodstock Road.	Residential	High	No
F2 PR9 Site Receptor	Residential	High	No

Note * Sensitivity assumed to be high for canal users if they are moored at these locations on a long term basis.

10.5.19 It is also noted that the Proposed Development will introduce new sensitive receptors within the Study Area. Where appropriate, the effects of demolition and construction noise and vibration at these receptors will be considered in the Chapter, while effects during the operational phase of the development will be considered as part of the outline site suitability assessment in Appendix 10.3. There is not yet certainty regarding the location of introduced receptors which may be completed and occupied in relation to where demolition and construction works may be ongoing. Therefore, rather than identifying specific receptors, reference has been made to the distances from the relevant sources at which adverse and significant adverse effects would be anticipated. This can then inform the management of construction noise and vibration impacts by the Contractor.

10.6 Embedded Mitigation (Scheme Design and Management)

Demolition and Construction

10.6.1 Measures will be undertaken during the construction phase in order to minimise disruption and manage the construction noise and, where applicable, vibration impacts of the Proposed Development.

10.6.2 It is standard practice that, prior to construction commencing, a CEMP is agreed with the Local Planning Authority. This would include measures to minimise the environmental impact during this phase. An Outline CEMP is provided as Appendix 6.1 to the ES.

10.6.3 It is anticipated that should the scheme be granted planning consent; production of a detailed CEMP(s) will be required by planning condition in accordance with the principles stated in the Outline CEMP. This will include the requirement for a Noise and Vibration Management Plan, describing the mitigation measures that will be implemented.

10.6.4 Required mitigation measures included in the Outline CEMP of relevance to noise and vibration are set out below:

- Selection of appropriate equipment and construction methods, i.e., hydraulic plant will be used in preference to pneumatic plant where possible.
- Plant and equipment will be maintained in good working order and fitted with silencers and acoustic panels where appropriate.
- All plant will be switched off when not in use or throttled down between periods of use.
- Acoustic enclosures and temporary hoardings/screens will be used where required.
- Works will take place during agreed site hours and there will be appropriate management of working hours for noisier tasks.
- Broad band type reversing warnings should be used on mobile plant in preference to tonal warnings in order to minimise intrusion.
- Site personnel instructed on Best Practicable Means (BPM) to reduce noise and vibration as part of their site induction training and as required prior to specific work activities.

- Liaison with residents in advance of works commencing and on an ongoing basis to provide information regarding the programme.
- Plant to be located as far as reasonably practicable from noise-sensitive receptors.

10.6.5 With the use of BPM, the noise from these activities would be mitigated and managed as far as is practicable.

10.6.6 The predicted noise levels for construction of the Proposed Development are based on estimates of the plant and equipment likely to be used for the construction activities, as well as their usage during a typical working day. The use of other specific BPM measures will be considered for all construction works associated with the Proposed Development and described in the relevant CEMP, when detailed information regarding the proposed construction methods are available.

Completed Development

10.6.7 The Proposed Development includes buffer zones of 10m to major infrastructure (i.e., adjacent major roads and the railway) to aid in lowering noise levels at the potential future façades. These zones are illustrated in the Land Use and Development Zones Parameter Plan.

10.6.8 As discussed in Appendix 10.3, the Begbroke Development Specification provides 'Development Principles' to inform the subsequent Reserved Matters Applications, Area Briefs and Design Guides. These include provision for schools to be sited and designed to provide a suitable external noise environment and for school buildings to be naturally ventilated where possible. In addition, noise attenuation in the form or fencing or bunding will be delivered adjacent to the A44 and railway to achieve a 10 dB reduction in noise levels at the sensitive receptors where this is needed to create a reasonable noise environment. Any noise generating uses which cannot be sufficiently mitigated will be located away from uses that are considered sensitive (i.e. residential dwellings and social infrastructure uses).

Where it has been identified in the site suitability assessment in Appendix 10.3 that specific mitigation will be required to achieve the required ambient noise levels on the school playing fields, this has been considered as inherent mitigation in the prediction of the noise levels arising from the use of the associated pitches and playing fields on existing receptors (as presented in this chapter) and proposed future receptors (as considered in Appendix 10.3. This includes the proposed 2m high barrier around the southern and western boundary of Primary School 2 and the 2.5m high barrier around the boundary of Secondary School 2 to minimise noise from the railway.

10.7 Assessment of Effects - Construction Stage

Construction Traffic Noise

10.7.1 Comparison of BNLs indicated that a detailed assessment was not required and there would not be any significant adverse effects.

Construction Activity Noise

10.7.2 The predicted construction noise levels for each development zone (i.e. Begbroke Hill, Begbroke Science Park, Parkers Farm and Foxes Cover are presented in Tables 2 to 5 of

Appendix 10.5 for the receptors where the predicted levels would exceed the daytime LOAEL threshold set out in Table 10.6.

10.7.3 As a conservative approach, the predictions reflect the unmitigated levels of construction activity and tend towards the worst case i.e., with plant operating near the Site boundary in proximity to that receptor. In practice, the noise level from construction activities will vary at the receptor depending on where works are concentrated within the Site boundary in relation to each receptor. Once plant is at least 220m from a receptor, the noise levels at the receptor from that activity would be below the LOAEL.

10.7.4 The cells that are shaded grey in Appendix 10.5 indicate where the SOAEL threshold is likely to be exceeded. However as outlined in Table 10.6, a significant adverse effect would only occur if the SOAEL threshold was exceeded for a period of one month or more.

10.7.5 In line with Government policy, where the SOAEL criterion (threshold and duration) is exceeded, significant adverse effects should aim to be avoided through mitigation. Where the level is between LOAEL and SOAEL or above SOAEL but will not last for one month the effect is not significant, but policy dictates that all reasonable steps should be taken to mitigate and minimise these adverse effects.

10.7.6 The subsequent sections discuss the prediction demolition noise levels and the construction noise predictions which are set out in Appendix 10.5.

Demolition Noise

10.7.7 The shortest distance between the locations where it is proposed buildings will be demolished and the offsite receptors is around 230m. At this distance the noise level from demolition activities would be 59 dB $L_{Aeq,T}$ and therefore below the LOAEL. If multiple demolition activities were to occur at once (i.e., at 3 locations all a similar distance from the same receptor) then there may be some minor exceedances of the LOAEL however these would not be considered significant.

10.7.8 With regard to the existing onsite receptors at Begbroke Science Park (located within the red line boundary), some of the buildings to be demolished are in close proximity to those which would remain occupied.

10.7.9 The minimum distance required between the works and the receptors to avoid exceeding the SOAEL threshold is 35m. Therefore, when Units 5&6 (the building to the west of the Christian Building) is demolished, significant adverse effects are likely to be avoided. However, the demolition of other buildings within the Science Park, such as those in proximity to the Impact and Shock Mechanics Laboratory could occur within 10-20m of occupied buildings giving rise to noise levels of 80 to 86 dB $L_{Aeq,T}$. Therefore, the threshold level of a significant adverse effect would be exceeded at the Impact and Shock Mechanics Laboratory and the Centre for Innovation and Enterprise. A significant adverse effect would be expected to occur if this level prevailed for one month or more. Given that there are several buildings to be demolished in close proximity it is considered likely that the SOAEL may be exceeded for one month or more. In line with policy these would require mitigation.

10.7.10 It is noted that these buildings appear to be low rise and potentially of lightweight construction, and therefore demolition effects could be lower than predicted using the worst-case assumptions adopted in the calculations.

10.7.11 As demolition works will occur early in the programme, it is not anticipated that any future introduced receptors would be occupied while these works were being undertaken and therefore no significant effects would arise at any introduced receptors.

Begbroke Hill

10.7.12 The construction noise assessment for the Begbroke Hill area (Table 2, Appendix 10.5) indicates that, during the earthworks and groundworks phases, the only receptor where the SOAEL would be exceeded (by 1 – 2 dB) when works are in close proximity to the receptor is receptor R19 (226 Woodstock Road). Given that the Site borders the receptor on three sides of the property boundary, it is anticipated that these noise levels would prevail for one month or more, resulting in a significant adverse effect, requiring mitigation.

10.7.13 At all other receptors listed in Table 2 (Appendix 10.5) the construction noise levels during earthworks and groundworks activities at Begbroke Hill are between the LOAEL and the SOAEL but should be mitigated and minimised as much as practicable.

10.7.14 Lower noise levels are predicted during superstructure and paving activities, with most receptors experiencing levels of below 70 dB during these activities and some predicted to experience levels below the LOAEL (e.g., R16 Poppy Close and R20 Begbroke Science Park).

Begbroke Science Park

10.7.15 The construction noise assessment for Begbroke Science Park area (Table 3, Appendix 10.5) identifies exceedances of the SOAEL (of up to 3 dB) would occur at:

- R15 (31 Sandy Lane) during the earthworks phase only.
- Three Science Park receptors (R20a, R20b and 20c) during the earthworks and groundworks phases.
- R20a (Science Park 1) during paving.

10.7.16 It is possible that these works may prevail for more than one month and therefore would result in a significant adverse effect requiring mitigation. For the other phases of works the predicted noise levels at the above receptors are between LOAEL and SOAEL.

10.7.17 At R13 (88 Sandy Lane) and R14 (Stanley Close) the construction noise levels would be between the LOAEL and the SOAEL during the earthworks, groundworks and paving phases (therefore no significant adverse effect is anticipated), and below the LOAEL during the superstructure works.

Parkers Farm

10.7.18 Table 4 of Appendix 10.5 indicates that, for construction works at Parkers Farm, the SOAEL threshold will be exceeded when the earthworks occur near R13 (88 Sandy Lane) and R20a (Science Park 1) during the earthworks, groundworks and paving phases (assuming works are within 15m of the receptor).

10.7.19 For the other phases of construction works, and at the other receptor locations shown in Table 4 (Appendix 10.5), lower noise levels are predicted, these are either between the LOAEL and SOAEL, or below the LOAEL.

Foxes Cover

10.7.20 The assessment for Foxes Cover (Table 5 Appendix 10.5) identifies exceedances of the SOAEL (by up to 8 dB) are predicted at;

- R4 (Caravans at Sandy Lane), R5 (Crossing Cottage), R10 (Gravel Pits Lane), R11 (4 Ryder Close), R12 (3 Ryder Close), R13 (88 Sandy Lane), and F1 (Former Piggery Residential Development) during the earthworks and groundworks phases.
- R4 and R13 during the paving phase.

10.7.21 At R6 (Littlemarsh Playing Fields), R8 (105 Woodstock Road) and R9 (128 Woodstock Road) the highest noise levels predicted are during the earthworks and groundworks phases, when the predicted levels are between the LOAEL and SOAEL.

10.7.22 In all cases the construction effects would be temporary and short term in duration.

10.7.23 In terms of impacts on introduced receptors within the red line boundary, distances between the works activities and introduced receptors which could be occupied are not known. Taking a worst-case scenario, the noisiest phase of works are earthworks and infrastructure. Once the plant associated with this construction activity is at least 220m from a receptor, the noise levels from that activity would be below the LOAEL and no significant effects would occur. At distances of 70m to 220m from the plant, the noise levels from that activity would be between the LOAEL and SOAEL at the receptor and therefore adverse but not significant adverse effects would be expected. At distances of less than 70m between the plant and the receptor, the threshold for a significant adverse effect would start to be exceeded. If the plant is likely to operate within 70m of the receptor for a period of one month or more, a significant adverse effect would be anticipated which would require mitigation.

Construction Vibration

10.7.24 There is not yet any certainty as to the distance between pile locations and existing sensitive receptors. It is likely that the receptor for which the piling would occur in closest proximity is the existing Begbroke Science Park buildings. It has been assumed that piling would be likely to occur at a distance of at least 15m from the nearest building. The measured historical data presented in Table 10.3 indicates that at such distances the maximum magnitude of vibration would likely be less than 0.3 mm/s PPV. This is below the threshold of the LOAEL presented in Table 10.7 and therefore any vibration effects arising from rotary bored piling would be temporary, short term and not significant.

10.7.25 For vibratory ground compaction, the empirical predictions of vibration levels at 30m from the source, indicate that a level of around 0.9mm/s PPV would occur. This is below the threshold of the SOAEL in Table 10.7 and therefore vibration from ground compaction would be not significant at this distance, but it may be perceptible from time to time.

10.7.26 If vibratory ground compaction is required at distances of less than 30m (as is anticipated at the former landfill site off Sandy Lane and potentially in proximity to other receptors along Sandy Lane and at R4/R5) then a significant adverse effect could occur based on the assumptions made. Therefore, mitigation would be required to avoid this effect. Once a contractor is appointed, the ground types, piling and compaction methodologies will be reviewed and determine if any specific measures are required to mitigate against the effects

of vibratory ground compaction occurring in proximity (less than 30m) to receptors. Suitable mitigation measures will be included in the CEMP, to be secured by planning condition.

10.7.27 With regard to R20a Begbroke Farm House Grade II listed building – it is not anticipated that any vibratory ground compaction or piling would take place within 30m of the receptor. This would normally be sufficient distance to preclude any significant adverse effects in terms of human perception. As indicated previously in the Chapter – the asset will need to be assessed to determine its level of vulnerability to cosmetic and structural damage to determine whether a lower criterion is required to protect the asset.

Additional Mitigation, Monitoring and Residual Effects

Construction Noise

10.7.28 Demolition and construction noise levels are anticipated to exceed the SOAEL and result in significant adverse effects at the following receptors during the associated phases of work:

- R20 Begbroke Science Park during demolition activities;
- R19 (226 Woodstock Road) during the Begbroke Hill groundworks and earthworks phases;
- R15 (31 Sandy Lane) during the Begbroke Science Park earthworks phase only;
- At Science Park receptors (R20a, R20b and R20c) during the Begbroke Science Park earthworks and groundworks phases;
- At R20a (Science Park 1) receptor during the Begbroke Science Park paving phase and during the Parkers Farm groundworks phase;
- At R13 (88 Sandy Lane) during the Parkers Farm earthworks, groundworks and paving phases;
- At R4 (Caravans at Sandy Lane) and R5 (Crossing Cottage), R10 (23 Gravel Pits Lane), R11 (4 Ryder Close), R12 (3 Ryder Close) and R13 (88 Sandy Lane) during the Foxes Cover earthworks and groundworks phases; and
- R4 (Caravans at Sandy Lane) and R5 (88 Sandy Lane) during the Foxes Cover paving phase.

10.7.29 Consequently, mitigation should be employed to avoid these significant adverse effects arising. There are also a number of receptors where the predicted construction noise level is between LOAEL and SOAEL, so all reasonable steps should be taken to mitigate and minimise these effects.

10.7.30 As identified, construction noise will be managed through best practicable means (BPM)[vi] and measures contained in a CEMP. It is difficult to determine precisely the reduction in

[vi] All reasonably practicable measures to minimise construction noise and vibration, having regard to local conditions and circumstances, available technology and financial implications

noise levels that will occur as a result of the adoption of BPM. Therefore, the predictions of construction noise do not make a numerical allowance for the effect of BPM measures and can be considered to be unmitigated levels.

10.7.31 It is recommended that localised acoustic barriers are adopted along the Site boundary in locations in proximity to receptors R4 (Caravans at Sandy Lane), R5 (Crossing Cottage), R13 (88 Sandy Lane), R19 (226 Woodstock Road) during the relevant construction work period to reduce the predicted noise levels to below the SOAEL threshold at these receptors. The barriers should be at least 2.4m high and should have a mass per unit area of at least 10 kg/m^2. Where the barrier obstructs the direct line of sight between the source and the receiver, a reduction of 5-10 dB can be achieved[vii], which would reduce the predicted noise levels to below the SOAEL thresholds and avoid the significant adverse effect at these receptors. However, acoustic barriers would generally not be as effective at mitigating noise at the upper storeys of the surrounding receptors and is unlikely to be as effective at Begbroke Science Park receptors which are generally a couple of storeys high.

10.7.32 Once a contractor is appointed, engagement should be undertaken with occupants of the Science Park Buildings to determine how the effects can be appropriately managed – this could include:

- Alternative working methods to reduce the noise levels generated by demolition activities where practicable.
- Evening, weekend or other out of hours working when the Science Park is not occupied, especially given that the distances to offsite residential receptors are likely to avoid any significant adverse impacts,
- Agreement of a schedule of noisy and quiet working hours to provide some periods of respite,
- Agreement with the Science Park to temporarily not using rooms with the highest levels of noise exposure,
- Investigation of the ventilation systems in the occupied buildings to determine if higher thresholds can be considered if they are mechanically ventilated.
- Alternative temporary accommodation while the noisiest phases of works are undertaken.
- Use of acoustic sheeting/quilts to wrap around the scaffolds of the buildings that are being constructed.

10.7.33 Ultimately, once BPM is employed, the mitigation of the adverse and significant adverse effects will come down to management and stakeholder engagement and liaison.

[vii] BS5228 indicates that as an approximation, attenuation of 5 dB can be assumed when the top of the plant is just visible to the receiver over the noise barrier and 10 dB attenuation achieved when the barrier completely hides the source from the receiver.

10.7.34 With regard to impacts at future introduced receptors within the red line boundary, the measures recommended to mitigate impacts at existing receptors can be applied. These effects will need to be carefully managed by the relevant Contractor as part of the construction programme and phasing, to avoid exposure to noise levels above the SOAEL through programming and localised screening. It is recommended that where practicable, the sequencing of construction activities within each development parcel gives consideration to the first occupiers of the Proposed Development and seeks to avoid them being exposed to noise levels above the SOAEL, through screening, phasing and buffer zones.

Construction Vibration

10.7.35 No significant adverse effects have been identified from piling that require mitigation.

10.7.36 If vibratory compaction works are required within 30m of a receptor, the resulting vibration level would be expected to SOAEL. To mitigate this, if the amplitude of drum vibration was reduced from 1.7mm to 0.9mm, this would allow works to occur between 15 – 30m from the receptor and avoid a significant adverse effect occurring. A review of the vibratory compaction works methods and proximity to the nearest sensitive receptors would be undertaken by the appointed contractor to determine whether additional assessment is warranted and whether vibration monitoring is required.

10.7.37 It is difficult to be prescriptive about the residual level of significance at distances of less than 15m with these mitigation measures in place. It would generally be considered that the Contractor would manage the vibration levels to avoid as much as practicable significant adverse effects arising, although there may be occasions when the level is exceeded particularly when works are occurring in very close proximity to the receptor. It is recommended that attended vibration monitoring is undertaken if there will be vibratory ground compaction within 30m of existing receptors. This can be used to quantify the levels of vibration against the empirical calculation method and determine the level of risk based on these measurements.

10.8 Assessment of Effects - Completed Development

Noise from Fixed Plant and Other Commercial Noise Sources

10.8.1 Target rating levels (including any applicable corrections for the acoustic characteristics of the specific sound) have been set for fixed plant and commercial noise sources in Table 10.14. These are based on the modal background sound levels identified during the survey. The standard (BS 4142:2014+A1:2019) specifically states that the objective is for the typical background sound level to be determined and used in the assessment as opposed to the lowest. The table also indicates the representative survey location which has been used to define the target level. In the case where a receptor is between two monitoring locations a cautious, but robust approach has been adopted i.e., the background sound levels have been assumed to be lower than they are in practice.

10.8.2 The target rating levels defined are equal to the background sound level, which according to BS 4142 would be an indication of the source having a low impact depending on context. Compliance with the target levels above would mean that any noise effects arising from mechanical plant would be not significant.

10.8.3 These criteria will also comply with the requirements of BREEAM Pol 05 Reduction of Noise Pollution[viii]. The targets are a cumulative rating level, i.e., these are the total levels from all plant servicing the Proposed Development that should ideally not be exceeded. Note that these are not proposed noise limits and some exceedances of these values could occur and still meet the requirements of policy. Furthermore, an exceedance of up to 3 dB above background at night would still meet the requirements to gain the credit available under BREEAM Pol 05.

10.8.4 As indicated within BS 4142:2014+A1:2019 the assessment of any fixed building services plant and commercial noise needs to take account of the context in which this occurs. The internal absolute levels are particularly important at night as well as where the background sound levels (L_{A90}) are below 40 dB. An assessment should be undertaken at the reserved matters stage and the requirement for an assessment should be secured by condition.

10.8.5 As indicated in paragraph 10.3.95, for proposed future onsite receptors which have not been exposed to the existing baseline noise environment, the predominant consideration would be the absolute noise levels at the receptor in the context of the desirable levels in Table 10.8 and consideration of the impact of any acoustic characteristics of the source that would be present at the receptor location. This should be considered as part of the detailed site suitability assessments that would be undertaken in the Reserved Matters Applications for each phase of the development. Should any commercial uses be developed in advance of the surrounding future noise sensitive development, consideration should be given to good acoustic design and layout of the receptor and the commercial uses, and achieving the internal ambient noise level requirements at likely locations of proposed dwellings i.e., mitigation at source to minimise noise emission to future onsite receptors.

Table 10.14 Target Fixed Plant and Commercial Rating Levels

Receptor Location	Representative Survey Location	Time Period	Typical Background Sound Level $L_{A90,15mins}$ (dB)	Target Cumulative Rating Level at Receptor $L_{Ar,T}$ (dB)
R1, R2, R4, R5	LT5	Daytime (07:00-23:00)	52	52 $L_{Ar,1\ hour}$
		Night-time (23:00-07:00)	46	46 $L_{Ar,15\ mins}$
R7, R8, R9, R17, R19	LT1	Daytime (07:00-23:00)	53	53 $L_{Ar,1\ hour}$
		Night-time (23:00-07:00)	37	37 $L_{Ar,15\ mins}$
R3	LT2	Daytime (07:00-23:00)	47	47 $L_{Ar,1\ hour}$
		Night-time (23:00-07:00)	38	38 $L_{Ar,15\ mins}$
R10, R16 R18, R14	Between LT5 and LT3	Daytime (07:00-23:00)	48	48 $L_{Ar,1\ hour}$
		Night-time (23:00-07:00)	40	40 $L_{Ar,15\ mins}$

[viii] BREEAM New Construction, Version 6.1 14/06/2023

R11, R12, R13, R14 R15, R22, R23	LT3	Daytime (07:00-23:00)	46	46 $L_{Ar,1\ hour}$
		Night-time (23:00-07:00)	35	35 $L_{Ar,15\ mins}$
R20	LT4	Daytime (07:00-23:00)	43	43 $L_{Ar,1\ hour}$
		Night-time (23:00-07:00)	42	42 $L_{Ar,15\ mins}$

Note: The noise levels at LT2 are dominated by existing plant serving Begbroke Science Park

Sports Pitches and Playground Sound

10.8.6 The predicted levels of noise arising from the use of the school playgrounds and pitches are presented in Table 10.15 and Table 10.16 respectively and compared against the ambient and background sound levels at the receptor. If the levels of noise predicted from the pitches or playground does not exceed 40 dB (i.e., 3 dB below the lowest background sound level during the day), then they have been determined to be below the LOAEL and are not presented within the Tables below.

10.8.7 It is noted that no allowance has been made for the duration of the use of these spaces over a typical day. As sports pitch and playground use would not be expected to occur continuously over the whole school day, these predictions represent the worst-case scenario when these spaces are being used.

Table 10.15 Predicted Playground Levels and Assessment

School	Receptor	Ambient $L_{Aeq,T}$ (dB)	Background $L_{A90,T}$ (dB)	Playground $L_{Aeq,1hour}$ (dB)	Difference against Ambient	Difference against Background
Primary School 1	R13 88 Sandy Lane [1]	53	45	50	-3	+5
	R14 Stanley Close [1]	53	45	50	-3	+5
	R15 31 Sandy Lane[1]	53	45	48	-5	+3
Primary School 2	R9 128 Woodstock Rd [2]	57	52	40	-17	-12
	R10 Gravel Pits Lane[3]	55	48	50	-5	+2
	R11 4 Ryder Close[1]	53	45	47	-6	+2
Secondary School	R4 Crossing Caravans [4]	64	50	47	-20	-3
	R5 Crossing Cottage[4]	64	50	39	-25	-11

Notes: T = 08:00 – 19:00 hours

Background and ambient sounds derived from representative monitoring locations as follows: [1] LT3 monitoring location, [2] LT1 monitoring location, [3] Midway between LT1 and LT5, [4] LT5 monitoring location

10.8.8 At all receptors, the predicted levels of sound arising from the use of the playground do not exceed 50 dB $L_{Aeq,16hours}$ and therefore complies with the recommended guidelines set out in BS 8233:2014 for external amenity spaces.

10.8.9 For Primary School 1, the predicted sound levels from the playground at the nearest receptors (R13, R14 and R15) are below the ambient sound by 3 to 5 dB, but above the background by up to 5 dB. This is primarily a function of the proximity of the source to the receptors and the lack of screening. The nature of this noise means that it is likely that characteristics of the noise (such as shouting) will be audible and that will increase its level of impact at the receptors. It is considered that this could give rise to an adverse effect which is not considered significant. However, in line with policy, reasonable steps should be taken to mitigate and minimise such effects.

10.8.10 The predicted playground sound from Primary School 2 is considerably below the ambient and background sound levels at R9, where the existing sound levels are elevated due to proximity to the A44. Therefore, no adverse effects are anticipated at this receptor. At R10 and R11 while the predicted level is below the ambient level by 5 to 6 dB it is above the background by 2 dB. It is likely that characteristics of the noise will be audible from time to time, and that will increase its level of impact at the receptors. It is therefore considered this would give rise to an adverse effect which is not considered significant, but in line with policy, all reasonable steps would be taken to mitigate and minimise such effects.

10.8.11 The noise from the Secondary School playground is more than 20 dB below the ambient noise levels at R4 and R5. It is also below the background sound levels at this location albeit by a smaller margin at R4. This is primarily because of the embedded mitigation of the proposed barrier to protect the school playing fields against railway noise. Overall, it is considered that the sound would be below the LOAEL and no adverse or significant adverse effect would arise at these receptors. Having said that, the sound from the playground being used may be audible from time to time.

Table 10.16 Predicted Sports Pitch Levels and Assessment

School	Receptor	Ambient $L_{Aeq,T}$ (dB)	Background $L_{A90,T}$ (dB)	Pitch $L_{Aeq\ 1\ hour}$ (dB)	Difference against Ambient	Difference against Background
Primary School 1	R13 88 Sandy Lane [1]	53	45	48	-5	+3
	R14 Stanley Close [1]	53	45	50	-3	+5
	R15 31 Sandy Lane[1]	53	45	56	+3	+11
Primary School 2	R9 128 Woodstock Rd [2]	57	52	50	-7	-2
	R10 Gravel Pits Lane[3]	55	48	59	+4	+11
	R11 4 Ryder Close[1]	53	45	34	-19	-11
Secondary School	R4 Crossing Caravans [4]	64	50	44	-20	-6
	R5 Crossing Cottage[4]	64	50	45	-19	-5

Notes: T = 08:00 – 19:00 hours

Background and ambient sounds derived from representative monitoring locations as follows: [1] LT3 monitoring location, [2] LT1 monitoring location, [3] Midway between LT1 and LT5, [4] LT5 monitoring location

10.8.12 For Primary School 1, the predicted level from sports pitches exceeds the background at all three receptors with the highest exceedance being 11 dB at R15. At R13 and R14 the levels remain below the ambient level and do not exceed the guidance in BS 8233 for outdoor amenity spaces. It is considered that this could give rise to an adverse but not significant

effect. All reasonable steps would be taken to mitigate and minimise the effect. At R15 the predicted noise level does exceed the guidance in BS 8233, by a small margin, although when considering the context and the character of the noise overall this could, at times, result in a significant adverse effect at this receptor and requires mitigation.

10.8.13 The predicted pitch noise from Primary School 2 is below the ambient and background sound levels at R9 and R11. Therefore, no adverse effects are anticipated at these receptors. At R10 the predicted level from the sports pitch exceeds both the ambient and background sound level and the guidance in BS 8233. Once the character of the noise is taken into consideration, this will increase the impact, and the potential to result in a significant adverse effect at this receptor, which will require mitigation as discussed later in this chapter.

10.8.14 Due to the embedded mitigation and the higher baseline sound levels, the sound from the Secondary School pitches is at least 19 dB below the ambient sound levels at R4 and R5 and at least 5 dB below the background sound level. As such, it is considered that the sound would be below the LOAEL and no significant adverse effect would arise at these receptors.

10.8.15 At each receptor the identified effects would be permanent, although they would only arise when the playground or pitches are in use, and therefore the effects would not be continuous over time but would occur regularly.

Mitigation, Monitoring and Residual Effects

Noise from Fixed Plant & Commercial Sources

10.8.16 Any mitigation required to reduce the noise levels arising from plant and commercial noise will be determined with reference to the target noise levels presented in this Chapter. Compliance with these levels would avoid any adverse and significant adverse effects from these sources. However, it is noted that exceedances of the targets would not automatically mean an adverse effect would occur. Should consent be granted for the Proposed Development, it is recommended that the requirement for these assessments to be undertaken is conditioned. These assessments can only be undertaken once sufficient information is available to permit an assessment. For fixed building services plant this might not be until after the reserved matters applications. For commercial sources, an assessment should be undertaken at the reserved matters application stage, assuming layout of these uses is fixed. An initial assessment should be undertaken, to guide outline mitigation measures, even if further assessment is required once the intended occupiers are confirmed.

Sports Pitches and Playgrounds

10.8.17 The following effects which require mitigation were identified at receptors as a result of sound generated from the use of the proposed school sports pitches and playgrounds;

- Primary School 1 playground: adverse effects (not significant) at R13, R14 and R15.
- Primary School 2 playground: adverse effects (not significant) at R10 and R11.
- Primary School 1 pitch: adverse effects (not significant) at R13 and R14 and a significant adverse effect at R15.
- Primary School 2 pitch: a significant adverse effect at R10.

10.8.18 As discussed previously an acoustic barrier which just removes the line of sight between the source and the receiver will typically reduce the noise levels at the receptor by 5 dB . Implementation of these at suitable locations would reduce the noise levels at the critical receptors to below 55 dB $L_{Aeq,T}$ recommended in BS 8233:2014 and by CDC. Furthermore, it would also mean that the pitch noise does not exceed the ambient noise level at any receptor. The residual effects at the receptors are presented in Table 10.17 and Table 10.18:

Table 10.17 Residual Predicted Playground Levels and Assessment

School	Receptor	Ambient $L_{Aeq,T}$ (dB)	Background $L_{A90,T}$ (dB)	Playground $L_{Aeq,1hour}$ (dB)	Difference against Ambient	Difference against Background
Primary School 1	R13 88 Sandy Lane [1]	53	45	45	-8	0
	R14 Stanley Close [1]	53	45	45	-8	0
	R15 31 Sandy Lane1	53	45	42	-10	-2
Primary School 2	R10 Gravel Pits Lane3	55	48	45	-10	-3
	R11 4 Ryder Close1	53	45	42	-11	-3

Notes: T = 08:00 – 19:00 hours

Background and ambient sounds derived from representative monitoring locations as follows: [1] LT3 monitoring location, [3] Midway between LT1 and LT5

Table 10.18 Residual Predicted Sports Pitch Levels and Assessment

School	Receptor	Ambient $L_{Aeq,T}$ (dB)	Background $L^{A90,T}$ (dB)	Pitch $L_{Aeq\ 1\ hour}$ (dB)	Difference against Ambient	Difference against Background
Primary School 1	R13 88 Sandy Lane [1]	53	45	43	-10	-2
	R14 Stanley Close [1]	53	45	45	-8	0
	R15 31 Sandy Lane[1]	53	45	51	-2	+5
Primary School 2	R10 Gravel Pits Lane[3]	55	48	54	+1	+6

Notes: T = 08:00 – 19:00 hours

Background and ambient sounds derived from representative monitoring locations as follows: [1] LT3 monitoring location, [3] Midway between LT1 and LT5

10.8.19 The mitigation will reduce the levels of playground sound at all of the receptors listed in the Table 10.17 below the ambient sound level and they would not exceed the background sound level. This would likely avoid any adverse effects at the receptors, and although noise may be audible at times, it would not be expected to result in any material change in behaviour.

10.8.20 For sports pitch sound, the mitigation will reduce the levels of sound at receptors R13 and R14 to below the ambient level and not exceed the background sound level. This would likely avoid any adverse effects at the receptors. At R15 and R10 the noise from the sports pitches exceeds the background by up to 6 dB and are either just below (R15) or just above (R10) the ambient sound levels. The predicted levels are also within the range of levels specified by BS 8233:2014 although this doesn't account for character of the sound. Overall, it is considered that this would result in an adverse but not significant effect at the receptors.

10.8.21 Given the outline nature of the planning application, the final effects of noise from sports pitches and playgrounds will depend on the layout of each school site and the proximity of these sources to the receptors. This should be reviewed as the design progresses and assessed at the reserved matters application stage, so that required level of mitigation to protect the existing and proposed receptors (including those which are introduced) is identified and secured by condition.

10.9 Cumulative Effects

Construction

Assessment

10.9.1 The only schemes which have been identified as being sufficiently close to the Site such that it may result in cumulative noise effects from construction activities are the Former Piggery and Land North of Woodstock Road (to the south of the Site and part of the PR8 allocation), the PR9 Site on the opposite side of the A44 (the PR9 allocation) and the Yarnton Lane and Sandy Lane Level Crossing).

10.9.2 Should all schemes be granted consent, it is possible that construction works could occur concurrently, which could lead to elevated construction noise levels at common receptors.

10.9.3 In the worst-case scenario construction works associated with the Former Piggery could occur concurrently with the construction in the Foxes Cover Development Zone of the Proposed Development. The main receptors this would potentially affect are R8 (105 Woodstock Road) and the properties in the vicinity along the A44 who could be exposed to construction noise from both sites at the same time. The highest predicted noise level at this receptor from the Proposed Development construction works is 72 dB $L_{Aeq,T}$ during the earthworks phase. Assuming a similar level of noise arises from the Former Piggery site construction, the noise levels at R8 and the surrounding properties could just exceed the SOAEL threshold during this phase of works. However, it is considered unlikely this would occur for a whole month and therefore, the cumulative effect at the receptors is anticipated to be adverse but not significant adverse.

10.9.4 If construction works were occurring concurrently with works at the PR9 site, the worst affected common receptors would be R17 and R19 when works are occurring in proximity to these receptors on both sites. Due to the proximity of these receptors to the Site, it is

considered unlikely the noise levels from Scheme 10 construction works would result in a significant cumulative adverse effect at these receptors.

10.9.5 The only receptors that the construction works associated with works at the Yarnton Lane and Sandy Lane Crossing sites would be in proximity to is R4 and R5, which are anticipated to be worst affected by Foxes Cover construction works and to a lesser extent Parkers Farm construction works. Mitigation in the form of acoustic barriers has been recommended to avoid the significant adverse effects that may occur. It is however possible that there could be a cumulative significant adverse effect if works associated with both developments are occurring for one month or more in proximity to these receptors.

10.9.6 It is not considered likely that any cumulative vibration effects would arise due to the distances between the cumulative developments and common receptors.

Mitigation, Monitoring and Residual Effects

10.9.7 The implementation of BPM on all construction sites would aid in reducing the noise arising from each scheme and therefore the cumulative levels arising at common receptors. It is likely that the only way these impacts could be further reduced would be through implementation of temporary acoustic barriers and/or scheduling of the works between the different contractors so that works are not occurring on neighbouring sites in close proximity to each other or in close proximity to common receptors at the same time. This is an issue that can be addressed in the phase specific CEMP for the Proposed Development and through liaison with the relevant contractors in order to avoid significant adverse effects. It is recommended that the respective contractors work in collaboration to mitigate and minimise effects on common receptors.

Completed Development

Assessment

Road Traffic Noise

10.9.8 The 2033 do minimum opening year reference case traffic data includes all relevant committed developments agreed with OCC. It is considered this includes all schemes which are likely to have a material impact on road traffic noise on the surrounding highway network. Scenario 4 includes the flows from the other PR sites as well as the proposed development and the committed developments. It has been used to determine whether there are any cumulative effects from the development in combination with the traffic generated by other PR sites. It was identified comparing Scenario 4 against Scenario 2, no increases in the BNL of 1 dB or more were predicted and therefore the no significant adverse effects are likely to occur.

Mitigation, Monitoring and Residual Effects

None Required.

10.10 Site Suitability

10.10.1 The assessment of the suitability of the Site for the proposed noise sensitive uses have been explored in Appendix 10.3 based on:

- The baseline noise and vibration survey results

- The likely evolution of the baseline sound environment (based on data supplied relating to the change in aircraft, rail and road traffic).

10.10.2 The assessment has considered the relevant standards and guidance documents that are considered applicable to the types of sensitive development proposed i.e., residential and schools.

10.10.3 Following a review of the noise levels affecting the development Site, it is considered that the Site is suitable for residential development from a noise and vibration perspective. The parts of the Site bordering the A44 and the rail line are affected by higher noise levels and will require more substantive mitigation which is likely to include alternative forms of ventilation. The acoustic performance requirements of the dwellings and layout of the Site should continue to be reviewed as the design of the scheme developments. It is also recommended that additional measurements are undertaken to determine the source of the L_{Amax} levels at positions away from the dominant sources on the ground (i.e., away from the railway and roads).

10.10.4 The levels of vibration recorded in proximity to the railway indicates that when factored for the number of trains during the day and the night and the likely future growth, the resultant estimated vibration is below the level at which a low probability of adverse comment would be expected.

10.10.5 With regard to the schools, a natural ventilation strategy should be feasible for all three schools from an acoustic perspective. Primary school 1 is located in an area of low noise exposure in the middle of the Site. Primary School 2 and the Secondary School would experience higher levels of noise exposure, due to the A44 and the Cherwell Valley Rail Line. However, the modelling demonstrates that with appropriate mitigation measures, the levels in outdoor spaces at the school can be reduced such that a good proportion of the space is below the 50 dB $L_{Aeq,T}$ recommended by OCC at the boundary of school sites, but some of the outdoor space will exceed this level. However, the higher residual levels are generally between 50 – 55 dB $L_{Aeq,T}$ and therefore to a level which complies with the Acoustics of Schools Design Guide recommendations and would be suitable for outdoor teaching.

10.11 Summary

10.11.1 A summary of the noise and vibration effects associated with the Proposed Development are presented in Table 10.19.

Table 10.19: Summary of Effects

Effect	Receptor/Phase	Receptor^ (Sensitivity)	Geographic & Temporal Scale	Magnitude of Impact	Significance of Effect	Additional Mitigation and Monitoring	Significance of Residual Effect
Construction							
Construction Traffic	All offsite receptors	High	Local Temporary	Negligible	Not significant	N/A	Not significant
Demolition Noise	All offsite receptors	High	Local Temporary	Below SOAEL[1]	Not significant	N/A	Not significant
	Begbroke Science Park – Impact and Shock Mechanics Lab and Centre for Innovation and Enterprise	Medium	Local Temporary	Above SOAEL	Significant	Stakeholder engagement, management and screening	Significant
	R20a (Begbroke Farm House)	Medium	Local Temporary	Below SOAEL[1]	Not significant	N/A	Not significant
Construction Noise – Begbroke Hill	Earthworks and groundworks phases at R19 (226 Woodstock Road)	High	Local Temporary	Above SOAEL	Significant	Acoustic barrier	Not significant
	All phases: R16 (3 Poppy Cl), R17 (204 Woodstock Rd), R18 (Garden Centre), R20b (Begbroke Science Park 2), and F2 (PR9 development)	High	Local Temporary	Below SOAEL[1]	Not significant	N/A	Not significant
	Superstructure and paving phases at R19 (226 Woodstock Road)						
	All other offsite receptors	High	Local Temporary	Below LOAEL	Not significant	N/A	Not significant

Effect	Receptor/Phase	Receptor^ (Sensitivity)	Geographic & Temporal Scale	Magnitude of Impact	Significance of Effect	Additional Mitigation and Monitoring	Significance of Residual Effect
Construction Noise – Begbroke Science Park	Earthworks and Groundworks phases: R20a, R20b, R20c (Begbroke Science Park).	High	Local Temporary	Above SOAEL	Significant	Acoustic barriers where they will be effective i.e., R15. Engagement and management for R20	Significant
	Earthworks phase: R15 (31 Sandy Lane)						
	Paving phase: R20a (Begbroke Farm House)						
	Earthworks: R15 (31 Sandy Lane)	High	Local Temporary	Above SOAEL	Significant	Acoustic barrier	Not significant
	All phases: R13 (88 Sandy Lane) and R14 (Stanley Close)	High	Local Temporary	Below SOAEL[1]	Not significant	N/A	Not significant
	Groundworks, superstructure and paving phases: R15 (31 Sandy Lane)						
	All other offsite receptors	High	Local Temporary	Below LOAEL	Not significant	N/A	Not significant
Construction Noise – Parkers Farm	Earthworks groundworks and paving phases: R13 (88 Sandy Lane)	High	Local Temporary	Above SOAEL	Significant	Acoustic barrier at R13	Not significant
	Earthworks: R20a (Begbroke Farm House)					N/A	Significant
	All phases: R4 (Crossing Caravans), R5 (Crossing Cottage), R20c and R20d (Begbroke Science Park).	High	Local Temporary	Below SOAEL[1]	Not significant	N/A	Not significant

Effect	Receptor/Phase	Receptor^ (Sensitivity)	Geographic & Temporal Scale	Magnitude of Impact	Significance of Effect	Additional Mitigation and Monitoring	Significance of Residual Effect
	During piling and superstructure: R13 (88 Sandy Lane)						
	During groundworks, piling and superstructure: R20a (Begbroke Farm House)						
	All other offsite receptors	High	Local Temporary	Below LOAEL	Not significant	N/A	Not significant
Construction Noise – Foxes Cover	Earthworks and groundworks phases: R4 (Crossing Caravans), R5 (Crossing Cottage), R10 (23 Gravel Pits Lane), R11 (4 Ryder Close), R12 (3 Ryder Close), R13 (88 Sandy Lane) and F1 (Former Piggery)	High	Local Temporary	Above SOAEL	Significant	Acoustic barriers	Below SOAEL Not significant
	Paving phase: R4 (Crossing Caravans), R12 (3 Ryder Close), R13 (88 Sandy Lane)						
	All phases: R6 (Littlemarsh Playing Fields), R8 (105 Woodstock Road), R9 (128 Woodstock Road)	High	Local Temporary	Below SOAEL[1]	Not significant	N/A	Not significant
	Superstructure and paving phases: R5 (Crossing Cottages), R10 (23 Gravel Pits Lane), R11 (4 Ryder Close),						

Effect	Receptor/Phase	Receptor^ (Sensitivity)	Geographic & Temporal Scale	Magnitude of Impact	Significance of Effect	Additional Mitigation and Monitoring	Significance of Residual Effect
	R12 (3 Ryder Close) and F1 (Former Piggery)						
	Superstructure phase: R4 (Crossing Caravans), R13 (88 Sandy Lane)						
	All other offsite receptors	High	Local Temporary	Below LOAEL	Not significant	N/A	Not significant
Construction Noise at introduced receptors	Introduced receptors within 70m of construction activity	High	Local Temporary	Above SOAEL	Significant	Acoustic barriers where they will be effective, consideration of phasing/sequencing	Significant
	Introduced receptors between 70m and 220m from construction activity	High	Local Temporary	Below SOAEL	Not significant	N/A	Not significant
	Introduced receptors 220m or more from construction activity	High	Local Temporary	Below LOAEL	Not significant	N/A	Not significant
Construction Vibration – Piling	Any receptor greater than 15m from site of piles (includes R20a Begbroke Farm House Listed Building)	High	Local Temporary	Below SOAEL[1]	Not significant	N/A	Not significant
Construction Vibration – Vibratory Ground Compaction	Any receptors closer than 15m (Sandy Lane)	High	Local Temporary	Above SOAEL	Significant	Reduce amplitude of drum vibration/use equipment that induces less vibration/	Potentially Significant (human perception)

Effect	Receptor/Phase	Receptor^ (Sensitivity)	Geographic & Temporal Scale	Magnitude of Impact	Significance of Effect	Additional Mitigation and Monitoring	Significance of Residual Effect
						Monitoring to be undertaken.	
	Any receptors between 15 – 30m from compaction (Sandy Lane)	High	Local Temporary	Above SOAEL	Significant	Reduce amplitude of drum vibration. Monitoring to be undertaken.	Not significant
	Any receptor greater than 30m from compaction (includes R20a Begbroke Farm House)	High	Local Temporary	Below SOAEL[1]	Not significant	N/A generally, Begbroke Farm House would need to be assessed to determine vulnerability to cosmetic and structural damage.	Not significant
Completed Development							
Noise from fixed plant and commercial sources	All offsite receptors	High	Local Permanent	-	Not significant assuming target levels met	Planning condition required to secure future assessment.	Not significant (assuming target levels met)
Primary 1 playground sound	R13 88 (Sandy Lane), R14 (Stanley Close) and R15 (31 Sandy Lane)	High	Local Permanent	Between LOAEL and SOAEL	Not significant	Acoustic barrier	Below LOAEL Not significant
	R9 (128 Woodstock Road)	High	Local Permanent	Below LOAEL	Not significant	N/A	Not significant

Effect	Receptor/Phase	Receptor^ (Sensitivity)	Geographic & Temporal Scale	Magnitude of Impact	Significance of Effect	Additional Mitigation and Monitoring	Significance of Residual Effect
Primary 2 playground sound	R10 (Gravel Pits Lane) and R11 (4 Ryder Close)	High	Local Permanent	Between LOAEL and SOAEL	Not significant	Acoustic barrier, through planning condition to secure future assessment.	Below LOAEL Not significant
Secondary: playground sound	R4 (Crossing Caravans) and R5 (Crossing Cottages)	High	Local Permanent	Below LOAEL	Not significant	N/A	Not significant
Primary 1: pitch sound	R15 (31 Sandy Lane)	High	Local Permanent	Above SOAEL	Significant	Acoustic barrier - through planning condition to secure future assessment	Below SOAEL, Not significant
	R13 (88 Sandy Lane) and R14 (Stanley Close)	High	Local Permanent	Between LOAEL and SOAEL	Not significant		Below LOAEL Not significant
Primary 2 pitch sound	R10 (Gravel Pits Lane)	High	Local Permanent	Above SOAEL	Significant	Acoustic barrier	Below SOAEL, Not significant
	R9 (128 Woodstock Road) and R11 (4 Ryder Close)	High	Local Permanent	Below LOAEL	Not significant	N/A	Not significant
Secondary: pitch sound	R4 (Crossing Caravans) and R5 (Crossing Cottages)	High	Local Permanent	Below LOAEL	Not significant	N/A	Not significant
Cumulative Effects							
Cumulative Construction Noise with Former Piggery	R8 (105 Woodstock Road)	High	Local Temporary	Below SOAEL	Not significant	N/A	Not significant

Effect	Receptor/Phase	Receptor^ (Sensitivity)	Geographic & Temporal Scale	Magnitude of Impact	Significance of Effect	Additional Mitigation and Monitoring	Significance of Residual Effect
Cumulative Construction Noise – Site and with PR9 Development	R17 and R19	High	Local Temporary	Below SOAEL	Not significant	N/A	Not significant
Cumulative Construction Noise – Site and Yarnton /Sandy Lane Crossings	R4 (Crossing Caravans) and R5 (Crossing Cottages).	High	Local Temporary	Above SOAEL	Significant	Liaison between contractors to minimise adverse effects, temporary barriers	Not significant
Construction Vibration	All	High	Local Temporary	Below LOAEL	Not Significant	N/A	Not significant
Operational Road Traffic	All	High	Local Temporary	Negligible	Not significant	N/A	Not significant

Notes:

^ where different receptors have different sensitivities the highest sensitivity is displayed in the table

[1] Below SOAEL indicates levels between LOAEL and SOAEL as well as those below the LOAEL.

References

[1] Environmental Protection Act (1990)

[2] Control of Pollution Act (1974)

[3] Ministry for Housing, Communities and Local Government, (2021). National Planning Policy Framework. July 2021.

[4] Defra (2010), Noise Policy Statement for England

[5] Oxfordshire County Council (2022), Local Transport and Connectivity Plan 2022 - 2050

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