

Barkham Square, Arborfield Green, Wokingham

Environmental Statement, Volume 1: Main Text for
Crest Nicholson Operations Limited
10 April 2026
Our Ref: SRS/24-02200/ESFinal

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Quality Assurance

This report has been prepared within the quality system operated at Rapleys LLP according to British Standard ISO 9001:2015.

We confirm that the undersigned is an appropriately qualified and experienced Chartered Planner experienced in the commercial property sector.

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1 INTRODUCTION

- 1.1 This Environmental Statement (ES) has been prepared by Rapleys LLP in conjunction with the Environmental Impact Assessment (EIA) Team (see Table 1.2 below) and forms part of an outline planning application for the creation of an urban extension of residential dwellings (C3) plus Elderly Care accommodation (C2/C3), associated open space, allotments, green and blue infrastructure including the provision of Suitable Alternative Natural Greenspace (SANG) and associated highway/drainage and other services (all matters reserved except for access) – (the ‘Proposed Development’). The land subject of this ES/application is known as Barkham Square, Wokingham (‘the Site’) (**Figure 1.1**). The planning application is to be submitted by Crest Nicholson Operations Limited (‘Crest’) to Wokingham Borough Council (‘the Council’).
- 1.2 This ES has been prepared in accordance with the requirements of The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (‘the Regulations’) and advice contained in the Planning Practice Guidance (PPG).
- 1.3 The structure of the ES is summarised as follows:
- Chapter 2 (Methodology) sets out the general methodology to the ES.
 - Chapter 3 (Background to Development) provides an overview of the Site, its location and physical characteristics, and planning history.
 - Chapter 4 (Development Description) describes the Proposed Development, including phasing where appropriate.
 - Chapter 5 (Alternatives) provides a description of the alternatives considered by Crest.
 - Chapter 6 (Planning Policies) summarises the relevant national and local planning policy context affecting the Site.
 - Chapters 7 to 14 incl. (Effects on the Local Environment) comprise the main element of EIA with a series of technical environmental studies undertaken by the EIA team.
 - Chapter 15 (Cumulative Effects) provides an overview of cumulative effects.
 - Chapter 16 (Overview/Conclusions) provides an overview and conclusions of the findings of the ES.
 - Abbreviations/References/Glossary.
- 1.4 The ES is contained within four volumes. Volume 1 (this document) comprises the main text body of the ES, Volume 2 the ES Figures, Volume 3 contains the ES Technical Appendices and Volume 4 the Non-Technical Summary (NTS).

LEGISLATIVE REQUIREMENTS FOR THE EIA

- 1.5 The requirement for an EIA is derived from EU Directive no. 2011/92/EU. This directive was transposed into UK law through the Regulations. The Regulations require that prior to the grant of planning permission the likely significant effects of a project on the environment are assessed.

Screening Opinion

- 1.6 In preparing development proposals for the Site, consideration was given at an early stage to whether the proposals, by virtue of the location and scale of development, would trigger the requirement for EIA to be undertaken. Reference was made to the Regulations together with guidance contained in the Planning Practice Guidance (PPG). Crest has made the decision to undertake an EIA for the Proposed Development to accompany the planning application. Whilst the location of the Site is not particularly sensitive (as described in the Regulations) the size of the scheme exceeds the determining thresholds in each case set out in Schedule 2, section 10 ‘urban development project’ of the Regulations, for the following reasons:
- the development includes more than 150 dwellings,
 - the overall area of the development exceeds 5 hectares.

- 1.7 As the submission of the ES is voluntary, it is not necessary to seek a formal Screening Opinion.

Scoping Opinion

- 1.8 In order to refine the information and aspects of the environmental topics that the EIA will consider, a Scoping Opinion Report (**Technical Appendix 1.1**) was produced with the intention that the Council could subsequently adopt that document as the formal Scoping Opinion Report confirming the EIA content to accompany the planning application for the Site. The Scoping Opinion Report was submitted to the

Council in December 2024, whilst baseline work for the ES was continuing to be undertaken. The Scoping Opinion from the Council was received on 28th January 2025 (**Technical Appendix 1.2**).

- 1.9 The Scoping Opinion Report identified the following technical topic areas to be included within the ES –
- Transportation,
 - Ecology/Conservation,
 - Historic Environment – Archaeology,
 - Landscape, Townscape and Visual Amenity,
 - Flood Risk, Drainage, Water Resources,
 - Noise and Vibration – the latter during construction only,
 - Air Quality,
 - Climate Change – operational effects of traffic; increased regulated/unregulated emissions at operational phase,
 - Cumulative Effects.
- 1.10 It also identified technical topic areas to be scoped out of the ES (**Technical Appendix 1.1**). These are –
- Historic Environment – built heritage, Scheduled Ancient Monuments (SAMs),
 - Ground Conditions,
 - Vibration during operational phase,
 - Climate change in terms of those areas identified as non-significant (see Scoping Report),
 - Major Accidents and Natural Disasters,
 - Human Health,
 - Society, Economy and Population.
- 1.11 The Council's Scoping Opinion confirmed that as a minimum the topics identified above should be included within the ES. Additional information over and above that included within the submitted Scoping Opinion Report that the Council has requested be included within the ES, is set out in the table below, together with the Crest team response.

Table 1.1: Scoping Opinion Response

Environmental Topic Area	Council Additional Requirements over and above that already identified in Applicant Scoping Opinion Report	Applicant Response
Archaeology	Council is content to deal with archaeology OUTSIDE of the EIA process, i.e., scope it out.	Noted, but for avoidance of doubt, it will remain within the EIA process.
Transport	To be modelled through updated Local Plan model and study area to be agreed.	Agreed to use updated model when available.
Ecology	Full baseline data to entire redline area to be provided. Tree survey to be provided.	Noted.
	White-clawed crayfish – in-combination effects for the whole of Barkham Brook is relevant, alongside Hall Farm SDL and Thames Water sewage works.	Noted.
	Great Crested Newts – site within strategic opportunity area for pond creation.	Noted.
	Thames Basin Heaths SPA – need for HRA which normally sits outside the EIA remit.	
Landscape/Visual	Impacts on Barkham and Bearwood Valued Landscape.	Separate HRA being produced of EIA process. Noted
Water/Drainage/Flood Risk	Groundwater risks should be quantified especially during construction.	Noted

Environmental Topic Area	Council Additional Requirements over and above that already identified in Applicant Scoping Opinion Report	Applicant Response
	Examine risks on both fluvial and pluvial flooding within Zones 1 and 3.	Noted
Climate Change	Local projections to be used rather than UK averages. Issues of reduced winter demand for heating and increased cooling should be separate points. Reduced rainfall in summer due to Wokingham being in an area of significant water stress should be covered.	Noted/agreed. Noted. Noted.
Cumulative Effects	Consideration of Hall Farm/Lodden Garden Village and the South Wokingham SDL should be included in the assessment.	Noted/agreed.

EIA TEAM

- 1.12 This ES has been prepared by Rapleys LLP with technical input from competent experts as set out below. A Statement of Expertise/Competence is provided at **Technical Appendix 1.3**.

Table 1.2: EIA Team

Scoping Topic Areas For Consideration	Responsibility
Transportation	I-Transport
Ecology including Trees	Sylvan Biodiversity/SJA Trees
Historic Environment – Archaeology	RPS
Landscape and Visual	Bradley Murphy Design
Water/Drainage/Flood Risk	Ardent
Air Quality	Create Consulting
Climate Change	Aether-UK
Noise	Create Consulting
Cumulative Impacts	Rapleys

COMMENTS AND DOCUMENT AVAILABILITY

- 1.13 This ES is to be made available by the Council for public viewing during normal office hours. For details of where it can be viewed and the times that it is available, the Council's Development Management Department can be contacted via the following contact details:
- **Telephone:** 0118 974 6000
 - **Email:** planning.enquiries@wokingham.gov.uk
 - **Address:** Development Management & Compliance, Wokingham Borough Council, PO Box 157, Shute End, Wokingham, RG40 1 BN
- 1.14 The ES and planning application documents will also be available electronically via the Council's website once the planning application has been registered, or by contacting the Applicant's agent, Rapleys:
- The Council - <https://planning.wokingham.gov.uk/FastWebPL/welcome.asp>
 - Rapleys email - info@rapleys.com
- 1.15 Comments on the planning application should be submitted to the Council's Development Management Department.

- 1.16 Hard copies of the ES documentation are also available for purchase by special request at a cost of £750.00 per copy. Contact should be made with Rapleys LLP for this as above.
- 1.17 Hard copies of the NTS are available free of charge from the Rapleys email address.

2 METHODOLOGY

2.1 This chapter describes the methodology used for the ES.

2.2 In accordance with Regulation 4(2) of the Regulations the environmental topics will identify, describe and assess in an appropriate manner, in light of each individual case, the direct and indirect significant effects of the Proposed Development to include the following factors -

- population and human health,
- biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC(a) and Directive 2009/147/EC(b),
- land, soil, water, air and climate,
- material assets, cultural heritage and the landscape, and
- the interaction between the factors referred to in sub-paragraphs (a) to (d).

MAJOR ACCIDENTS AND NATURAL DISASTERS

2.3 The EIA Regulations refer to the consideration of major accident and natural disasters. The definition of a 'major accident' for this ES draws on the Control of Major Accident Hazards Regulations 2015 (COMAH2015). These are applicable in this context as their purpose is to prevent major accidents and limit the consequences to people and the environment. A major accident is one such as fire, emission, or explosion resulting from uncontrolled developments in the course of the operation of any establishment and leading to serious danger to human health or the environment inside or outside the establishment.

2.4 A naturally occurring event such as extreme weather or ground-related hazard event (landslip) can also meet the definition of major accident.

2.5 Assessment of major accidents and hazards was scoped out of the EIA on the basis that the likely significant effects to human health and the environment from major accidents or disasters given mitigation measures being put in place are not significant. Various risk management legislation will apply to the Proposed Development including the Health and Safety at Work Act, etc and various design and technical specifications which require consideration of potential hazards. As part of the detailed design, risk assessments will be undertaken and will consider maintenance and operational activities. The Proposed Development is not considered to be vulnerable to major accidents or disasters and, therefore, no significant effects are identified in this regard. It is not considered further in this ES.

HUMAN HEALTH

2.6 A separate chapter on Human Health is not considered necessary as the individual topic chapters presented within this ES assess potential impacts on human receptors where relevant. Consequently, this is scoped out of the ES.

CUMULATIVE EFFECTS

2.7 The EIA assesses the potential cumulative effects of the Proposed Development combined with existing and approved developments both during the construction phase and following completion. A broad assessment of the cumulative effects is contained within the individual ES chapters where relevant.

2.8 In addition, a more comprehensive consideration of cumulative effects is provided within chapter 15 of this ES, in accordance with the Scoping Opinion Report. The list of sites/developments considered in relation to cumulative effects, specifically as identified by the Council for inclusion are -

- Hall Farm/Lodden Garden Village – site allocation in emerging Local Plan , and recent application submission,
- South Wokingham SDL – site allocation in emerging Local Plan,
- South of Cutbush Lane, Shinfield – part of Lodden Garden Village, proposed allocation,
- East of Shinfield (phase 2), south of Church Lane, Shinfield – committed site.

CONSULTATION

2.9 Pre-application advice has been sought from the Council in respect of the planning application through the medium of a Planning Performance Agreement (PPA), and there has been ongoing discussions with the Highway Authority to agree the scope of the Transport Assessment. At the same time, there has been continued discussion with the Council over a number of months concerning the policy promotion of the Site through the Local Plan process. This has resulted in the Site being identified as a proposed allocation in the Regulation 19 consultation Local Plan.

- 2.10 In addition, as part of the planning application process, a public consultation exercise was conducted through the medium of a public exhibition on 4 December 2024, associated leaflet drop and a web site hosting information on the public exhibition. Further detail on this is provided within the separate Statement of Community Involvement (SCI) which accompanies the planning application.

EIA PARAMETERS

- 2.11 This EIA assesses potential significant environmental effects having regard to a set of parameter plans, which are described in detail in chapter 4 of this ES. Of particular importance in this context are -

- the road alignment changes, and
- the green infrastructure, particularly SANG.

TEMPORAL SCOPE

- 2.12 Construction of the Proposed Development is expected to take place over a circa 8-year period following the grant of planning permission, commencing during 2027 and completing/ become operational in 2034/5. It is noted, however, that this timescale differs slightly from the Council Local Plan trajectory for the Site, where it has been assumed first completions will occur in 2030/31 and 2035 for full completion.
- 2.13 The strategic transport model requires analysis of completed development in 2040.

SPATIAL SCOPE

- 2.14 The spatial scope of the EIA takes into account –
- The physical extent of the Proposed Development as defined by the redline area of the Site Location Plan (and ultimate application boundary),
 - The nature of the baseline environment and the way the impacts are likely to be propagated, for example, through defining source-pathway-receptor approaches, or visual envelopes/zones of theoretical visibility or specific highways/junctions within the wider network, and
 - The pattern of governmental administrative boundaries providing the planning policy context.
- 2.15 Appropriate study areas for each technical topic chapter have been defined by the specialists consultants and are set out in each technical topic chapter.

EIA METHODOLOGY

Description of environmental baseline and future baseline

- 2.16 The existing and likely future environmental conditions in the absence of the Proposed Development are known as the 'baseline conditions' and form the basis of the assessment. Each technical topic chapter includes a description of the current baseline conditions.
- 2.17 The future baseline represents the conditions that would exist in the absence of the Proposed Development at the time that the development is likely to be implemented – for example these changes might include construction and operation of other consented developments in the immediate locality.
- 2.18 Arborfield Green is immediately adjacent to the Proposed Development with a permission for Crest of circa 2,000 dwellings – circa 1,802 have reserved matters consent of which 1,389 are occupied and a further 207 are under construction. It is anticipated, that at the commencement of construction of this Barkham Square Proposed Development (anticipated to be circa 2027 earliest), the remaining Crest Arborfield Green will have been built out. Therefore, for the purposes of this ES, Arborfield Green is considered to be part of the baseline.
- 2.19 The Studios area immediately south of the Proposed Development is included within the Crest Arborfield Green development from a spatial/physical site and landscape and visual point of view (i.e., as part of the original permission); however, an additional circa 300 dwellings are actually likely to be built on this part of the Site taking the overall Crest Arborfield Green development beyond the permitted 2,000. These additional dwellings are therefore to be considered as a planned future development and will be assessed as part of the cumulative effects assessment, notwithstanding that there is no planning permission for them as yet.
- 2.20 In all other instances, projects within the defined 4km area as agreed with the Council, that have an existing allocation, extant planning permission or are under construction will be considered as part of the cumulative effects assessment (Chapter 15).

Approach to identifying significant effects

- 2.21 The approach to identifying significant effects is one that develops an understanding of the baseline (as set out above in this case); identifying environmental effects and evaluating the magnitude of their effect to determine significance; considering whether there will be cumulative effects; designing mitigation methods to minimise significance of effects and identifying residual effects post mitigation.

Approach to assessing significant effects

- 2.22 The methodology used to assess the relative magnitude of significance of the effects reviewed in this ES is based on a standardised scale, as set out in Table 2.1 below. **Figure 2.1** sets out in simple diagrammatic form, the key stages to the EIA process. Each of the specialist consultants have based their assessment on this general approach, but the accepted good practice criteria within each topic have led, in some cases, to modifications to this general approach, detailed as appropriate in the respective technical topic chapters.
- 2.23 The magnitude of an impact is judged by comparing the extent of the change with particular standards and criteria relevant to each environmental topic. The magnitude is generally estimated as combination of the magnitude of the impact and the sensitivity or value of the affected receptor. The process is described in Tables 2.1 and 2.2.

Table 2.1: Magnitude of Impact

Magnitude of Impact	Description – include subject specific examples
High	Very large or large change in environmental conditions (e.g., pollution levels, destruction of habitat). This could result in exceedance of Statutory objectives and/or breaches of legislation.
Medium	Intermediate change in environmental conditions.
Low	Small change in environmental conditions.
Negligible	No discernible change in environmental conditions.

Table 2.2: Sensitivity/Value of Receptor

Sensitivity/Value of a Receptor	Description
Very High	Change resulting in a high degree of deterioration or improvement.
High	Change resulting in a material deterioration or improvement.
Medium	Change resulting in a low degree of deterioration or improvement.
Low	Change resulting in a negligible degree of deterioration or improvement.
Neutral	No change.

- 2.24 Table 2.3 provides a matrix showing impact significance and magnitude of change.
- 2.25 The effect is determined by combining the predicted magnitude of impact with the assigned sensitivity of the receptor. The level at which a significant effect arises is provided within the topic method section of each chapter of the ES. Unless stated otherwise, effects of moderate significance or above are considered to be significant in EIA terms.

Table 2.3: Impact Significance Matrix

Sensitivity/ value of a Receptor	Magnitude of Impact			
	High	Medium	Low	Negligible
Very High	Substantial	Substantial	Moderate	Slight
High	Substantial	Moderate	Slight	Negligible
Medium	Moderate	Slight	Negligible	Negligible
Low	Slight	Negligible	Negligible	Negligible

- 2.26 There is no statutory definition of significant. For the purpose of the EIA, Table 2.4 below provides a general description of significance.

Table 2.4: General Definition of Significant

Significance	Description
Substantial	These effects represent key factors in the decision-making process and will have a major influence on key decision-making issues.
Moderate	These effects are likely to be important considerations at a local scale. If adverse these effects have a moderate influence on key decision-making issues.
Slight	These effects may be raised as local issues but are unlikely to be of importance in the decision-making process. Nevertheless, they are of relevance in the detailed design of the project. When combined with other effects these effects may have a moderate influence on decision making issues.
Negligible	Effects which are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error. These effects will not have an influence on decision making issues.

2.27 The likely significant effects of the Proposed Development are described as -

- Adverse or beneficial,
- Direct or indirect,
- Temporary or permanent,
- Reversible or irreversible,
- Cumulative.

MITIGATION

2.28 The key objective of mitigation is to avoid, offset or reduce the significant adverse effects of the development. The mitigation strategy follows the following hierarchy -

- Avoid,
- Reduce,
- Remedy.

2.29 Mitigation can be carried out through design (inherent/embedded mitigation) or management (additional mitigation), the latter often being considered separately for construction and operation.

2.30 Measures that avoid environmental impacts and effects and which form part of the assessed Proposed Development (as set out in the scheme description or shown on the Site Layout Plan) are known as inherent/embedded mitigation that is included in the design of the Proposed Development. Such mitigation is taken into account in the assessments.

2.31 Additional Mitigation is defined as a proposed measure that is additional to the assessed Proposed Development in response to environmental impacts identified through the assessment. These aspects may not be capable of representation on the Site Layout Plan as they may involve off-site measures and/or be delivered by a third party via financial contributions.

2.32 Mitigation measures are broadly described in Table 2.5 below.

Table 2.5: Mitigation Measures

Category	Description
Design (Inherent/Embedded)	Measure incorporated into design in order to minimise specific effects.
Construction (Additional)	Management Commitment to undertake the construction works in a specific way, for example the use of particular plant, phasing of the works, regular monitoring, and management of works.
Operational (Additional)	Management Features specific to the particular technical category including management practices, Environmental Management Systems etc.

STRUCTURE OF ES CHAPTERS

2.33 In order to ensure consistency in the presentation and methodology contained within the ES the following structure and key sub-headings are used for each technical chapter:

- Introduction

- **Context:** A general legislative and policy context is provided.
- **Methodology:** A description of the methodology adopted is provided. Unless otherwise stated the methodology used to assess the relative magnitude of significance of the effects reviewed in this ES is based on a general standardised scale contained within this chapter of the ES.
- **Baseline Conditions:** The baseline situation is the prevailing environmental conditions against which the potential environmental impacts of the proposals are assessed. The conditions refer to the present time and with no significant change predicted during the interim period before the Proposed Development works are programmed to commence.
- **Impacts:** Identifies the likely significant impacts resulting from the Proposed Development and considers impacts during construction and once the development is completed (Construction Impacts and Operational Impacts).
- **Mitigation:** Summarises mitigation required to avoid, offset or reduce the significant adverse effects of the Proposed Development.
- **Residual Effects:** A summary of residual effects i.e. the effects remaining after mitigation following the form within the Impact section.
- **Cumulative Effects:** Identifies the likely significant cumulative effects.
- **Summary.**

ASSUMPTIONS AND LIMITATIONS

- 2.34 The principal assumptions that have been made, and any limitations that have been identified, in undertaking the EIA are set out below. Assumptions specifically relevant to each topic have been set out in the relevant chapter.
- The assessments contained within each of the technical chapters are based on the design parameters, highway drawings and parameter plans (described in Chapter 4 of this ES), for which planning approval is sought,
 - Baseline conditions have been established from a variety of sources, including historical data. Due to the dynamic nature of the environment, conditions may change during the construction and operation of the Proposed Development,
 - For the purposes of the ES, it has been assumed development would start in 2027 and would take circa 8 years to build out, with the overall development completing and becoming operational during 2034/5.
 - Construction activities will take place to a pre-determined schedule and are likely to be conditioned as part of any planning permission,
 - At the time of writing, the construction processes and equipment/plant has not been determined specific to this Site. Instead, generic standard best practice assumptions have been used to identify likely plant and determine a potential impacts arising from a noise and air quality point of view, and
 - A commitment is made to the delivery of a Construction Environmental Management Plan (CEMP), which would form a planning condition to permission.

3 BACKGROUND TO THE DEVELOPMENT

- 3.1 This chapter describes the Site and the surrounding area and sets out the background to the Proposed Development. Relevant planning history is also identified.

SITE

- 3.2 The Site extends to circa 44.89ha and is presently principally comprised of poor-quality agricultural grassland, DEFRA classification Grade 4. It is relatively unconstrained physically, with a narrow corridor in the central spine of the Site within Flood Zone 3 based around the Barkham Brook which flows northwards into the River Loddon. The remainder of the Site lies within Flood Zone 1. Ditches within the Site are associated with the linear boundary vegetation which includes native hedgerows. Three ponds are found within the Site.
- 3.3 There is sporadic mature tree coverage across the Site, including veteran trees and parcels of ancient woodland. Tree Preservation Orders (TPOs) are found along the southern boundary of the Site (individual trees) and a woodland TPO on the northern boundary of the western part of the Site.
- 3.4 The Site is gently undulating, rising to the north. The western part of the Site features a localised plateau at circa 55+AoD beyond the central hedgerow with the landform sloping gently downhill east towards the Barkham Brook corridor; the eastern part of the Site features a localised ridgeline at circa 60m+ AoD running east/west centrally with the landform then gently sloping westwards towards the Barkham Brook corridor.
- 3.5 There is an existing access into the Site from Commonfield Lane to the east.
- 3.6 There are no listed buildings or SAMs within the Site and the Site is not included within any conservation area.
- 3.7 There are no landscape or ecological designations within the Site boundary.

SURROUNDINGS

- 3.8 The Site is located adjacent to the northern boundary of Arborfield Green and circa 1km south-west of Barkham Village. Wokingham lies to the north-east at circa 2km and Reading a circa twenty-minute drive to the north. Wokingham railway station lies 4km to the north-east of the Site.
- 3.9 Arborfield Green is a strategic development site (the regeneration of the former Arborfield Garrison), where Crest are the lead developer. Crest has planning permission for circa 2,000 dwellings and associated infrastructure and facilities, including a district centre. It is currently under construction.
- 3.10 Barkham Village also provides a range of local facilities, including a pub and village hall, small retail shop. Arborfield Green provides a leisure centre, playing fields and Hazebrouck Meadows SANG, local shop, primary school and secondary school. Medical and dental facilities can be found at Finchampstead and the nearest supermarket, a Tesco, is in Wokingham, circa a 10-minute drive.
- 3.11 The Site lies within the buffer zone to the Thames Basin Heaths Special Protection Area (SPA). The Longmoor Bogg SSSI and Local Nature Reserve (LNR) lie some 230m to the east of the Site. The wider landscape of the Chilterns National Landscape lies to the north and the North Wessex Downs National Landscape to the west.

PLANNING HISTORY

- 3.12 There is no planning history of relevance associated with the Site.
- 3.13 As already noted, the Site has been promoted as a location for between 500-1,000 dwellings as part of the Wokingham Local Plan review process, with representations submitted at appropriate times, including –
- The call for sites, and
 - The two Regulation 18 consultations.
- 3.14 In September 2024 the Council published its Regulation 19 Plan for consultation. The Site is a proposed allocation for 600 dwellings in that Plan. Representations in support of the principle of the allocation were made on behalf of the client, alongside representations seeking an uplift in the capacity of the Site to 660.

4 PLANNING POLICY

- 4.1 A detailed review of the Proposed Development against the background of the planning policy context is set out in the Planning Statement accompanying the Application. This chapter lists those policies that are most relevant to the Site and Proposed Development.
- 4.2 Specific policies relating to individual issues such as for ecological development management, are referred to in the relevant technical topic chapters of this ES.

NATIONAL PLANNING POLICY FRAMEWORK (NPPF)(DECEMBER 2024)

- 4.3 Relevant national planning policy and guidance is set out in the NPPF and PPG. The following sections of the NPPF are relevant to the Site and the Proposed Development.
- The presumption in favour of sustainable development,
 - Delivering sufficient homes,
 - Promoting sustainable transport,
 - Making effective use of land,
 - Achieving well-designed places.

Presumption of sustainable development

- 4.4 The fundamental foundation of the planning system through the NPPF is to achieve sustainable development through three overarching objectives – economic, social and environmental. Paragraph 11 requires that decisions should apply a presumption in favour of sustainable development, albeit the starting point for such decisions is the statutory status of the development plan. Decisions should accord with the development plan unless material considerations indicate otherwise.

Delivering a sufficient supply of homes

- 4.5 The Government's key objective is to significantly boost the supply of homes. Paragraph 77 notes that the supply of large numbers of houses can often be best achieved through planning for larger scale development such as extensions to existing towns/villages

Promoting sustainable transport

- 4.6 Paragraph 109 explains that transport issues should be considered from the earliest stages of development proposals so that, inter alia, the potential impacts of development on transport networks can be addressed, opportunities for promoting walking, cycling and public transport can be pursued in parallel with mitigating any adverse effects on the environment, and contributing to making high quality places.
- 4.7 Paragraph 115 notes that sustainable transport modes should be prioritised within the vision for the development and that safe and secure access for all users should be achieved, and that any significant impacts from the development can be cost effectively mitigated to an acceptable degree.
- 4.8 Paragraph 116 states that development should only be prevented or refused on highways grounds if there would be an unacceptable impact on highway safety, or if the residual cumulative impacts on the road network would be severe.

Making effective use of land

- 4.9 Paragraph 129 requires that decisions on applications should support development that makes efficient use of land taking into account the identified need for different types of housing, local market conditions, availability and capacity of infrastructure and services, desirability of maintaining character of and area and the importance of securing well-designed, attractive and healthy places.

Achieving well-designed places

- 4.10 Paragraph 135 sets out a number of design criteria applicable to new developments covering matters such as function, visual attractiveness, local character (whilst not preventing or discouraging appropriate innovation or change, including increased densities), a sense of place, accessibility and security.

PLANNING PRACTICE GUIDANCE (PPG)

- 4.11 The PPG was first published in March 2014 and has been updated over time to reflect the latest Government guidance supplementing national planning policy. The last update was made in March 2019.

ADOPTED DEVELOPMENT PLAN

- 4.12 The Development Plan comprises –
- the Retained Policy NRM6 of the revoked SouthEast Plan,
 - the Berkshire Mineral and Waste Local Plan,
 - the Wokingham Core Strategy, adopted 2010,
 - the Adopted Managing Development Delivery Local Plan of February 2014 (MDD),
 - the made Arborfield and Barkham Neighbourhood Plan, 2020, and
 - the Gypsy and Traveller Local Plan.
- 4.13 It identifies development and growth up to 2026 and includes the allocation of Arborfield Green.
- 4.14 The Site lies outside of any defined settlement boundary and is therefore ‘countryside’. The Site is not located within any national designations or protected landscapes although the very north-eastern edge is partially within the Barkham and Bearwood Valued Landscape. The Site is not a conservation area and does not contain any listed buildings, although Barkham Square farmhouse is Grade II listed and lies to the north-east of the Site’s northern boundary.
- 4.15 Detail and commentary is provided within the Planning Statement, but key relevant policies from the Core Strategy (CP policies) and the MDD (CC/TB policies) are –
- **Policy CP1** – Sustainable development
 - **Policy CP2** – Inclusive communities
 - **Policy CP3** – General Principles for development
 - **Policy CP5** – Housing mix, density and affordability
 - **Policy CP6** – Managing Travel Demand
 - **Policy CP7** – Biodiversity
 - **Policy CP8** – Thames Basin Heaths Special Protection Area
 - **Policy CP10** – Improvements to the Strategic Transport Network
 - **Policy CP11** – Proposals Outside Development Limits
 - **Policy CP17** – Housing delivery
 - **Policy CP18** – Arborfield Garrison Strategic Development Location
 - **Policy CC01** – Presumption in Favour of Sustainable Development
 - **Policy CC02** – Development Limits
 - **Policy CC03** – Green Infrastructure, Trees and Landscaping
 - **Policy CC04** – Sustainable Design and Construction
 - **Policy CC06** – Noise
 - **Policy CC07** – Parking
 - **Policy CC08** – Safeguarding alignments of the Strategic Transport Network and Road Infrastructure
 - **Policy CC09** – Development and Flood Risk (from all sources)
 - **Policy CC10** – Sustainable Drainage
 - **Policy TB05** – Housing Mix

- **Policy TB06** – Development of Private Residential Gardens
- **Policy TB07** – Internal Space Standards
- **Policy TB08** – Open Space, sport and recreational facilities standards for residential development
- **Policy TB09** – Residential accommodation for vulnerable groups
- **Policy TB10** – Traveller Sites
- **Policy TB12** – Employment Skills Plan
- **Policy TB21** – Landscape Character
- **Policy TB23** – Biodiversity and Development
- **Policy TB24** – Designated Heritage Assets (Listed Buildings, Historic parks and Gardens, Scheduled Ancient Monuments and Conservation Areas
- **Policy TB25** – Archaeology

4.16 From the Neighbourhood Plan, the following policies are relevant –

- **Policy IRS1** – Preservation of separation of Settlements
- **Policy IRS2** – Recognise, Respect and Preserve Identity and Rural Setting of Settlements
- **Policy IRS3** – Protection and Enhancement of the Natural Environment and Green Spaces
- **Policy IRS4** – Protection and Enhancement of the Historic Character of the Area
- **Policy AD3** – High Quality Development with Generous Open Space, Properly Landscaped

EMERGING LOCAL PLAN

4.17 The Regulation 19 Plan was published for consultation in Autumn 2024. Within this Plan, the Site is a proposed allocation for circa 600 houses as part of the wider Arborfield Green Strategic Development under Policy SS11.

4.18 The Plan was submitted to the Secretary of State on 28th February 2025. The Examination commenced on 18 November 2025, with the Arborfield Green SDL allocation discussed on 20th November. Adoption will be dependent on the Inspector's reporting of the Examination.

4.19 The following policies that are potentially of relevance to the Proposed Development are –

- **Policy SS1:** Sustainable development principles
- **Policy SS2:** Spatial strategy and settlement hierarchy
- **Policy SS11:** Arborfield Green Strategic Development Location
- **Policy SS15:** Securing Infrastructure
- **Policy SS17:** Transport improvements
- **Policy CE1:** Design principles for efficient buildings
- **Policy CE3:** Environmental standards for residential development
- **Policy CE5:** Embodied carbon
- **Policy C1:** Active and sustainable transport and accessibility
- **Policy C2:** Mitigation of transport impacts and highways safety and design

- **Policy C3:** Active travel
- **Policy C4:** Green and blue infrastructure and public rights of way
- **Policy C5:** Parking and electric vehicle charging
- **Policy C7:** Digital infrastructure and communications technology
- **Policy C8:** Utilities
- **Policy H1:** Housing mix, density and standards
- **Policy H3:** Affordable housing
- **Policy H6:** Self-build and custom housebuilding
- **Policy H7:** Specialist accommodation
- **Policy FD1:** Development and flood risk (from all sources)
- **Policy FD3:** River corridors and watercourses
- **Policy NE1:** Biodiversity and geodiversity
- **Policy NE2:** Biodiversity net gain
- **Policy NE4:** Trees, woodland, hedges and hedgerows
- **Policy NE5:** Landscape and design
- **Policy NE6:** Valued landscapes
- **Policy DH1:** Place making and quality design
- **Policy DH5:** The historic environment
- **Policy DH6:** Archaeology
- **Policy HC1:** Promoting healthy communities
- **Policy HC4:** Open space, sports, recreation and play facilities
- **Policy HC5:** Environmental protection
- **Policy HC6:** Air pollution and air quality
- **Policy HC7:** Light pollution
- **Policy HC8:** Noise pollution

5 THE PROPOSED DEVELOPMENT

- 5.1 This chapter of the ES describes the Proposed Development parameters and provides an overview of its construction. More detail is available in the Design and Access Statement (DAS) that also accompanies the planning application.

DESCRIPTION OF DEVELOPMENT

- 5.2 The Proposed Development is a north-eastern urban extension to Arborfield Green on a total Site area of circa 44.89ha, comprising -

- Up to 660 C3 dwellings including affordable plus Elderly Care dwellings (Class C2/3),
- Open space/play space/landscaping,
- Green/blue infrastructure including new wetlands, drainage/attenuation ponds,
- Sustainable Alternative Natural Green Space (SANG)/natural/semi-natural space,
- Access – the main vehicular access is provided from Langley Common Road in the west. A secondary vehicle access is also provided to the east from Commonfield Lane to serve the allotments and SANG car park only.

KEY DESIGN PRINCIPLES AND PARAMETER PLANS

- 5.3 The following principles form the basis of the Proposed Development design -

- Retention of existing central watercourse corridor and associated woodland,
- Retention of woodland, hedgerows and trees within the Site and along boundaries as far as possible, and existing ponds, and using these as part of a network of green/blue infrastructure corridors linking open spaces of high natural and amenity values within and outside the Site and as locations where biodiversity enhancement can take place,
- Creation of SANG with linkages to the Hazelbrouck SANG within Arborfield Green
- Encouraging travel by sustainable modes through a pedestrian/cycle connection to the Site boundary.

- 5.4 The design principles for the Site seek to create a place with a clear identity through the creation of a series of neighbourhoods linked by sustainable routes, green infrastructure corridors and open space that also make connections back to the existing Arborfield Green settlement and surrounding countryside.

Land Use Parameter Plan (Figure 5.1)

- 5.5 In terms of housing, up to 660 dwellings, including affordable, are to be provided in a range of types and sizes to accord with policy and local market needs. Provision for elderly care is also proposed, although whether this is as a care home or as apartments for independent elderly living has not been determined and, to a certain extent, will be driven by the local market need.

- 5.6 The residential part of the Site has been designed with five character areas –

- Langley Gateway – informal edge urban grain at the entrance to the Proposed Development,
- Community Greenway – formal urban grain,
- Kidgem Copse – informal loose urban grain,
- Parkland View – formal loose urban grain,
- Arborfield Rise – informal urban grain on the southern edge of the Proposed Development.

Access and Movement Parameter Plan (Figure 5.2)

- 5.7 The key principles of access and movement within the Site are –

- A new roundabout offset within the Site from Langley Common Road providing the main vehicular/pedestrian/cycle route into the Site,
- A secondary vehicular loop road from which the development parcels and hierarchy of other roads will be accessed,
- A network of pedestrian/cycle routes, including one to the Site boundary,

- Recreational footpaths through the SANG,
- An access off Commonfield Lane serving the allotments and SANG car park.

Green/Blue Infrastructure Parameter Plan (Figure 5.3)

5.8 The key principles that make up the green/blue infrastructure provision are –

- Retention of existing ancient woodland and hedgerows,
- A community green,
- 2 landscaped play areas - NEAP, LEAP and a number of LAPs,
- Green corridors running between and framing development parcels and linking up with existing green networks outside of the Site,
- Large area of SANG (13.23ha), incorporating extensive woodland planting to replicate and increase the size of Kidgem Copse with footpaths and circular walks incorporated within it, other BNG and an associated car park access off Commonfield Lane,
- Allotments accessed off Commonfield Lane,
- A combination of swales and detention basins alongside permeable paving, small scale rainwater harvesting and bio-retention features.

Density/Building Heights Parameter Plan (Figure 5.4)

5.9 Building heights across the Site will vary between 2 and 3 storeys depending on the character area -

- Langley Gateway will contain 2-2.5 storey semi-detached, detached and terraced dwellings at a medium density,
- Community Greenway will be made up of 2.3 storey terraces, semi-detached and apartments at a high density,
- Kidgem Copse will be 2-2.5 storey semi-detached and detached dwellings at medium to low density,
- Parkland View will be 2-3 storey semi-detached, detached and occasional terraced dwellings at a medium density, and
- Arborfield Rise will be 2-2.5 storey semi-detached and detached dwellings at medium-low density.

UTILITIES AND SERVICES

5.10 A programme of new utilities infrastructure, upgrades and diversions will be required to facilitate the scale of development proposed. This will include works to electricity, gas, potable water and foul drainage networks as appropriate. A separate Utilities Report accompanies the planning application.

PHASING

5.11 It is difficult at this stage to be precise in respect of the phasing of the Proposed Development. Construction methods are influenced by a combination of factors including the existing ground conditions and the preferred methods of the building contractor that will eventually be appointed. As such, a programme for the delivery of the Proposed Development has not yet been established or confirmed. The planning application approval would likely be subject to a condition requiring the submission of a phasing plan prior to commencement in any event.

5.12 Notwithstanding this, and subject to the timing of planning permission, the broad anticipated timetable of construction over a period of circa 8 years is as follows:

- Commencement on site (site clearance and preparatory works) February 2027,
- Construction of the Langley Common Road access 2027,
- Construction of the Commonfield Lane access into the allotments/SANG car park 2027/2028,
- Commencement of construction of residential dwellings Q1 2028/29 with circa 40 delivered,
- Completion of full site during 2034/35.

5.13 Green infrastructure and SANG will be delivered in accordance with requirements of a S106 Agreement.

5.14 The identification of potentially significant effects at the construction stage (and the identification of suitable mitigation measures) assumes that a generic construction methodology will be adopted based

on standard construction methods and timings derived from similar developments in similar locations. The assumptions made will need to be realistic and appropriate to the development proposed, and many will ultimately be defined in the CEMP.

- 5.15 It is assumed, however, that construction of built development will be more or less continuous throughout this time and will include the following activities -
- **Enabling works and site preparation:** to include earth moving (cut and fill) and arboricultural works,
 - **Provision of infrastructure:** to include the provision of the access road and access points into the Proposed Development,
 - **Construction of substructure:** to include localised re-grading, excavation for foundations and installation of ground slabs where necessary,
 - **Construction of superstructure:** comprising the construction of the main building envelope,
 - **Fit out of buildings:** to include the installation of insulated timber frames or block work party walls, surfaces finishes, internal division walls, mechanical and electrical installations; and internal fixtures,
 - **Landscaping:** soil preparation; tree and vegetation planting, seeding, and construction of footpaths/ cycle routes.

- 5.16 Enabling works and site preparation will include -
- Earth moving – excavation and grading,
 - Arboricultural works – including the protection of trees/vegetation to be retained and removal of trees/vegetation to be lost, and
 - Some new structural planting may also be implemented as part of the Site.

- 5.17 There will be some requirement for cut and fill to facilitate the Proposed Development, particularly in relation to the drainage basins, but the amount is unknown at this stage.

Hours of Work

- 5.18 It is anticipated that the working hours for works audible at the Site boundary will be as set out below -
- 0730 – 1800 Monday to Friday,
 - 0800 – 1300 Saturday, and
 - No working on Sundays or Bank Holidays.
- 5.19 These hours will be agreed with the Council prior to the commencement of the works. All work outside of these hours will be subject to prior agreement, and/ or reasonable notice, to the Council, who may impose certain restrictions and will have regard to any planning conditions attached to any grant of permission. Night-time working will be restricted to exceptional circumstances.

Construction Environmental Management Plan (CEMP)

- 5.20 A CEMP, which will clearly set out the methods of managing environmental issues for all involved with the construction works, including supply chain management, will be provided to the Council prior to commencement of the relevant phase of works.
- 5.21 Throughout the ES measures are set out to mitigate the effects of the Proposed Development during construction. These would be collated in, and implemented by, the CEMP where appropriate.

Waste Management, Recycling and Disposal

- 5.22 Waste will be generated during all stages of the construction works. Sources of waste within the construction process include -
- Packaging – tins, plastics, pallets, expanded foams etc,
 - Dirty water, for example from silt, and
 - Timber, offcuts etc.
- 5.23 All relevant contractors will be required to investigate opportunities to minimise waste arisings at source and, where such waste generation is unavoidable, to maximise the recycling and re-use potential of construction materials. Wherever feasible, such arisings will be dealt with in a manner that reduces environmental impact and maximises potential re-use of materials.

- 5.24 A Site Waste Management Plan (SWMP) will be implemented specifically to mitigate the effects of waste arisings during the construction of the Proposed Development. Measures will likely include -
- Making efficient use of materials, including the use of recycled and existing materials on site when and where appropriate, and
 - Screening and crushing of surplus material generated during site clearance (where the opportunity exists) prior to relocation in order to reduce the amount of waste generated on the Site.
- 5.25 For those materials removed from the Site, notification by the Construction Liaison Officer for approval (via consultation with the authorities) will take place. The Construction Liaison Officer will ensure that any water which may have come into contact with any contaminated materials during construction will be disposed of in accordance with the Water Resources Act (1991) and other legislation, and to the satisfaction of the Environment Agency (EA). In addition, any risk will be reduced by adopting good management practices.
- 5.26 All liquids and solids of a potentially hazardous nature (for example diesel fuel, oils, solvents) will be stored on surfaced areas, with bunding, to the satisfaction of the EA.

ENERGY AND SUSTAINABILITY STATEMENT

- 5.27 This EIA has been prepared having regard to the design parameters described above. The Application is accompanied by a DAS which contains the overall design principles to promote a sustainable development consistent with national and local planning policies and guidance. A separate Energy and Sustainability Statement has also been prepared to accompany the application.
- 5.28 The detailed design of the Proposed Development, including measures to promote energy efficiency and carbon reduction, will be determined at the reserved matters stage. This will include, amongst other matters, consideration of building orientation, windows, and building materials.
- 5.29 The Proposed Development will adopt the nationally recognised energy hierarchy, which places emphasis on reducing energy demands in the first instance, using energy efficiently and, only then, providing renewable and low carbon energy generation technologies where it is appropriate to do so.
- 5.30 The suitability of renewable and low carbon technologies will be reviewed as the design process progresses at the reserved matters stage. The Proposed Development will aim to meet national and local requirements to reduce CO² emissions, enhancing energy efficiency, and provision of renewable energy where appropriate and viable.

6 ALTERNATIVES

- 6.1 This chapter of the ES outlines the main alternatives considered by the Applicant. This is a requirement of The Regulations: Schedule 4, Part 1 which states -

“An outline of the main alternatives studied by the applicant and an indication of the main reasons for the choice, taking into account the environmental effects”.

- 6.2 This section outlines the need for the Proposed Development and the main alternatives considered.

NEED FOR THE DEVELOPMENT AND ITS OBJECTIVES

- 6.3 The Council has a duty to provide a sufficient and continuous five-year supply of housing to meet its identified needs. There is a continuing need for housing to be delivered in the Council area and the Site represents an opportunity on which to provide this. (Further commentary on this is provided in the Planning Statement accompanying the application).

- 6.4 The key objectives of this Application can be summarised as follows -

- Creation of an attractive, deliverable, sustainable development in accordance with the planning policy, and
- Provision of necessary housing to meet identified needs.

ALTERNATIVES

- 6.5 The alternatives considered within this ES are summarised as follows -

- Do nothing,
- Alternative site location.

Do Nothing

- 6.6 Guidance on the preparation of an EIA suggests that the evaluation of a site in the absence of specific proposals should be addressed, which can be described as the “do nothing” scenario. The “do nothing” scenario is a hypothetical alternative, conventionally considered in EIA as a basis for comparing the development proposal under consideration.

- 6.7 The “do nothing” scenario would result in the Site’s baseline remaining unchanged thus avoiding any associated adverse impacts identified as arising as a result of the Proposed Development. However, the “do nothing” scenario is not a reasonable alternative in the context of the need for housing within District.

Alternative Site Location

- 6.8 The Site is controlled by the Applicant, who has also constructed the adjacent Arborfield development. In this context, there is not an alternative location for the Proposed Development to take place. The Site is being promoted as a proposed allocation through the Local Plan process as a suitable and sustainable location for residential development.

7 TRANSPORT

INTRODUCTION

- 7.1 This chapter, which has been prepared by I-Transport, considers the likely effects of the Proposed Development upon traffic and highway conditions within the vicinity of the Site. A comprehensive Transport Assessment (TA) has been prepared (**Technical Appendix 7.1**). A Framework Travel Plan (FTP) (**Technical Appendix 7.2**) has also been prepared to support the ES and Application.

- 7.2 Specifically, the assessment focuses on the following topics: severance, pedestrian/driver delay, pedestrian/cyclist amenity, fear and intimidation, and accidents and safety. There will be no hazardous loads associated with the construction or operation of the Proposed Development. Any mitigation measures required to prevent, reduce, or offset any significant adverse effects and the likely residual or cumulative effects following the implementation of these have also been identified.
- 7.3 The transport strategy for the Proposed Development concentrates on encouraging sustainable modes of travel, focussing on creating good connections to existing walking and cycling routes.

POLICY CONTEXT

Legislation

Guidelines for the Environmental Assessment of Road Traffic (IEMA)

- 7.4 This document forms the basis of EIA assessments and will be reviewed during the EIA process and includes detailed descriptions of potential Transport impacts.

LA 104 Environmental Assessment and Monitoring (August 2020)

- 7.5 Published by Highways England (HE) as part of the Design Manual for Roads and Bridges (DMRB) sets out the principles and purpose of an environmental assessment. The significant matrix used to assess the environmental effects with respect to Transport is provided within the guidance document. The 'Reporting of environmental assessments' chapter within the LA 104 will be reviewed to ensure this ES chapter reporting follows good practice and is clear for the reader.

Planning Policy

National Planning Policy Guidance (December 2024)

- 7.6 The presumption in favour of sustainable development remains the core objective of the NPPF. Paragraph 10 states that, *"So that sustainable development is pursued in a positive way, at the heart of the Framework is a presumption in favour of sustainable development"*
- 7.7 To promote sustainable transport, paragraph 115 states that, *"In assessing sites that may be allocated for development in plans, or specific applications for development, it should be ensured that:*
- *Sustainable transport modes are prioritised taking account of the vision for the site, the type of development and its location;*
 - *safe and suitable access to the site can be achieved for all users;*
 - *the design of streets, parking areas, other transport elements and the content of associated standards reflects current national guidance, including the National Design Guide; and*
 - *any significant impacts from the development on the transport network (in terms of capacity and congestion), or on highway safety, can be cost effectively mitigated to an acceptable degree through a vision-led approach."*
- 7.8 Paragraph 109 states that, *"Transport issues should be considered from the earliest stages of plan-making and development proposals, using a vision-led approach to identify transport solutions that deliver well-designed, sustainable and popular places. This should involve:*
- *Making transport considerations an important part of early engagement with local communities;*
 - *Ensuring patterns of movement, streets, parking and other transport considerations are integral to the design of schemes, and contribute to making high quality places;*
 - *Understanding and addressing the potential impacts of development on transport networks;*
 - *Realising opportunities from existing or proposed transport infrastructure, and changing transport technology and usage – for example in relation to the scale, location or density of development that can be accommodated;*
 - *Identifying and pursuing opportunities to promote walking, cycling and public transport use, and*
 - *Identifying, assessing and taking into account the environmental impacts of traffic and transport infrastructure – including appropriate opportunities for avoiding and mitigating any adverse effects, and for net environmental gains."*

- 7.9 This framework outlines the development vision for Wokingham Borough up to 2026. This framework is designed to ensure that development in Wokingham Borough is well-planned and sustainable, addressing the needs of the community while protecting the environment. It seeks to provide the means of addressing the deficiencies of the Borough in vital infrastructure including roads, schools, parks and community facilities. The framework pledges to focus on delivering development in towns and villages that either already have a good range of facilities and services or will have when development is completed.

WBC Highways Guide for Developers in Wokingham (2019)

- 7.10 This guide provides detailed advice on design standards, legal agreements, and procedures for creating new highway layouts. It provides guidelines for creating new highway layouts, parking and other transport interventions with an emphasis on safety, accessibility, and sustainability in design.

Arborfield and Barkham Neighbourhood Plan (adopted 2020)

- 7.11 This document is a collaborative effort by the Arborfield and Newland Parish Council and Barkham Parish Council with participation encouraged for local residents. The plan sets out a vision for the future development of the area, focusing on sustainable growth, preserving the character of the parishes, and enhancing community facilities. The plan addresses significant changes like the development of Arborfield Green garden village and the construction of the Arborfield Cross Relief Road.

METHODOLOGY

Scoping

- 7.12 The Scoping Opinion received from the Council (refer to paragraphs 1.8-1.11 of this ES and **Technical Appendix 1.2**) confirmed the approach that Transport would be scoped into the EIA assessment, and the assessment would be undertaken under IEMA guidelines.
- 7.13 The Council suggested that the Proposed Development would need to be modelled through the updated Local Plan model so the future year flows can be provided in suitable formats for the EIA assessment. This has been undertaken, with modelling completed in accordance with the Council's Highway use of Highway Model Protocol.
- 7.14 ITL11337-011D Strategic Model Scoping was prepared to set out the proposed strategic highway modelling scope and testing for the Proposed Development, following feedback on the TA Scoping Report received on 20th August 2024 and meeting with Gordon Adam on 29th August 2024. The document was also updated to reflect additional feedback from Gordon Adam as set out in email dated 17th October 2024 and to reflect the latest parameter plan proposals. Final amendments to the proposed modelling methodology were made following comments from the Council Highways as set out within their Pre-application Comments received on 2nd June 2025.
- 7.15 The assessment of individual environmental elements will be carried out in accordance with the 'Guidelines for the Environmental Assessment of Road Traffic and 'LA 104 Environmental Assessment and Monitoring'. These documents are appropriate tools for the appraisal of environmental impacts of transport and access, and they identify appropriate standards for assessment.

Trip Generation

- 7.16 The Proposed Development trip generation is provided in the table below for the AM peak and PM peak as well as daily. This is based on the agreed trip generation as set-out within the Strategic Model Scoping based on surveys of existing vehicle movements from Oak Drive (within Arborfield Green).
- 7.17 The number of elderly care beds and type of provision has not been determined at this stage, but for the purposes of the trip generation assessment, 50 have been assumed, alongside the 660 dwellings.

Table 7.1 – Trip Generation

	AM Peak (0800-0900)			PM Peak (1700-1900)			Daily		
	Arr	Dep	2 way	Arr	Dep	2 way	Arr	Dep	2 way
Trip generation of scheme	127	266	393	201	125	326	1359	1447	2806

- 7.18 The trip rates include a 10% reduction from the surveyed flows in line with the Council's Climate Emergency Action Plan (CEAP) targets and the active travel mode measures proposed as part of the Development which the surveyed flows do not fully account for. In particular, this includes -
- Full delivery of facilities and services as part of Arborfield Green,
 - Full operation of the bus route serving Arborfield Green,
 - Borough wide initiatives to influence and reduce the need to travel (including MyJourney).

Wokingham Highway Model

- 7.19 The Council maintains a Wokingham Strategic Highways Model (VISUM) based on surveyed traffic data that represents an average weekday (Tuesday to Thursday). The following model outputs are available -

- Actual and Demand Flow,
- Junction Turning Flow (only if requested),
- Delay,
- Level of Service,
- Volume over Capacity (VoC).

- 7.20 Traffic surveys were undertaken on key local links and junctions in July 2024. This survey data was shared with the Council to help inform the Strategic Highway Model outputs and assessment of the Proposed Development. Outputs for the following junctions have been derived from the Council's Strategic Highway Model for each future baseline and operational scenario -

- B3349 / Biggs Lane Roundabout,
- B3349 / Eversley Road Roundabout,
- A321 / Observer Way / Eversley Road Roundabout,
- B3349 / School Road T-Junction,
- B3349 Barkham Road / Barkham Street Roundabout, and
- B3349 Barkham Road / Bearwood Road.

- 7.21 The AM and PM peak hour flows for each arm of the above junctions have been provided for all considered scenarios. These peak hour link flows have been factored to determine the AADT and AAWT flows for each considered link.

Study Area

- 7.22 The study area has been determined from the Strategic Highway Model, which identified the junctions which the Proposed Development is likely to have an impact on. Flow data has been derived across the following links -

- Eversley Road (Between Poperinghe Way and Observer Way)
- Eversley Road (Between Observer Way and Baird Road)
- Eversley Road (Towards Arborfield Cross)
- Langley Common Road (Between Eversley Road and Biggs Lane)
- Langley Common Road (Between Biggs Lane and Site Access)
- Langley Common Road (Between Site Access and School Road)
- Barkham Road (Between School Road and Barkham Street)
- Barkham Road (Between Barkham Street and Bearwood Road)
- Barkham Road (Bearwood Road and Edneys Hill)
- Observer Way
- Baird Road
- Biggs Lane

- School Road
- Barkham Street
- Bearwood Road

7.23 The location of these links are demonstrated in **Figure 7.1**.

Determining Baseline Conditions and Sensitive Receptors

7.24 As per IEMA (2023) guidelines, the scope of links includes roads which may experience higher traffic temporarily or indefinitely as a result of the Proposed Development.

7.25 The IEMA Guidelines suggest two broad rules to identify the appropriate extent of the highways assessment area, which are as follows -

- Rule 1: Include highway links where traffic flows will increase by more than 30% (or the number of heavy good vehicles will increase by more than 30%), and
- Rule 2: Include highway links of high sensitivity where traffic flows have increased by 10% or more.

7.26 Increases in traffic flows below 10% are not generally considered to be material in environmental terms, given that daily variations in background traffic flow may also vary by this amount. As such, where the predicted increases in traffic flows are lower than the above thresholds, the IEMA Guidelines suggest that the significance of the effects should be stated to be 'Negligible', and therefore further assessment as part of the EIA is not warranted.

7.27 Therefore, whilst the highway scope area includes all links on the local and strategic road network surrounding the Site that are likely to be subject to daily traffic flow changes as a result of the Proposed Development's construction or operation, a full assessment has only been undertaken on those links which satisfy the conditions set out in the rules above.

7.28 The receptors that have been identified for assessment of the Proposed Development have been determined based on professional judgement; this has considered their relative importance for all road users, and their existing characteristics such as the presence (or absence) of pedestrian facilities.

7.29 For this assessment, the anticipated construction traffic is to be added to the 2040 – Do Minimum baseline as to provide a 'worst case scenario'. The uplift in the Heavy Goods Vehicles (HGVs) traffic is assessed in accordance with IEMA Guidelines.

Assessment Scenarios

7.30 The Proposed Development is expected to commence in 2027, with an 8-year build programme. Completion and occupation of the Site is expected to occur in 2035. Only 2032 and 2040 years are available for the Strategic Highway Model and as such 2040 has been used for all future scenarios, providing a robust assessment.

7.31 The following Strategic Highway Model scenarios have been used -

- 2040 – Do Minimum (background growth not accounting for local plan or infrastructure),
- 2040 – Do Something without Development (providing local plan growth and distribution),
- 2040 – Do Something with completed Development (providing distribution for development trips),
- 2040 – Do Minimum with Construction (prior to occupation).

7.32 The traffic survey data (which has been shared with the Council) identified that the peak hourly traffic flow varies between 07:45 – 08:45 and 08:00 – 09:00 during the AM peak and 16:45 – 17:45 and 17:00 – 18:00 during the PM peak. The network has been assessed for the AM peak period of 08:00 – 09:00 and PM peak of 17:00 – 18:00 for consistency with the trip generation and strategic model.

Table 7.2 Modelled Scenarios

Reference	Scenario	Description
1	Future Reference Case	2040 – Do Minimum (background growth not accounting for local plan or infrastructure)
2	Future Baseline Local Plan	2040 – Do Something without Development (providing local plan growth and distribution)
3	Operational Scenario	2040 – Do Something with Development

- 7.33 The Future Reference Case (Do Minimum) includes sites with planning permission in Wokingham Borough.
- 7.34 The Future Local Plan Scenarios (Do Something) include all developments outlined within the emerging Local Plan Regulation 19 Submission in addition to those sites with planning permission. In terms of Arborfield Green, this includes 3,800 dwellings, comprising 3,500 as part of the initial Arborfield SDL and 300 associated with Arborfield SDL additional capacity.
- 7.35 Below are the specifically identified cumulative schemes that have potential for cumulative effects which were scoped into the assessment –
- South Cutbush Lane, Shinfield (18/1499) – Granted permission in 2020 and forms part of the committed development within the Borough – captured as a reference case in the Local Plan traffic modelling,
 - East of Shinfield (phase 2), south of Church Lane (17/2450) – forms part of the South of M4 SDL included as an allocated site in adopted Plan – captured as a reference case in the Local Plan traffic modelling,
 - Hall Farm/Lodden Garden Village (24/3188) – Allocated in the emerging Local Plan – captured in Local Plan traffic modelling,
 - South Wokingham SDL (including extension south of Waterloo Road) – Allocated in emerging Local plan – captured in Local Plan traffic modelling.

Receptors and Receptor Sensitivity

- 7.36 The potential environmental effects in relation to transport mainly arise from increases in traffic flows and heavy goods vehicle movements along the adjacent highway links during construction and operational periods.
- 7.37 The scale and extent of assessment focusses on those highway links where traffic flows are predicted to increase by more than 30% or the number of heavy goods vehicles will increase by more than 30%.
- 7.38 The effect of significance has been derived from measures of the magnitude (or scale) of the change and the sensitivity (or importance) of the receptors affected. Categories of sensitivity and magnitude will be defined and assessed to determine the significance of the effect following the principles set out by the IEMA Guidelines.
- 7.39 The IEMA Guidelines identify the main transport effects that could arise from the construction and operation of new developments. These effects relate to the following –
- Severance of communities,
 - Road vehicle driver and passenger delay,
 - Non-motorised user delay,
 - Non-motorised user amenity,
 - Fear and intimidation on and by road users,
 - Road user and pedestrian safety,
 - Dust and dirt,
 - Hazardous/ large loads.
- 7.40 The ‘dust and dirt’ criterion is not considered further within this chapter as it covered within Air Quality Chapter. The ‘hazardous loads’ criterion is also not considered in this assessment, as the construction or operation of the Proposed Development will not require the transportation of hazardous loads that would have the potential for a significant effect on receptors.

Magnitude of Impact

Severance

- 7.41 The IEMA Guidelines states that “*Severance is the perceived division that can occur within a community when it becomes separated by a major transport infrastructure*”, whilst DMRB LA 112 Rev 1 ‘Population

and human health' defines severance as "*The extent to which members of communities are able (or not able) to move around their community and access services / facilities*".

7.42 It is acknowledged within the Guidelines that the measurement and prediction of severance is "*extremely difficult*" and that "*there are no predicative formulae that give simple relationships between traffic factors and levels of severance*". However, the Guidance tentatively suggests that "*Changes in traffic flow of 30%, 60% and 90% are regarded as producing 'slight', 'moderate' and 'substantial' changes in severance respectively*".

7.43 The assessment of severance pays full regard to specific local conditions, in particular the location of pedestrian routes to key local facilities, and whether or not crossing facilities are provided.

7.44 Table 7.3 below details the thresholds for severance used in this assessment.

Table 7.3 – Scale of Magnitude for Severance

Magnitude	Description
High	90% or greater change in traffic flow
Medium	60% to 89% change in traffic flow
Low	30% to 59% change in traffic flow
Negligible	Less than 30% change in traffic flow

Driver Delay

7.45 Para. 3.19 of the IEMA Guidelines states that "*Traffic delays to non-development traffic can occur at several points on the network surrounding a development site including: at the site entrance, on the highways passing the site, at other key intersections, and at side roads where the ability to find gaps in traffic may be reduced, thereby lengthening delays*".

7.46 Total Delay has been derived for all considered links in the Strategic Highway Model to assess the significance of effect.

7.47 The IEMA Guidelines further state that "*These delays are only likely to be significant when the traffic on the network surrounding the proposed development is already at, or close to, the capacity of the system*".

7.48 Table 7.4 below sets out the magnitude-scale which has been applied for the purposes of this assessment.

Table 7.4 – Scale of Magnitude for Driver Delay

Magnitude	Description
High	Average vehicle delay changes of more than 60 seconds as a result of the Proposed Development during the peak hour periods
Medium	Average vehicle delay changes of 30 – 60 seconds as a result of the Proposed Development during the peak hour periods
Low	Average vehicle delay changes of 20 – 30 seconds as a result of the Proposed Development during the peak hour periods
Negligible	Average vehicle delay changes of less than 20 seconds as a result of the Proposed Development during the peak hour periods

Pedestrian/Cycle Delay and Amenity

7.49 Pedestrian delays for a particular walking journey can be increased by changes to traffic flows and can affect the ability of pedestrians to cross roads. This will therefore affect an individual's desire to make particular journeys on foot. Para. 3.24 of the IEMA Guidelines states that "*Changes in the volume, composition or speed of traffic may affect the ability of people to cross roads*", dependent on the "*level of pedestrian activity, visibility and general physical conditions*" at the Site.

- 7.50 For the purposes of this assessment, the scale of magnitude set out in Table 7.5 will be used to categorise and assess the impact on pedestrian delay, with the characteristics of the link-receptor and professional judgement taken into consideration.

Table 7.5 – Scale of Magnitude for Pedestrian Delay

Magnitude	Description
High	Link subject to a two-way traffic flow of more than 5,600 vehicles per hour
Medium	Link subject to a two-way flow of 3,500 – 5,600 vehicles per hour
Low	Link subject to a two-way flow of 1,400 – 3,000 vehicles per hour
Negligible	Link subject to a two-way flow of less than 1,400 vehicles per hour

- 7.51 Pedestrian amenity is broadly defined as the *“relative pleasantness of a journey”*, and it is affected by traffic flow, traffic composition, and pavement width/separation from traffic. Based on qualitative factors, pedestrian amenity can be assessed with reference to the levels of connectivity, safety, crossing facilities, lighting, barriers, and attractiveness.
- 7.52 The IEMA Guidelines suggest a tentative threshold for judging the significance of changes in pedestrian amenity where traffic flow (or its lorry component) is halved or doubled. For the purposes of this assessment, if this is not met the magnitude of impact can be described as ‘Negligible’.

Fear and Intimidation

- 7.53 The impact on levels of fear and intimidation is dependent upon the volume of traffic, its HGV composition, the proximity to people, and/or the lack of protection caused by such factors as narrow pavement widths. The IEMA 2023 guidelines suggest thresholds based on 18-hour daily flow and vehicle speeds, as identified in Table 7.6.

Table 7.6 – Scale of Impact Magnitude for Fear and Intimidation

Magnitude	Average Hourly Two-Way Traffic Flow Over 18-Hour Day	Total 18-Hour HGV Flows	Average Vehicle Speed Over 18-Hour Day (mph)	Degree Of Hazard Score
High	> 1,800	> 3,000	> 40	30
Medium	1,200 – 1,800	2,000 – 3,000	30 – 40	20
Low	600 – 1,200	1,000 – 2,000	20 – 30	10
Negligible	< 600	< 1,000	< 20	0

- 7.54 The criteria above define the degree of hazard to pedestrians by average traffic flow, 18-hour HGV flow and average vehicle speed over an 18-hour day in miles/hour. The total score from all three elements is combined to provide a ‘level’ of fear and intimidation for all three elements as per the table below.

Table 7.7 – ‘Level’ of fear and intimidation

Level Of Fear and Intimidation	Combined Hazard Score
Extreme	>71
Great	41-70
Moderate	21-40

Level Of Fear and Intimidation	Combined Hazard Score
Small	<20

- 7.55 The magnitude of impact is approximated with reference to the changes in the level of fear and intimidation from baseline conditions using the table below.

Table 7.8 – Scale of Magnitude for fear and intimidation

Magnitude of Impact	Combined Hazard Score
High	Two step changes in level
Medium	One step change in level, but with >400 veh increase in average 18hr AV two-way all vehicle flow; and/or >500 HV increase in total 18hr HV flow
Low	One step change in level, but with <400 veh increase in average 18hr AV two-way all vehicle flow; and/or <500 HV increase in total 18hr HV flow
Negligible	No step changes in level

- 7.56 It should, however, be reasserted that whilst quantitative thresholds are suggested, the experience of road users is dependent on qualitative factors such as the availability of pedestrian facilities. These thresholds also do not take into consideration how change in traffic flow is perceived by road users; for example, a small rise in flows on a link already experiencing higher traffic volumes is unlikely to correspond with higher levels of fear and intimidation as it is likely to be in line with the existing perception of the road.
- 7.57 In light of this, the guidance relating to the percentage change in traffic flow will additionally be utilised to understand higher trafficked roads (those with Medium or High baseline levels) where the perception of the road and therefore the levels of fear and intimidation is unlikely to be impacted. If the additional traffic is in line with the existing perception of the area, i.e., a Negligible increase in traffic flow, the impact will be described as Negligible.

Accidents and Safety

- 7.58 The IEMA Guidelines suggest that *“The calculation of collision rates is still considered a relevant approach to scale a road safety assessment; however, it is more common for stakeholders to request a ‘collision cluster’ assessment to identify potential impacts at a more detailed level”*.
- 7.59 For the purposes of this assessment, links where no inherent highway safety issues were identified in the Baseline scenario are described as having a Negligible magnitude. Where a professional review of the Proposed Development and potential traffic impact suggests that there will be no effect on highway safety in the area, the impact magnitude will be described as Negligible.
- 7.60 Table 7.9 below sets out the criteria which shall be used to assess the impact of the Proposed Development on accidents and highway safety.

Table 7.9 – Scale of Impact Magnitude for Accidents and Safety

Magnitude	Description
High	Expected change in accident risk of 15%+
Medium	Expected change in accident risk of 10 – 14%
Low	Expected change in accident risk of 5 – 9%
Negligible	Expected change in accident risk of less than 5%

- 7.61 Cumulative Schemes and local improvement schemes have additionally been reviewed and factored into the assessment of accidents and safety.
- 7.62 The access proposals have undergone a Stage 1 Road Safety Audit, the results of which will form a qualitative component of the Accidents and Safety assessment.
- 7.63 The scale and extent of the assessment can be informed by the general principle that a specific increase in traffic flows or corresponding number of HGVs on a given link indicates that it should be scoped into the ES assessment of traffic and transport as a receptor.
- 7.64 In addition, para. 3.20 of the IEMA Guidelines states that *“The competent traffic and movement expert should include any other link or location where it is felt that specific environmental sensitivities may occur”*.
- 7.65 Table 7.10 below sets out the scale of sensitivity applied to the identified receptors.

Table 7.10 – Scale of Receptor Sensitivity used in the Assessment

Magnitude	Description
High	High importance and rarity, and limited potential for substitution. Includes receptors of greatest sensitivity to traffic flows; schools, colleges, playgrounds, accident black spots (with reference to appropriate accident data), retirement homes, and urban / residential roads without footways that are used by pedestrians
Medium	Medium importance and rarity, and limited potential for substitution. Receptors sensitive to traffic flow include congested junctions, doctors' surgeries, hospitals, shopping areas with roadside frontage, roads with narrow footways, unsegregated cycleways, community centres, parks, and recreation facilities
Low	Low importance and rarity. Receptors with some sensitivity to traffic flow include places of worship, public open space, nature conservation areas, listed buildings, tourist attractions, and residential areas with adequate footway provision
Negligible	Very low importance and rarity, and local scale. Receptors include with low sensitivity to traffic flows and those sufficiently distant from affected roads and junctions

Defining the Effect

- 7.66 The assessment has been undertaken in accordance with relevant policies and guidance, including the IEMA Guidelines, and as such the criteria established above are considered appropriate to assess whether the potential transport effects of the Proposed Development will be significant. As outlined above, the potential effects have been assessed with reference to quantitative criteria unless it is appropriate to consider the effect in a qualitative manner, or it is not possible to undertake a quantitative assessment. Where qualitative assessment criteria is applied, a professional judgement will be made and any relevant assumptions or uncertainties identified.
- 7.67 The scale of effect on a receptor, will therefore be determined by combining the predicted magnitude of the impact with the sensitivity of the receptor under consideration. The effects matrix that has been applied to this assessment is given in Table 7.11 below.
- 7.68 The following criteria is applied to the effects -
- Moderate or major are deemed to be significant,
 - Minor are considered to be not significant, although they may be a matter of local concern, and
 - Negligible effects are considered to be not significant.

Table 7.11 – Effects Matrix

Sensitivity/ value of a Receptor	Magnitude of Impact			
	High	Medium	Low	Negligible
Very High	Substantial	Substantial	Moderate	Slight
High	Substantial	Moderate	Slight	Negligible
Medium	Moderate	Slight	Negligible	Negligible
Low	Slight	Negligible	Negligible	Negligible

- 7.69 The assessment of significance considers the existing future transport conditions (without development) as a baseline and provides a prediction of the future effect on the transport network for the construction and operation phases of the Proposed Development.

- 7.70 The nature of the effects may be either adverse (negative) or beneficial (positive). The significance of the effects arising from the Proposed Development will be reported using a seven-point scale -
- Major Adverse
 - Moderate Adverse
 - Minor Adverse
 - Negligible
 - Minor Beneficial
 - Moderate Beneficial
 - Major Beneficial

Methodology for Construction Assessment

- 7.71 With regards the construction assessment baseline, IEMA Guidelines recommends...
- "...that the environmental assessment should be undertaken at the construction/decommissioning phase, year of opening of the project or the first full year of its operation."*
- 7.72 This is because...
- "...the natural increase of traffic will generally have the effect of diluting the environmental impact of a project."*
- 7.73 The 2040 – Do Minimum scenario has therefore been assumed as the baseline that the construction impacts will be assessed against. This is a realistic assumption as it is unlikely that the Local Plan infrastructure interventions will be developed by the time construction is underway. The 2040 – Do Minimum scenario may also be considered a worst case as there is less traffic on the network than the 2040 – Do Something scenario, thereby the construction traffic represents a higher proportion.
- 7.74 The number of construction related vehicle movements have been derived from the original EIA produced for the Arborfield Garrison Strategic Development Location outline permission (O/2014/2280). An indicative phasing programme has been prepared by Crest Nicholson which estimates on average there would be 150 dwellings constructed per annum. This enabled a worst-case estimate of the associated construction traffic to be determined, which found that during the peak construction period, there would be circa 250 two-way vehicle trips. The majority of these would be light vehicle movements associated with onsite personnel travelling to and from the Site whilst 68 two-way trips per day are predicted to be HGVs transporting various materials to and from Site.
- 7.75 With regards to routing, the shortest route to the strategic road network (M4 motorway) is via the A327 to the north, therefore all HGV traffic has been assumed to route west along Langley Common Road from the Site access and along Observer Way to access the A327. In terms of light vehicle movements these will be dispersed across the adjoining road network arriving from a variety of origins. It has therefore been assumed the distribution of the light vehicle construction trips will follow that of the operational trips derived from the Strategic Highway Model.

Table 7.12 – Peak AAWT Construction Vehicle Trips

AAWT	Arrive	Depart	Two-way
Lights	91	91	182
Heavies	34	34	68
Total	125	125	250

Methodology for Completed Development Assessment

- 7.76 The IEMA guidance is used to determine a Significance value for each relevant transport link for the construction phase and full build out, as determined from Sensitivity and Magnitude of Impact. The Significance criteria adopted for likely traffic and transport effects is based on the Magnitude of Impact (or scale) of the change as well as the Sensitivity' (or importance) of the receptor affected. The magnitude of effects and receptor sensitivity will be compared to estimate the significance of the effect. Table 7.12 shows how the Receptor Sensitivity and Magnitude of Impact determine the Significance.

- 7.77 The Magnitude of Impact value has been determined by considering Severance, Pedestrian and Cycle Delay and Amenity, Fear and Intimidation, and Accidents and Road Safety together. Finally, a Significance value for each link for the demolition and construction phase, as determined from Sensitivity and Magnitude of Impact.
- 7.78 The ES will also report on the significance of the environmental effects associated with transport prior to mitigation, in line with DMRB and IEMA guidance. This will be based on a sensitivity / magnitude matrix basis as demonstrated in Table 7.11, in combination with professional judgement of subjective impacts.

Limitations and Assumptions

- 7.79 In undertaking the traffic and transport assessment of the Site and wider surrounding area, several assumptions have been applied, however, these comprise the standard assumptions and limitations inherent to assessments of this nature. As such they are not considered to affect the validity of the results.

BASELINE CONDITIONS

- 7.80 This section provides a summary of the baseline conditions with respect to transport and traffic within the Site and its surroundings, including an assessment of the local transport networks.

Pedestrian and Cycle

- 7.81 The Council's 'Greenways Project' will deliver several routes around Barkham and Arborfield Green. Greenways are largely traffic-free routes connecting the major Strategic Development Locations (SDLs) and key destinations in the Borough for pedestrians, cyclists and, in some cases, equestrians. The first phase, known as California Way, links Arborfield Green and Finchampstead, via California Country Park, and is already built and in use.
- 7.82 The internal walking and cycling routes within Arborfield Green will connect to the Greenway routes. Greenway Route 2 routes along the eastern boundary of the site (Commonfield Lane), providing an opportunity for the Proposed Development to link to it and add to the network of safe walking and cycling routes in the area. The full network of walking and cycling routes, including the links to the external Greenways (both built and proposed routes) to be delivered is illustrated in **Figure 7.2**.
- 7.83 The extension to Greenway Route 2 is proposed to follow the alignment of Commonfield Lane, although the detail of the route is still to be developed, it is expected that this would continue in a similar form to the existing route which is set-back from the carriageway with a landscaped buffer.
- 7.84 The Site will deliver a connection to the boundary to provide connections to the walking and cycling network delivered as part of the Arborfield Green development, providing access to the local facilities there which include -
- District centre (including local supermarket, shops and pub/restaurant),
 - Two primary schools (Farley Hill Primary and one under construction),
 - A secondary school (Bohunt Wokingham),
 - Youth football club,
 - Green open space (Hazebrouck Meadows),
 - Leisure centre,
 - Community Centre,
 - Play areas,
 - Allotments and community gardens,
 - Village Green and
 - Sports pitches.
- 7.85 There is a network of public rights of way (PRoW) routes to the north, west and east of the Site. BARK7 is a footpath which routes along the northern boundary of the Site, connecting Langley Common Road to Barkham Street. The Wokingham Rights of Way Improvement Plan (2020) features some proposed routes nearby including one from roughly the middle of BARK7 routing north to link to Barkham Road and one along Barkham Street. The plan includes proposals to change the BARK7 footpath to a bridleway

allowing equestrian and cycle use. These are illustrated on **Figure 7.3** along with indicative all-modes and pedestrian/cyclist only access points.

- 7.86 These routes offer walking and cycling connections to the wider area including Wokingham to the north-east, Finchampstead to the south and towards Shinfield to the north-west. These destinations are all within reasonable cycling distance and offer access to a variety of additional facilities and services.

Bus

- 7.87 Currently, the Leopard 3 offers a 15-minute service to Arborfield Green, routing from Reading, Shinfield, Arborfield Cross to Langley Common Road, Biggs Lane and then right to Princess Marina Drive southwards to Bohunt School. The Leopard 3 also offers a 30-minute service to Wokingham, Arborfield and Reading which has recently been increased from an hourly service.

- 7.88 Bus route 145 is a Tuesday morning service between Winnersh, Arborfield and Wokingham. It also extends to Eversley, Riseley and Spencers Wood. A summary of the current Leopard 3 services is provided below-

- One service per hour between Arborfield and Reading,
- Two services per hour between Reading and Wokingham via Arborfield,
- One service per hour between Reading and Bracknell via Arborfield, and
- Daily services to Bohunt Secondary school.

- 7.89 There is existing good quality bus provision available within Arborfield Green which can be accessed within walking distance of the Site, that provide connections to Reading, Wokingham, and other key regional destinations. There are opportunities to further improve access to these services by routing existing services along Princess Marina Drive, Baston Road or Langley Common Road.

Rail

- 7.90 The nearest train station is Wokingham, circa 4km north-east of the Site. The station can be accessed by the Leopard 3 bus service which offers two buses per hour once fully operational. The rail services available from Wokingham provide direct connections to Reading and London Waterloo with typical frequencies at peak and off-peak times summarised in Table 7.13.

Table 7.13 – Rail Frequency

Destination	Average Journey Times	Typical Frequency of Service	
		Peak Times	Off-Peak Times
Reading	10 minutes	4 per hour	4 per hour
London Waterloo	1 hr 10 minutes	2 per hour	1-2 per hour
Gatwick Airport	1 hr 22 minutes	2 per hour	2 per hour

- 7.91 There are good opportunities for travel via train with frequent services to key destinations particularly Reading which is only a 10-minute journey.

- 7.92 As demonstrated, the Site benefits from good connections to the public transport network as well as the walking and cycling networks. This will offer future residents a choice of sustainable modes of travel to reach both local destinations and destinations further afield for commuting journeys.

Local Highway Network

- 7.93 The local highway network is demonstrated in **Figure 7.4**.

Langley Common Road

- 7.94 This road borders the Site to the north-west and runs from the roundabout junction with Eversley Road and Baird Road to the south-west and the simple priority junction with School Road towards the northern extent of the Site boundary. Beyond the junction with School Road, Langley Common Road becomes Barkham Road which continues north-east and retains a similar character.

- 7.95 Langley Common Road provides access to Arborfield Film Studios just south of the Site. This access is opposite a couple of small businesses (vehicle sales and vehicle servicing) with short and long term onsite parking provision. The remaining accesses along Langley Common Road are to driveways for residential properties predominantly fronting the north-western kerbside, however there is also a parcel several of properties fronting the Site-side of the road.

- 7.96 Footway provision runs along the full extent of Langley Common Road on the north-western kerbside providing continuous access south to the Arborfield Green residential area (a pinch point along this route exists just south of the aforementioned businesses opposite the film studio). Footway provision does exist along the south-eastern kerbside along the extent of the parcel of dwellings. There is no formal crossing provision connecting the footways however very good visibility exists in both directions.
- 7.97 The speed limit increases from 30mph from the roundabout junction with Eversley Road and Baird Road and 20 Langley Common Road where it becomes 40mph. The road is in good condition with good forward visibility and is lit.

Barkham Road

- 7.98 This road continues from the Langley Common Road junction with School Road, and continues through Barkham and into Wokingham, joining Reading Road close to the Rail Station. Heading east, a footway continues on the north side of the road and the speed limit is 40mph until it drops to 30mph just before reaching a small number of dwellings (1-6 Bridge Cottages). The road layout has been updated in the last 5 years to replace shuttle operation over a stream with two-way operation and improved pedestrian facilities.
- 7.99 The road has three mini-roundabout junctions as it arrives in Barkham. The performance and capacity of these junctions will be assessed as part of the TA (**Technical Appendix 7.1**) and within this ES chapter. The road operates as the main distributor road within Barkham running along the southern boundary of the main settlement. The road provides access to residential driveways on both sides of the road within Barkham and footways on both sides of the road extend through Barkham. Footways on just the north kerbside continue for 350m until the road arrives at the outskirts of Wokingham. The road broadly retains its character into Wokingham although more pedestrian amenities are introduced such as signalised crossings. There are many bus stops along the extent of Barkham Road from the northern extent of the Proposed Development to Wokingham Town Centre.

Barkham Street

- 7.100 Barkham Street runs from the mini-roundabout junction with Barkham Road in a north/south orientation to a simple priority junction with Commonfield Lane, at which point the road becomes Barkham Ride which continues south-east to Finchampstead North. The road has a 40mph speed limit and 6'6 vehicle height restrictions. The road is in good condition and unlike the roads detailed above is not residential in nature, serving a handful of larger residencies, farms and rural businesses.
- 7.101 There is footway provision along the west side of the road from its northern extent. Footway provision ceases at the priority junction with Church Lane (which provides access to a church and village hall), from which point the road continues (in excellent condition considering its more rural nature) without footway provision and serving very little until arriving in Finchampstead North settlement. Significant resurfacing works appears to have been undertaken along this road in 2021. The road is unlit.

Commonfield Lane

- 7.102 This Lane runs from its junction with Barkham Street south along the eastern boundary of the Site and ends at the junction with Biggs Lane to the south. Commonfield Lane is much more rural in nature than the roads discussed above. The carriageway appears no wider than 3.5m and does not have separate running lanes. Larger vehicles can use informal laybys that are common along its extent to pass each other. The lane is bordered on both sides by thick trees and shrubbery although this does not seem to impact upon the safety or amenity of the road. There are a small number of farm accesses until towards the southern extent of the lane, it provides more formal accesses to a small number of dwellings and a small caravan park. The lane is not lit, has no pedestrian footway provision and is subject to the national speed limit.

Biggs Lane

- 7.103 This road operates as one of the local distributor roads for Arborfield Green running from its roundabout junction with Langley Common Road to the west running east to its simple priority junction with Commonfield Lane, beyond which Biggs Lane becomes Park Lane which routes away from the Arborfield Green settlement south and provides access to the B3430 which runs east towards Bracknell.

- 7.104 Biggs Lane is in excellent condition, much of it having been resurfaced in the last few years. The road is subject to a 30mph speed limit, has wide footways on both sides of the road which are segregated within large and well landscaped verges creating a very pleasant pedestrian environment.
- 7.105 Biggs Lane provides the main distributor access route to several residential plots via simple priority junctions. There are no driveways or minor accesses along the route and there are double yellow line restrictions along its extent. Pedestrian footways on the south side of the road cease towards the junction with Oak Drive. Segregated provision continues to the junction with Commonfield Lane when Biggs Lane becomes Park Lane which is more rural in character.

Local Amenities

- 7.106 A plan showing local amenities is contained within **Figure 7.5**.

Baseline Traffic Data

- 7.107 Manual Classified Counts (MCC) have been undertaken at 5 junctions, and Automatic Traffic Counts (ATC) at 6 locations, as listed below: -
- Manual Classified Count Locations -
 - A327 Observer Way/ A327 Eversley Road roundabout
 - Eversley Road/ Langley Common Road roundabout
 - Langley Common Road/ Biggs Lane roundabout
 - Barkham Road/ Barkham Street mini roundabout
 - Barkham Road/ Bearwood Road mini roundabout
 - Automatic Traffic Count Locations -
 - Langley Common Road
 - Biggs Lane
 - Commonfield Lane
 - Barkham Road (west of Barkham Street junction)
 - Barkham Road (east of Barkham Street junction)
 - Barkham Street
- 7.108 The MCCs were undertaken on 2nd and 3rd July 2024 covering the AM (07:00 – 10:00) and PM (16:00 – 19:00) peak periods, and the ATCs were undertaken for a two-week period from 20th June 2024, these will provide vehicle speeds and volume data along key links near the site for 24 hours.
- 7.109 The survey results were issued to the Council to advise the Strategic Model outputs.

Personal Injury Collision (PIC) Review

- 7.110 The collision casualties are classified into three categories, based on severity: Slight, Serious and Fatal, definitions of which are provided below -
- Slight Injury: Injuries of a minor nature, such as sprains, bruises, or cuts not judged to be severe, or slight shock requiring only roadside attention (medical treatment is not a prerequisite for an injury to be defined as slight),
 - Serious Injury: Injuries for which a person is detained in hospital, as an in-patient, or any of the following injuries, whether or not a person is detained in hospital; fractures, concussion, internal injuries, severe cuts and lacerations, severe general shock requiring medical treatment and injuries which result in death 30 days after the accident. The serious category, therefore, covers a very broad range of injuries, and
 - Fatal Injury: Injuries which cause death either immediately or any time up to 30 days after the accident.

Receptors and Receptor Sensitivity

Existing

7.111 The links identified as being potentially impacted, their associated sensitivity, and a brief justification for the designation of their sensitivity, is provided in Table 7.14 below.

Table 7.14 – Receptor Sensitivity

Link Receptor Reference	Link Receptor Name	Road Speed	Specific Receptors	Sensitivity
1	Eversley Road (Between Poperinghe Way and Observer Way)	40mph	- Signalised Pedestrian Crossing - No footway provision	Low
2	Eversley Road (Between Observer Way and Baird Road)	40mph	No footway provision	Low
3	Eversley Road (Towards Arborfield Cross)	30mph	- Bus stops (approximately half hourly services) - Vehicle storage facility / repair shop - Auction house - Give-way to oncoming traffic feature - Ducks Nest Farmhouse – Grade II listed - Access to listed buildings within Arborfield Village	Low
4	Langley Common Road (Between Eversley Road and Biggs Lane)	30mph	- Bus stops (approximately half hourly services) - Footway provision - Access to Rickman close	Low
5	Langley Common Road (Between Biggs Lane and Site Access)	40mph	- Bus stops (approximately half hourly services) - Footway provision - Access to Arborfield Studios - Relatively narrow carriageway	Low
6	Langley Common Road (Between Site Access and School Road)	40mph	- Bus stops (approximately half hourly services) - Footway provision - Access to residential driveways - Relatively narrow carriageway	Low
7	Barkham Road (Between School Road and Barkham Street)	30mph	- Bus stops (approximately half hourly services) - Footway provision - Congestion can occur eastbound	Low
8	Barkham Road (Between Barkham Street and Bearwood Road)	30mph	- Bus stops (approximately half hourly services) - Footway provision - Wall To Barkham Manor – Grade II listed	Low
9	Barkham Road (Bearwood Road and Edneys Hill)	30mph	- Bus stops (approximately half hourly services) - Footway provision	Low
10	Observer Way	50mph	- Observer Way Bridge - Shared footway/cycleway	Low
11	Baird Road	30mph	- Footway provision - On-street parking - Residential access road	Low
12	Biggs Lane	30mph	Footway provision	Low

			• 20mph School Zone • Residential access road	
13	School Road	30mph	• Through road closed, access only • Access to residential driveways • Access to primary school • Langleypond Farmhouse – Grade II listed	Low
14	Barkham Street	40mph	• The Bull Barkham Pub • Access to residential driveways • Footway provision • Relatively narrow carriageway • Barkham Village Hall • St James Church • Congestion can occur northbound	Medium
15	Bearwood Road	30mph	• Access to residential driveways • Footway provision	Low

IMPACTS

Construction Impacts

7.112 Demolition and construction would generate short term increases in vehicle movements on the highway in the vicinity of the Site. It should also be noted that these increases are not constant throughout the overall construction period. The construction trip generation and distribution outlined in Table 7.12 result in the AAWT construction flows across the considered network presented in Table 7.15.

7.113 This seeks to determine whether each link in this scenario respectively satisfies Rules 1 and 2 of the IEMA Guidelines (as defined in paragraph 7.25 of this ES) for further detailed assessment.

Table 7.15 – Construction Impacts

Link	Direction	Construction Assessment			
		Scenario 1	Scenario 4	% Change in Traffic Flows	% Change in HGV Traffic Flows
Eversley Road (Between Poperinghe Way and Observer Way)	EB/NB	10218	10228	0.1%	0.0%
	WB/SB	9235	9239	0.4%	0.0%
	Two-way	19453	19467	0.2%	0.0%
Eversley Road (Between Observer Way and Baird Road)	EB/NB	9776	9798	0.6%	19.5%
	WB/SB	9604	9637	0.7%	32.2%
	Two-way	19380	19435	0.6%	24.3%
Eversley Road (Towards Arborfield Cross)	EB/NB	3700	3709	0.2%	0.0%
	WB/SB	4291	4301	0.2%	0.0%
	Two-way	7991	8010	0.2%	0.0%
Langley Common Road (Between Eversley Road and Biggs Lane)	EB/NB	8407	8433	0.3%	22.2%
	WB/SB	7466	7492	0.3%	35.2%
	Two-way	15873	15925	0.3%	27.2%
Langley Common Road (Between Biggs Lane and Site Access)	EB/NB	5533	5602	1.2%	45.0%
	WB/SB	7029	7091	0.9%	25.6%
	Two-way	12562	12693	1.0%	32.6%
Langley Common Road (Between Site Access and School Road)	EB/NB	6910	6940	0.4%	0.0%
	WB/SB	5349	5385	0.7%	0.0%
	Two-way	12259	12325	0.5%	0.0%
Barkham Road (Between School Road and Barkham Street)	EB/NB	6910	6940	0.4%	0.0%
	WB/SB	5349	5385	0.7%	0.0%
	Two-way	12259	12325	0.5%	0.0%

Barkham Road (Between Barkham Street and Bearwood Road)	EB/NB	7707	7725	0.2%	0.0%
	WB/SB	10207	10239	0.3%	0.0%
	Two-way	17914	17964	0.3%	0.0%
Barkham Road (Bearwood Road and Edneys Hill)	EB/NB	8498	8514	0.2%	0.0%
	WB/SB	7198	7204	0.1%	0.0%
	Two-way	15696	15718	0.1%	0.0%
Observer Way	EB/NB	8371	8377	0.1%	0.0%
	WB/SB	9181	9203	0.2%	0.0%
	Two-way	17552	17580	0.2%	0.0%
Baird Road	EB/NB	340	352	3.4%	0.0%
	WB/SB	176	177	0.6%	0.0%
	Two-way	516	529	2.5%	0.0%
Biggs Lane	EB/NB	4200	4208	0.2%	0.0%
	WB/SB	3645	3699	1.5%	0.0%
	Two-way	7845	7907	0.8%	0.0%
School Road	EB/NB	0	0	0.0%	0.0%
	WB/SB	0	0	0.0%	0.0%
	Two-way	0	0	0.0%	0.0%
Barkham Street	EB/NB	4930	4949	0.4%	0.0%
	WB/SB	4160	4185	0.6%	0.0%
	Two-way	9090	9134	0.5%	0.0%
Bearwood Road	EB/NB	9229	9236	0.1%	0.0%
	WB/SB	8028	8049	0.3%	0.0%
	Two-way	17257	17285	0.2%	0.0%

- 7.114 The number of HGVs increases beyond 30% for Langley Common Road (Between Biggs Lane and Site Access) warranting further assessment for the construction scenario as per Rule 1 of the IEMA Guidelines.

Operational Impacts

- 7.115 Operational trips would generate permanent increases in vehicle movements on the highway in the vicinity of the Site. Table 7.16 demonstrates the comparison between Scenario 2 (Do Something) and 3 (Do Something with Development). The full AADT and AAWTs for this scenario are identified on Figure 7.7.

Table 7.16 – Operational Impacts

Link	Direction	Operational Assessment			
		Scenario 2	Scenario 3	% Change in Traffic Flows	% Change in HGV Traffic Flows
Eversley Road (Between Poperinghe Way and Observer Way)	EB/NB	12135	12276	1.1%	0.0%
	WB/SB	10052	10095	0.4%	0.4%
	Two-way	22186	22371	0.8%	0.1%
Eversley Road (Between Observer Way and Baird Road)	EB/NB	10522	10842	3.0%	0.3%
	WB/SB	11095	11451	3.1%	0.2%
	Two-way	21618	22293	3.0%	0.1%
Eversley Road (Towards Arborfield Cross)	EB/NB	4487	4626	3.0%	0.0%
	WB/SB	4894	5011	2.3%	0.0%
	Two-way	9381	9637	2.7%	0.0%
Langley Common Road (Between Eversley Road and Biggs Lane)	EB/NB	9845	10235	3.8%	0.3%
	WB/SB	9718	9996	2.8%	0.3%
	Two-way	19563	20231	3.3%	0.1%

Langley Common Road (Between Biggs Lane and Site Access)	EB/NB	6971	7997	12.8%	-0.4%
	WB/SB	7945	8610	7.7%	0.2%
	Two-way	14916	16607	10.2%	0.0%
Langley Common Road (Between Site Access and School Road)	EB/NB	7799	8235	5.3%	0.2%
	WB/SB	6745	7136	5.5%	0.4%
	Two-way	14543	15371	5.4%	0.0%
Barkham Road (Between School Road and Barkham Street)	EB/NB	7799	8235	5.3%	0.2%
	WB/SB	6745	7136	5.5%	0.4%
	Two-way	14543	15371	5.4%	0.0%
Barkham Road (Between Barkham Street and Bearwood Road)	EB/NB	8734	9002	3.0%	0.3%
	WB/SB	10664	11002	3.1%	0.1%
	Two-way	19398	20004	3.0%	-0.1%
Barkham Road (Bearwood Road and Edneys Hill)	EB/NB	9593	9832	2.4%	0.0%
	WB/SB	8159	8225	0.8%	0.3%
	Two-way	17752	18058	1.7%	0.1%
Observer Way	EB/NB	9789	9885	1.0%	0.7%
	WB/SB	12446	12674	1.8%	-0.1%
	Two-way	22235	22559	1.4%	0.2%
Baird Road	EB/NB	476	658	27.7%	0.0%
	WB/SB	196	207	5.3%	0.4%
	Two-way	672	864	22.2%	0.3%
Biggs Lane	EB/NB	4772	4883	2.3%	0.0%
	WB/SB	3924	4510	13.0%	0.6%
	Two-way	8695	9393	7.4%	0.3%
School Road	EB/NB	0	0	0.0%	0.0%
	WB/SB	0	0	0.0%	0.4%
	Two-way	0	0	0.0%	0.1%
Barkham Street	EB/NB	5453	5747	5.1%	0.3%
	WB/SB	4609	4878	5.5%	0.2%
	Two-way	10061	10625	5.3%	0.1%
Bearwood Road	EB/NB	9176	9293	1.3%	0.0%
	WB/SB	8681	8900	2.5%	0.0%
	Two-way	17856	18194	1.9%	0.0%

- 7.116 Importantly, the above table demonstrates that no links within the study area surpass the two broad rules to identify the appropriate extent of the highways assessment. This means the impact of the Proposed Development can be considered **Negligible**. Nonetheless, the links have still been assessed against the main transport effects below in order to ensure that a worst-case assessment has been undertaken and that any possible impacts across the main transport effects are commented on, even with the Proposed Development not making a notable contribution to them.

Severance

- 7.117 No considered links exceed a 30% change in traffic following the completion of the Proposed Development. All links are therefore considered **Negligible** (not significant) with regards to severance.

Driver Delay

- 7.118 Driver delay has been derived from both the individual junction modelling undertaken as well as the outputs from the Strategic Highway Model.
- 7.119 The IEMA guidance dictates that an average vehicle delay change of less than 20 seconds as a result of the Proposed Development during the peak hour periods may be characterised as a negligible impact

on Driver Delay. The Delay Difference outputs from the Strategic Highway Model can be seen on **Figures 7.8 (do Something) and 7.9 (Do Something with Development)**.

- 7.120 The Strategic Highway Model outputs demonstrate that none of the considered links have a difference in delay of more than 20 seconds in the AM and PM peak hours between the Do Something and Do Something with Development scenario. All links are therefore considered **Negligible** (not significant) with regard to Driver Delay.

Pedestrian / Cycle Delay and Amenity

- 7.121 The total vehicle and pedestrian/cycle link flow, the increase in vehicle and pedestrian/cycle link flow as well as the existing pedestrian/cycle infrastructure have been assessed to determine the impacts on Pedestrian / Cycle Delay and Amenity.

- 7.122 The following links are subject to two-way flow of between than 1,400 – 3,000 vehicles per hour which categorises them as having a Low impact, as per IEMA guidance. The remaining links can be categorised as having a **Negligible** impact -

- Eversley Road (Between Poperinghe Way and Observer Way)
- Eversley Road (Between Observer Way and Baird Road)
- Langley Common Road (Between Eversley Road and Biggs Lane)
- Langley Common Road (Between Biggs Lane and Site Access)
- Langley Common Road (Between Site Access and School Road)
- Barkham Road (Between School Road and Barkham Street)
- Barkham Road (Between Barkham Street and Bearwood Road)
- Barkham Road (Bearwood Road and Edneys Hill)
- Observer Way
- Bearwood Road

- 7.123 Of these, it is only Langley Common Road (between Biggs Lane and Site access) (10.2%) Langley Common Road (between Site access and School Road) (5.4%) and Barkham Road (between School Road and Barkham Street) (5.4%) which experience an uplift in flows of more than 5% resulting from the Proposed Development. The links identified as attracting walking and cycling trips from the Proposed Development are Barkham Road (between School Road and Barkham Street), Barkham Road (between Barkham Street and Bearwood Road), Barkham Road (Bearwood Road and Edneys Hill), Biggs Lane, School Road, and Barkham Street. The remaining links listed above which qualify as having a Low impact, as per IEMA guidance, are relegated to **Negligible** given the anticipated low number of pedestrian and cycling trips along them.

- 7.124 With regard to the distribution of walking and cycling trips to and from the Site, it is anticipated that most will be accessing the schools, shops and other amenities in Arborfield Green to the south of the Site. These trips will exit the Site via a connection to the boundary and access Biggs Road via Princess Marina Drive. There is a pelican crossing facility at the Biggs Lane / Princess Marina Drive junction as well as wide verges and footways. Biggs Lane has a future with development AADT of 9,393 two-way vehicles trips (an increase of 7.4% resulting from the Proposed Development), with a low proportion of HGVs. The relatively low two-way vehicle movements as well as the very good pedestrian infrastructure and crossing provision over Biggs Lane results in the impact of the Proposed Development on Pedestrian / Cycle Delay and Amenity being categorised as **Negligible**.

- 7.125 There are also pedestrian and cycle routes into the Site via the proposed access roundabout onto Barkham Road to the west of the Site as well as a PRoW access onto Barkham Street to the east, which will be improved as part of the Proposed Development. There are therefore anticipated to be some pedestrian and cycle trips accessing the Langley Common Road / Barham Road corridor to access Arborfield Cross, Barkham and Wokingham. Pedestrian and cycle trips routing north can access the Langley Common Road / Barham Road at Barkham Road (between School Road and Barkham Street). There is continuous footway provision along the Barkham Road link north of the Site, although most of the extent is along one side of the road and in sections some overgrowth reduces the effective footway width. Although the speed limit is 30mph (which is controlled along sections by speed cameras), the walk can be intimidating with the occasional speeding vehicle. The route is attractive, although there are few places to stop and rest before reaching Barkham.

- 7.126 Cycling on-street along the Barkham Road links is suitable for more experienced cyclists given the lack of segregated facilities and gradual inclines. There is relatively good forward visibility and some opportunities for safe overtaking. The route along Barkham Road is direct for cyclists, with Wokingham Railway Station and Town Centre being accessible within a 15-minute cycle. School Road offers access to Wood Lane, a lightly trafficked rural road which gives access to a series of bridleways including Cole Lane, Ellis Hill and onto Coombes Lane which provides a predominantly traffic-free cycle connection to Barkham in less than 15-minutes from the Proposed Development access. Although a longer route, this provides an excellent alternative for less confident cyclists to access Barkham. Less experienced cyclists, or leisure cyclists can avoid the B3349 completely on route to Wokingham using the above byways and travelling through Barkham along the lightly trafficked Sandy Lane before crossing onto Doles Lane for the rest of the 20-minute cycle from the site into Wokingham.
- 7.127 Barkham Road (between School Road and Barkham Street), Barkham Road (between Barkham Street and Bearwood Road), Barkham Road (between Bearwood Road and Edneys Hill) are defined as a '**Low**' impact given the 'Low' number of two-way vehicle trips along this corridor (albeit a negligible uplift resulting from the Proposed Development), the likely uplift in active travel trips resulting from the Proposed Development, the lack of cycle facilities and the continuous albeit narrow footway provision, as described above.
- 7.128 Pedestrians and cyclists are also likely to use School Road to access Arborfield Cross and The Coombes C Of E Primary School. This road is closed as a through road to traffic and therefore has very good pedestrian / cycle amenity and low delays. This link is therefore defined as **Negligible**.
- 7.129 There will be a relatively small number of pedestrian trips using the PRoW to access Barkham Street as there are few amenities along here. This will be more of a leisure route and as such is defined as a **Negligible** impact.
- 7.130 The Magnitude of Impact across each link is summarised below for Pedestrian / Cycle Delay and Amenity. A detailed above, the links have been assessed by their hourly vehicle flow as well as whether they are an anticipated route for pedestrians and cyclists. One link is categorised as having a **Low** Magnitude of Impact as it is subject to two-way flow of over 1,400 vehicles per hour, and as it is an anticipated route for pedestrians and cyclists. The remaining links are considered to have a **Negligible** impact.

Table 7.17 – Pedestrian / Cycle Delay and Amenity – Magnitude of Impact

Link Receptor Reference	Link Receptor Name	Subject to two-way flow of between than 1,400 – 3,000 vehicles per hour	Anticipated route for development walking and cycling trips	Magnitude of Impact
1	Eversley Road (Between Poperinghe Way and Observer Way)	Yes	No	Negligible
2	Eversley Road (Between Observer Way and Baird Road)	Yes	No	Negligible
3	Eversley Road (Towards Arborfield Cross)	No	No	Negligible
4	Langley Common Road (Between Eversley Road and Biggs Lane)	Yes	No	Negligible
5	Langley Common Road (Between Biggs Lane and Site Access)	Yes	No	Negligible
6	Langley Common Road (Between Site Access and School Road)	Yes	No	Negligible
7	Barkham Road (Between School Road and Barkham Street)	Yes	Yes	Low
8	Barkham Road (Between Barkham Street and Bearwood Road)	Yes	Yes	Low

Link Receptor Reference	Link Receptor Name	Subject to two-way flow of between than 1,400 – 3,000 vehicles per hour	Anticipated route for development walking and cycling trips	Magnitude of Impact
9	Barkham Road (Bearwood Road and Edneys Hill)	Yes	Yes	Low
10	Observer Way	Yes	No	Negligible
11	Baird Road	No	No	Negligible
12	Biggs Lane	No	Yes	Negligible
13	School Road	No	Yes	Negligible
14	Barkham Street	No	Yes	Negligible
15	Bearwood Road	Yes	No	Negligible

Fear and Intimidation

7.131 The criteria used to define the degree of hazard to pedestrians is average peak hour traffic flow, 18-hour HGV flow and average vehicle speed along each considered link. Each threshold across the criteria represents a degree of hazard score, the sum of which determines the Level of Fear and Intimidation. This has been assessed for all the links in both Scenario 2 (Do Something) and Scenario 3 (Do Something with Development) to understand the Magnitude of Impact across the links assessed for Fear and Intimidation.

7.132 Table 7.18 assesses the fear and intimidation degree of hazard for Scenario 2 (Do Something).

Table 7.18 – Fear and Intimidation (Scenario 2 Do Something) – Degree of Hazard

Link Receptor Reference	Link Receptor Name	Hourly Vehicles	HGV AAWT	Vehicle Speed (Weekday 85 th Percentile)	Total Score
1	Eversley Road (Between Poperinghe Way and Observer Way)	1879 (High)	461 (Negligible)	33.4 (Medium)	50 (Great)
2	Eversley Road (Between Observer Way and Baird Road)	1863 (High)	280 (Negligible)	41.2 (High)	50 (Great)
3	Eversley Road (Towards Arborfield Cross)	895 (Low)	133 (Negligible)	41.2 (High)	20 (Small)
4	Langley Common Road (Between Eversley Road and Biggs Lane)	1675 (Medium)	247 (Negligible)	41.2 (High)	50 (Great)
5	Langley Common Road (Between Biggs Lane and Site Access)	1243 (Medium)	177 (Negligible)	41.2 (High)	40 (Moderate)
6	Langley Common Road (Between Site Access and School Road)	1218 (Medium)	176 (Negligible)	41.2 (High)	40 (Moderate)
7	Barkham Road (Between School Road and Barkham Street)	1218 (Medium)	176 (Negligible)	38.9 (Medium)	30 (Moderate)
8	Barkham Road (Between Barkham Street and Bearwood Road)	1786 (High)	234 (Negligible)	28.8 (Low)	40 (Moderate)

Link Receptor Reference	Link Receptor Name	Hourly Vehicles	HGV AAWT	Vehicle Speed (Weekday 85 th Percentile)	Total Score
9	Barkham Road (Bearwood Road and Edneys Hill)	1522 (Medium)	303 (Negligible)	28.8 (Low)	30 (Moderate)
10	Observer Way	1853 (High)	414 (Negligible)	41.2 (High)	60 (Great)
11	Baird Road	73 (Negligible)	3 (Negligible)	33.4 (Medium)	10 (Small)
12	Biggs Lane	843 (Low)	89 (Negligible)	33.4 (Medium)	20 (Small)
13	School Road	0 (Negligible)	0 (Negligible)	28.8 (Low)	10 (Small)
14	Barkham Street	938 (Low)	86 (Negligible)	38.2 (Medium)	30 (Moderate)
15	Bearwood Road	1615 (Medium)	192 (Negligible)	28.8 (Low)	30 (Moderate)

7.133 Table 7.19 assesses the fear and intimidation degree of hazard for Scenario 3 (Do Something with Development).

Table 7.19 – Fear and Intimidation (Scenario 3 Do Something with Development) – Degree of Hazard

Link Receptor Reference	Link Receptor Name	Hourly Vehicles	HGV AAWT	Vehicle Speed (Weekday 85 th Percentile)	Total Score
1	Eversley Road (Between Poperinghe Way and Observer Way)	1900 (High)	461 (Negligible)	33.4 (Medium)	50 (Great)
2	Eversley Road (Between Observer Way and Baird Road)	1913 (High)	280 (Negligible)	41.2 (High)	50 (Great)
3	Eversley Road (Towards Arborfield Cross)	915 (Low)	133 (Negligible)	41.2 (High)	20 (Small)
4	Langley Common Road (Between Eversley Road and Biggs Lane)	1707 (Medium)	246 (Negligible)	41.2 (High)	50 (Great)
5	Langley Common Road (Between Biggs Lane and Site Access)	1400 (Medium)	173 (Negligible)	41.2 (High)	40 (Moderate)
6	Langley Common Road (Between Site Access and School Road)	1298 (Medium)	178 (Negligible)	41.2 (High)	40 (Moderate)
7	Barkham Road (Between School Road and Barkham Street)	1298 (Medium)	178 (Negligible)	38.9 (Medium)	30 (Moderate)
8	Barkham Road (Between Barkham Street and Bearwood Road)	1855 (High)	234 (Negligible)	28.8 (Low)	40 (Moderate)
9	Barkham Road (Bearwood Road and Edneys Hill)	1545 (Medium)	302 (Negligible)	28.8 (Low)	30 (Moderate)
10	Observer Way	1880 (High)	414 (Negligible)	41.2 (High)	60 (Great)
11	Baird Road	103 (Negligible)	3 (Negligible)	33.4 (Medium)	10 (Small)
12	Biggs Lane	896 (Low)	84 (Negligible)	33.4 (Medium)	20 (Small)

Link Receptor Reference	Link Receptor Name	Hourly Vehicles	HGV AAWT	Vehicle Speed (Weekday 85 th Percentile)	Total Score
13	School Road	0 (Negligible)	0 (Negligible)	28.8 (Low)	10 (Small)
14	Barkham Street	988 (Low)	85 (Negligible)	38.2 (Medium)	30 (Moderate)
15	Bearwood Road	1658 (Medium)	193 (Negligible)	28.8 (Low)	30 (Moderate)

7.134 The assessment demonstrates that there is no change in the levels of fear and intimidation between Scenario 2 and 3 showing that all links can be considered to have a **Negligible** impact.

Accidents and Road Safety

7.135 Accident data has been obtained from the Council for the previous 5 years. This showed that there have been 7 recorded collisions within the study area during that 5-year period, 6 of which were slight, and one was serious. A plan showing the recorded collisions is included as **Figure 7.6**.

7.136 Table 7.20 demonstrates the number of recorded collisions at each link. Barkham Street has been classified as having a **Low** Magnitude of Impact for Accidents and Road Safety given the 3 collisions recorded on this link. The other links are classified as **Negligible**.

7.137 The recorded collisions are summarised as -

- **Barkham Street** - A 'moderately serious' collision occurred on Barkham Street when a car travelling south along Barkham Street attempted to overtake and LGV and collided with an oncoming vehicle. The possible causal factors included exceeding the speeding limit and driving aggressively. A 'slight' collision east of the Commonfield Lane junction occurred between a car and an oncoming LGV due to likely speeding/distraction and a poor manoeuvre.
- **B3349 Corridor (Eversley Road, Langley Common Road, Barkham Road)** - A 'slight' collision occurred at the Langley Common Road/Biggs Lane roundabout with an LGV entered the roundabout and collided with a cyclist using the circulatory. At the School Road junction a 'slight' collision also occurred between a car and a cyclist. A 'slight' collision also occurred at the Observer Way roundabout when a car collided with another car waiting at the Observer Way entry.
- **Biggs Lane** - A 'slight' collision occurred when a car left the carriageway and collided with a bus pole along Biggs Lane. The possible causal factors listed are tiredness or illness/disability.

Table 7.20 – Accidents and Road Safety – Magnitude of Impact

Link Receptor Reference	Link Receptor Name	Number of Collisions	Magnitude of Impact
1	Eversley Road (Between Poperinghe Way and Observer Way)	0	Negligible
2	Eversley Road (Between Observer Way and Baird Road)	1	Negligible
3	Eversley Road (Towards Arborfield Cross)	0	Negligible
4	Langley Common Road (Between Eversley Road and Biggs Lane)	0	Negligible
5	Langley Common Road (Between Biggs Lane and Site Access)	1	Negligible
6	Langley Common Road (Between Site Access and School Road)	0	Negligible

Link Receptor Reference	Link Receptor Name	Number of Collisions	Magnitude of Impact
7	Barkham Road (Between School Road and Barkham Street)	1	Negligible
8	Barkham Road (Between Barkham Street and Bearwood Road)	0	Negligible
9	Barkham Road (Bearwood Road and Edneys Hill)	0	Negligible
10	Observer Way	0	Negligible
11	Baird Road	0	Negligible
12	Biggs Lane	1	Negligible
13	School Road	0	Negligible
14	Barkham Street	3	Low
15	Bearwood Road	0	Negligible

Public Transport

- 7.138 There will be an increase in the number of person trips associated with the Proposed Development when compared with the baseline conditions, with an increase of people travelling locally by public transport. The trip generation assessment in the TA (**Technical Appendix 7.1**) demonstrates the impact of the Proposed Development on the local bus routes. The TA also commits to contributing to improvements to local bus services. Therefore, the impact of the Proposed Development is considered **Negligible** (not significant). The effect will be direct, permanent and long term.

MITIGATION

Construction Mitigation

- 7.139 No significant adverse effects have been identified by the assessment of demolition and construction works. Therefore, no additional mitigation is necessary over and above the measures that will be included within the Construction Logistics Plan (CLP) and CEMP which will be prepared, submitted and agreed with the Council as part of future condition discharge/ reserved matters planning applications.
- 7.140 The CLP will seek to support the achievement of the following objectives -
- Reduce construction emissions,
 - Enhance safety for vehicles and road users, and
 - Reduce congestion from construction.

Operational Mitigation

- 7.141 No significant adverse highways and transport related effects have been identified, and therefore no specific mitigation or monitoring is required. Nevertheless, a number of measures will be implemented to promote the use of sustainable modes of travel and thus minimise the impacts on the transport network. This includes improvements to location pedestrian and cycle connectivity to be delivered as part of the Proposed Development, including a connection to the Site boundary. The new Site access junction also incorporates improved, widened shared-use footways as well as crossing points at appropriate locations.
- 7.142 The uptake of sustainable modes of travel will also be promoted through sustainable travel initiatives delivered through the Council's MyJourney, which the Proposed Development is supportive of. This

follows the same approach to implementation as Arborfield Green, enabling a collaborative, holistic approach to wider travel initiatives.

7.143 The operational mitigation is summarised as follows -

- Sustainable travel initiatives to encourage future occupants of the development to travel sustainably,
- Appropriate vehicle access strategy, providing connections to influence traffic distribution,
- Comprehensive sustainable travel strategy to encourage sustainable modes of travel and reduce car use.

RESIDUAL IMPACTS

7.144 All of the residual effects resulting from the Proposed Development, are presented in Table 7.21, identifying whether the effect is significant or not.

CUMULATIVE IMPACTS

7.145 During the pre-application scoping process, a number of planned / Cumulative Schemes were identified. It should also be noted that each of the cumulative schemes will need to provide a detailed CEMP / CLP setting out the impacts of their construction and any required mitigation measures. This, therefore, should go some way to making the cumulative impact of construction from these schemes negligible (not significant).

7.146 It is anticipated that the Council will manage cumulative construction impacts in the typical manner and the developers will cooperate with this process.

7.147 As noted in the methodology section above, the main assessment includes the potential trip generation associated with the cumulative sites as they are included within the Council's traffic model. As such, the main assessments are, in effect, cumulative assessments. Therefore, the effects are expected to be direct, permanent, long term and **Negligible** (not significant).

7.148 It is anticipated that surrounding cumulative schemes will also deliver and support sustainable travel initiatives through the Council's My Journey or Travel Plans and any necessary mitigatory actions required to reduce the potential adverse effects will also be actioned and implemented to ensure no significant impacts occur.

SUMMARY

7.149 No significant effects relating to traffic and transport are anticipated during demolition and construction or once the Proposed Development is complete and operational. No likely significant cumulative effects have been identified.

Table 7.21: Summary of Residual Effects

Effect	Receptor (Sensitivity)	Magnitude of Impact	Scale of Effect	Additional Mitigation and Monitoring	Residual Effect
Construction					
Severance of communities	Langley Common Road (Between Biggs Lane and Site Access)	Negligible	Not significant	No additional monitoring/mitigation required.	Negligible (not significant) temporary at the local level
Road vehicle driver and passenger delay	Langley Common Road (Between Biggs Lane and Site Access)	Negligible	Not significant	No additional monitoring/mitigation required.	Negligible (not significant) temporary at the local level
Non-motorised user delay	Langley Common Road (Between Biggs Lane and Site Access)	Negligible	Not significant	No additional monitoring/mitigation required.	Negligible (not significant) temporary at the local level
Non-motorised user amenity	Langley Common Road (Between Biggs Lane and Site Access)	Negligible	Not significant	No additional monitoring/mitigation required.	Negligible (not significant) temporary at the local level
Fear and intimidation on and by road users	Langley Common Road (Between Biggs Lane and Site Access)	Negligible	Not significant	No additional monitoring/mitigation required.	Negligible (not significant) temporary at the local level

Effect	Receptor (Sensitivity)	Magnitude of Impact	Scale of Effect	Additional Mitigation and Monitoring	Residual Effect
Road user and pedestrian safety	Langley Common Road (Between Biggs Lane and Site Access)	Negligible	Not significant	No additional monitoring/mitigation required.	Negligible (not significant) temporary at the local level
Operational					
Severance of communities	Eversley Road (Between Poperinghe Way and Observer Way)	Negligible	Not significant	No additional monitoring/mitigation required.	Negligible (not significant) permanent at the local level
	Eversley Road (Between Observer Way and Baird Road)	Negligible	Not significant	No additional monitoring/mitigation required.	Negligible (not significant) permanent at the local level
	Eversley Road (Towards Arborfield Cross)	Negligible	Not significant	No additional monitoring/mitigation required.	Negligible (not significant) permanent at the local level
	Langley Common Road (Between Eversley Road and Biggs Lane)	Negligible	Not significant	No additional monitoring/mitigation required.	Negligible (not significant) permanent at the local level
	Langley Common Road (Between Biggs Lane and Site Access)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Langley Common Road (Between Site Access and School Road)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Barkham Road (Between School Road and Barkham Street)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Barkham Road (Between Barkham Street and Bearwood Road)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Barkham Road (Bearwood Road and Edneys Hill)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Observer Way	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Baird Road	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Biggs Lane	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	School Road	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Barkham Street	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Bearwood Road	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
Road vehicle driver and passenger delay	Eversley Road (Between Poperinghe Way and Observer Way)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Eversley Road (Between Observer Way and Baird Road)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Eversley Road (Towards Arborfield Cross)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
		Negligible	Not significant		

Effect	Receptor (Sensitivity)	Magnitude of Impact	Scale of Effect	Additional Mitigation and Monitoring	Residual Effect
	Langley Common Road (Between Eversley Road and Biggs Lane)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Langley Common Road (Between Biggs Lane and Site Access)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Langley Common Road (Between Site Access and School Road)	Low	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Barkham Road (Between School Road and Barkham Street)	Low	Not significant	No additional monitoring/mitigation required	Low (not significant) permanent at the local level
	Barkham Road (Between Barkham Street and Bearwood Road)	Low	Not significant	No additional monitoring/mitigation required	Low (not significant) permanent at the local level
	Barkham Road (Bearwood Road and Edneys Hill)	Negligible	Not significant	No additional monitoring/mitigation required	Low (not significant) permanent at the local level
	Observer Way	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Baird Road	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Biggs Lane	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	School Road	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Barkham Street	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Bearwood Road			No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
Pedestrian / Cycle Delay and Amenity	Eversley Road (Between Poperinghe Way and Observer Way)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Eversley Road (Between Observer Way and Baird Road)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Eversley Road (Towards Arborfield Cross)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Langley Common Road (Between Eversley Road and Biggs Lane)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Langley Common Road (Between Biggs Lane and Site Access)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Langley Common Road (Between Site Access and School Road)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Barkham Road (Between School Road and Barkham Street)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Barkham Road (Between Barkham Street and Bearwood Road)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Barkham Road (Bearwood Road and Edneys Hill)	Negligible	Not significant		

Effect	Receptor (Sensitivity)	Magnitude of Impact	Scale of Effect	Additional Mitigation and Monitoring	Residual Effect
Fear and intimidation on and by road users	Observer Way	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Baird Road	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Biggs Lane	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	School Road	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Barkham Street	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Bearwood Road	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Eversley Road (Between Poperinghe Way and Observer Way)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Eversley Road (Between Observer Way and Baird Road)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Eversley Road (Towards Arborfield Cross)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Langley Common Road (Between Eversley Road and Biggs Lane)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Langley Common Road (Between Biggs Lane and Site Access)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Langley Common Road (Between Site Access and School Road)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Barkham Road (Between School Road and Barkham Street)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Barkham Road (Between Barkham Street and Bearwood Road)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Barkham Road (Bearwood Road and Edneys Hill)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Observer Way	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Baird Road	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Biggs Lane	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	School Road	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Barkham Street	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Bearwood Road	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
		Negligible	Not significant		

Effect	Receptor (Sensitivity)	Magnitude of Impact	Scale of Effect	Additional Mitigation and Monitoring	Residual Effect
				No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
Road user and pedestrian safety	Eversley Road (Between Poperinghe Way and Observer Way)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Eversley Road (Between Observer Way and Baird Road)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Eversley Road (Towards Arborfield Cross)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Langley Common Road (Between Eversley Road and Biggs Lane)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Langley Common Road (Between Biggs Lane and Site Access)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Langley Common Road (Between Site Access and School Road)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Barkham Road (Between School Road and Barkham Street)	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
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	Observer Way	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Baird Road	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Biggs Lane	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	School Road	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level
	Barkham Street	Low	Not significant	No additional monitoring/mitigation required	Low (not significant) permanent at the local level
	Bearwood Road	Negligible	Not significant	No additional monitoring/mitigation required	Negligible (not significant) permanent at the local level

8 ECOLOGY

INTRODUCTION

- 8.1 This chapter of the ES reports on the findings of an Ecological Impact Assessment (EclA) of the Proposed Development. It describes the assessment methodology and the existing (baseline) conditions in further detail; identifies the likely ecological effects of the Proposed Development; and highlights measures to mitigate and compensate for any adverse effects, and any measures that will be undertaken to enhance biodiversity / achieve a biodiversity net gain.

- 8.2 **Technical Appendices 8.1 -8.10** comprising a Preliminary Ecology Desk Survey and a suite of phase II species baseline surveys referenced in the Methodology section of this chapter, accompany the chapter.

POLICY CONTEXT

Legislation

- 8.3 The following ecology-related legislation has been considered in this assessment and in the development of appropriate avoidance, enhancement, mitigation and compensation measures -

- Conservation of Habitats and Species Regulations 2017,
- Wildlife and Countryside Act 1981 (as amended),
- Countryside and Rights of Way Act 2000,
- Natural Environment and Rural Communities Act 2006,
- The Hedgerow Regulations 1997,
- European Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive),
- European Council Directive 2009/147/EC on the conservation of wild birds (the codified version of Council Directive 79/409/EEC as amended) (Birds Directive),

Conservation of Habitats and Species Regulations 2017

- 8.4 The Conservation of Habitats and Species Regulations 2017 (Habitats Regulations 2017) implements in law the European Directive 92/43/EEC on the conservation of natural habitats and wild fauna and flora (Habitats Directive) adopted in 1992. The legislation supersedes legislation from 2010 and 1994.

- 8.5 Several species such as otter *Lutra lutra*, dormouse *Muscardinus avellanarius* and all native bat *Chiroptera* species, receive a high level of protection under the Habitat Regulations.

- 8.6 Potential effects on European protected habitats are to be a key consideration in decision-making. If features are likely to be affected, then an appropriate assessment is required under Article 6(3) of the Habitats Directive with consideration of mitigation options to avoid adverse effects.

Wildlife and Countryside Act 1981 (as amended)

- 8.7 The Wildlife and Countryside Act 1981 (as amended) is the principal legislative protection for wildlife in England. It establishes protection for certain species of plant and animals and allows for the protection in law of various designated sites. It implements the European Directive 2009/147/EC on the conservation of wild birds (The Birds Directive) in the UK; Special Protection Areas (SPAs) were designated under the Wildlife and Countryside Act 1981 for the protection of significant numbers of wild birds.

Countryside and Rights of Way Act 2000

- 8.8 The Wildlife and Countryside Act 1981 has been amended and reinforced in England by the Countryside and Rights of Way Act (CRoW) Act 2000 (as amended). The CRoW Act increases protection for Sites of Special Scientific Interest (SSSIs) and strengthens wildlife enforcement legislation.

- 8.9 The Act places a duty on the Government to maintain lists of species and habitats for which conservation action should be taken or promoted, in accordance with the CBD. Schedule 9 of the Act amends the Wildlife and Countryside Act 1981 by altering the notification procedures for SSSIs and providing increased powers for their protection and management.

Natural Environment and Rural Communities Act 2006

- 8.10 The Natural Environment and Rural Communities (NERC) Act 2006 places a duty on public authorities to have regard to the purpose of conserving biodiversity.

- 8.11 Section 40 of the Act 2006 imposes a duty ('the biodiversity duty') on public bodies to have regard to biodiversity in the exercise of their functions, with particular regard to the species of conservation priority.

- 8.12 In England, Section 41 of the Act lists the species and habitats of highest importance for conserving biodiversity (derived from the UK BAP). The list is a guide for decision-makers with regard to the

conservation of biodiversity. This 'biodiversity duty' includes taking steps to promote the restoration and enhancement of the populations of Section 41 species.

- 8.13 Section 41 species include a number of native bat species (including greater horseshoe bat *Rhinolophus ferrumequinum* and lesser horseshoe bat *Rhinolophus hipposideros*, noctule *Nyctalus noctula*, soprano pipistrelle *Pipistrellus pygmaeus*, and brown long-eared bat *Plecotus auritus*), dormouse, hedgehog *Erinaceus europaeus*, brown hare *Lepus europaeus*, a number of bird species associated with grassland and woodland habitats, slow-worm *Anguis fragilis*, and great crested newt *Triturus cristatus* amongst others.

The Hedgerow Regulations 1997

- 8.14 The Hedgerow Regulations 1997 protect *Important* hedgerows from removal. The criteria for *Important* is defined in the Regulations and is followed for the grading of hedgerows surveyed for this EclA.
- 8.15 The Regulations apply to any hedgerow growing in, or adjacent to common or protected land (local nature reserves and SSSIs) and land used for agriculture, forestry or the breeding or keeping of horses, ponies or donkeys, if it: (a) has a continuous length of, or exceeding, 20m; or (b) it has a continuous length of less than 20m and, at each end, meets another hedgerow.

Protected Sites Legislation

- 8.16 The European Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, known as the 'Habitats Directive' was adopted in 1992. The Directive is the means by which the European Union (EU) meets its obligations under the Council Decision 82/72/EEC of 3 December 1981 concerning the conclusion of the Convention on the conservation of European wildlife and natural habitats (Bern Convention).
- 8.17 The Habitats Directive requires EU Member States to maintain or restore natural habitats and wild species listed in the Annexes to the Directive to a favourable conservation status. Member States are required by the Directive to introduce a range of measures as listed in the Directive.
- 8.18 The Habitats Regulations transpose the requirements of the Habitats Directive into national law. The Regulations provide for the designation of the following sites -
- Special Areas of Conservation (SACs): designated in recognition of their value as best representatives of the range and variety within the EU of habitats and (non-bird) species listed on Annexes I and II,
 - Sites of Special Scientific Interest (SSSIs): notified under the Wildlife and Countryside Act 1981 (as amended) designated to protect the best examples of the UK's flora, fauna, or geological or physiographical features,
 - Ramsar sites: designated for wetland conservation and sustainable use of European Marine Sites, which are management units incorporating areas designated as e.g. SACs or SPAs SSSIs,
 - National Nature Reserves (NNR), established to conserve and enhance landscapes, and
 - Local Nature Reserves (LNR): local authority designations under the National Parks and Access to the Countryside Act 1949, managed for nature conservation and people.

- 8.19 The European Council Directive 2009/147/EC on the conservation of wild birds (the codified version of Council Directive 79/409/EEC as amended) (Birds Directive) provides a framework for the conservation and management of, and human interactions with wild birds in Europe. Special Protection Areas (SPAs) are designated under the Birds Directive due to their value as areas of the most important habitat for rare and vulnerable birds (Annex I of the Directive), and for regularly occurring migratory birds in Europe.

Species Legal Protection and Conservation Status

Breeding Birds

- 8.20 Nesting birds are protected under the Wildlife and Countryside Act 1981 (as amended), which makes it an offence to intentionally kill, injure or take any wild bird or take, damage or destroy its nest whilst in use or being built, or take or destroy its eggs. In addition to this, for some rarer species (listed on Schedule 1 of the Act), it is an offence to intentionally or recklessly disturb them while they are nest building or at or near a nest with eggs or young, or to disturb the dependent young of such a bird.

Bats

- 8.21 All bats and their breeding and roosting sites are protected under the Habitats Regulations 2017 and Section 9(4)(b), (c) and (5) of the Wildlife and Countryside Act 1981 with an amendment in the Countryside and Rights of Way Act 2000 to include both intentional and reckless disturbance. This

legislation makes it an offence to - deliberately capture, injure or kill a bat; intentionally or recklessly disturb a bat in its roost or group of bats; damage or destroy a roost (even if bats are not present); or intentionally or recklessly obstruct access to a roost. Any disturbance of a roost due requires licensing. In addition, consideration should be given to circumstances where loss of foraging habitat could result in loss of the roost.

- 8.22 Barbastelle bats *Barbastella barbastellus*, Bechstein's bat *Myotis bechsteinii*, noctule *Nyctalus noctula*, soprano pipistrelle *Pipistrellus pygmaeus*, brown long-eared bat *Plecotus auritus*, greater horseshoe bat *Rhinolophus ferrumequinum* and lesser horseshoe bat *Rhinolophus hipposideros* are listed as species of principle importance under Section 41 of the NERC Act 2006. Barbastelle, Bechstein's, and greater and lesser horseshoe bats are also listed on Annex II of the Habitats Directive. As such a site may be designated a Special Area of Conservation (SAC) due to the presence of these species.

Badger

- 8.23 Under the Protection of Badgers Act 1992, badgers *Meles meles* are protected from killing, injury or disturbance while occupying a sett, and their setts are protected from obstruction, damage or destruction.

Hazel Dormouse

- 8.24 Dormice are fully protected under Schedule 5 of the Wildlife and Countryside Act 1981, as amended. Dormice are also included on Schedule 2 of the Habitats Regulations 2017 as European Protected Species (EPS). They are also listed on Section 41 of the NERC Act 2006.

Reptiles

- 8.25 All native British reptiles are protected under the Wildlife and Countryside Act 1981 (as amended). The four most widespread species (grass snake *Natrix natrix*, slow worm *Anguis fragilis*, common lizard *Zootoca vivipara* and adder *Vipera berus*) are protected from intentional killing or injury.

Amphibians

- 8.26 The great crested newt is a European Protected Species and, as such, is afforded full protection under the Habitats Regulations 2017. It is also fully protected under the Wildlife and Countryside Act 1981 (as amended) which makes it an offence to intentionally kill, injure or take great crested newts or to damage, destroy or obstruct access to any structure or place used for shelter or protection. In addition to this, it is an offence to intentionally or recklessly disturb them while they are occupying a structure or place used for that purpose. Other common amphibians such as common frog *Rana temporaria*, toads *Bufo bufo*, and palmate *Lissotriton helveticus* or smooth newts *L. vulgaris* may be present at the site. These are currently protected against sale only under the Wildlife and Countryside Act 1981.

- 8.27 Great crested newt and toad are of principle importance in England under Section 41 of the NERC Act 2006.

White clawed crayfish

- 8.28 White clawed crayfish are protected under the Wildlife and Countryside Act 1981. It is an offence to intentionally take them. They are also listed as rare and most threatened species under Section 41 of the Natural Environment and Rural Communities Act (2006).

Riparian mammals

- 8.29 Otter and water vole are both listed as a Species of Principal Importance under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006. Otter and water vole are both fully protected under Schedule 5 of the Wildlife & Countryside Act 1981 (as amended). It is an offence to intentionally kill, injure or take these species, or intentionally disturb these species whilst occupying a structure or place used for that purpose.

- 8.30 Otter is also classified under the Conservation of Habitats and Species Regulations 2017 (as amended).

Invertebrates

- 8.31 Two key pieces of legislation are relevant for terrestrial invertebrates: Conservation of Habitats and Species Regulations 2017 (as amended) and the Wildlife and Countryside Act 1981 (as amended). Numerous species of invertebrate are listed under Section 41 of The Natural Environment and Rural Communities Act (2006) as being of principle importance for conservation in England (Priority Species). Public bodies and planning authorities have a legal duty to have regard for conserving a species of principal importance when exercising their duties.

Planning Policy

- 8.32 The following planning policies, which relate to ecology and biodiversity, have been taken into account when valuing ecological features that could be affected by the Proposed Development, and in the subsequent assessment of significance of effect. The objectives, requirements and recommendations

of the policies have informed the ecological strategy for the project (i.e. avoidance, enhancement, mitigation and compensation strategy). Further details of these policies are provided below.

NPPF, December 2024

- 8.33 The NPPF sets out the government planning policies for England and how they should be applied. Chapter 15: Conserving and Enhancing the Natural Environment relates to ecology and biodiversity.
- 8.34 The Government Circular 06/2005, which is referred to by the NPPF, provides further guidance in respect of statutory obligations for biodiversity and geological conservation and their effects within the planning system.
- 8.35 The following aims and objectives of the NPPF, listed in Chapter 15 of the document (paragraph 187 *et seq.*), have been considered in this assessment and incorporated into the Proposed Development where practicable and appropriate -
- a) protecting and enhancing valued landscapes, sites of biodiversity ... and soils;*
 - b) recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services ...;*
 - d) minimising impacts and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures;*
 - e) preventing ... unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions ...; and,*
 - f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land...*
- 8.36 Paragraphs 192 – 195 of the NPPF cover issues relating to habitats and biodiversity, and include the following requirements of statements -
- Identify, map and safeguard components of local wildlife-rich habitats and wider ecological networks,
 - promote the conservation, restoration and enhancement of priority habitats, ecological networks and the protection and recovery of priority species; and identify and pursue opportunities for securing measurable net gains for biodiversity,
 - if significant harm to biodiversity resulting from a development cannot be avoided, adequately mitigated, or, as a last resort, compensated for, then planning permission should be refused,
 - development ... which is likely to have an adverse effect on [a SSSI] should not normally be permitted,
 - development resulting in the loss or deterioration of irreplaceable habitats ... should be refused, unless there are wholly exceptional reasons⁵⁸ and a suitable compensation strategy exists,
 - The following should be given the same protection as habitats sites: ... potential Special Protection Areas and possible Special Areas of Conservation; ... b) listed or proposed Ramsar sites; and ... c) sites identified, or required, as compensatory measures for adverse effects on habitats sites, potential Special Protection Areas, possible Special Areas of Conservation, and listed or proposed Ramsar sites,
 - The presumption in favour of sustainable development does not apply where the ... project is likely to have a significant effect on a habitats site ... unless an appropriate assessment has concluded that the plan or project will not adversely affect the integrity of the habitats on site.
- 8.37 The NPPF is supported by the Government Circular: *Biodiversity and Geological Conservation – Statutory Obligations and their Effect within the Planning System* (Office of the Deputy Prime Minister and Defra). This circular refers to the UK Biodiversity Action Plan (BAP), England Biodiversity Strategy and Local Biodiversity Partnerships, which outline strategic actions for biodiversity.

NPPG, 2014

- 8.38 The Natural Environment section of the NPPG 2014 states that information on biodiversity impacts and opportunities should inform all stages of development. The guidance advises that development should deliver enhancement for biodiversity by - habitat restoration, re-creation and expansion; improved links between existing sites; buffering of important sites; new biodiversity features; and securing long term enhancement. Guidance is also provided on the mitigation hierarchy, i.e. avoidance, mitigation and compensation.

Biodiversity Action Plans

- 8.39 The UK Biodiversity Action Plan (BAP) was the UK Governments response to the Convention on Biological Diversity (CBD), which the UK signed in 1992 in Rio de Janeiro and ratified in 1994. The CBD requires signatory countries to develop and enforce action plans to conserve, protect and enhance biological diversity. The UK BAP provided lists of species and habitats considered to be of priority for conservation.
- 8.40 In 2007 the UK Biodiversity Partnership published an updated list of priority UK species (1150 species) and habitats (65 habitats) to focus conservation action on rarer species and habitats.
- 8.41 The tenth meeting of the CBD parties in 2010 resulted in the adoption of a revised and updated Strategic Plan for Biodiversity for the 2011-2020 period. As a result, the UK BAP was replaced in July 2012 by the UK Post-2010 Biodiversity Framework to help address the new Strategic Plan. However, the UK BAP continues to be referenced and informs the lists of priority species and habitats in England listed under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 (see below).
- 8.42 The Wokingham Borough Biodiversity Action Plan (BAP) covers the period 2021-2024 and includes plans for species as well as a list of habitat action plans for target habitats of nature conservation concern.

Biodiversity 2020: A Strategy for England's wildlife and ecosystem services (Natural England, 2011)

- 8.43 The *Biodiversity 2020 Strategy for England's wildlife and ecosystem services* describes how the UK is implementing its international and EU commitments and sets out the direction for biodiversity policy.
- 8.44 The aims of the strategy are to: halt overall biodiversity loss; support healthy well-functioning ecosystems; and establish coherent ecological networks, with more and better places for nature for the benefit of wildlife and people.
- 8.45 The four approaches to achieve these aims are - an integrated large-scale approach to conservation; putting people at the heart of biodiversity policy; reducing environmental pressures; and improving knowledge. Priority actions for each approach are included in the strategy along with outcomes required for 2020.

Adopted Core Strategy (Wokingham Borough Council 2010)

- 8.46 The current adopted Core Strategy includes policy CP7 – Biodiversity which sets out that:
- Sites designated as of importance for nature conservation at an international or national level will be conserved and enhanced and inappropriate development will be resisted. The degree of protection given will be appropriate to the status of the site in terms of its international or national importance.*
- 8.47 With respect to development, CP7 goes on to say that development -
- A) Which may harm county designated sites (Local Wildlife Sites in Berkshire), whether directly or indirectly, or*
- B) Which may harm habitats or, species of principle importance in England for nature conservation, veteran trees or features of the landscape that are of major importance for wild flora and fauna (including wildlife and river corridors), whether directly or indirectly, or*
- C) That compromises the implementation of the national, regional, county and local biodiversity action plans will be only permitted if it has been clearly demonstrated that the need for the proposal outweighs the need to safeguard the nature conservation importance, that no alternative site that would result in less or no harm is available which will meet the need, and:*
- i) Mitigation measures can be put in place to prevent damaging impacts; or*
- ii) Appropriate compensation measures to offset the scale and kind of losses are provided*
- 8.48 In addition, the Core Strategy includes policy CP8 Thames Basin Heaths Special Protection Area which sets out specific protection for the SPA -
- Development which alone or in combination is likely to have a significant effects on the Thames Basin Heaths Special Protection Area will be required to demonstrate that adequate measures to avoid and mitigate any potential adverse effects are delivered.*

- 8.49 The WBC Local Plan is currently under review with draft Policy NE1: Biodiversity and Nature Conservation. This sets out the aims of the Plan with respect to biodiversity and development. It includes seven key elements -
- 1. Development proposals should protect and enhance biodiversity and/or geodiversity features of conservation value and implement appropriate conservation management. The degree of protection will be proportionate to the status of the site or species in terms of its international, national and/or local importance.*
 - 2. Development proposals should demonstrate through a suitable level of ecological survey information and assessment how they conserve and enhance biodiversity and/or geodiversity including their long-term management.*
 - 3. Development will only be supported where it: a) Avoids fragmentation of existing habitats and provides coherent ecological connectivity and permeability that is integrated and linked to the wider green and blue infrastructure network, through the restoration, enhancement and connection of: linear features such as wildlife corridors; stepping stones; and any nature recovery networks (including links to habitats outside the borough); b) Incorporates beneficial biodiversity and/or geodiversity conservation features and enhances existing features through design, layout and landscaping; c) Provides or retains appropriate buffer zones between development proposals and designated sites, protected species, priority species or priority habitats or main rivers, which are informed by detailed site-based assessment; d) Seeks to eradicate or control any invasive non-native species present on site; and e) Is compatible with any national, regional, county, and local biodiversity action plans, Local Nature Recovery Strategy and/or other strategic conservation management plans for species or habitats.*
 - 4. Development proposals likely to result in a significant effect on internationally designated sites either alone or in combination with other plans or projects, will not be supported unless Wokingham Borough Local Plan Update: Proposed Submission Plan 2023-2040 182 | Page it can be demonstrated that the adverse effects on the integrity of the designated site can be fully avoided, mitigated and/or compensated.*
 - 5. Development proposals that are likely to have an adverse effect on the notified features of a nationally designated site will only be supported in exceptional circumstances, and provided it has been clearly demonstrated that: a) A suitable alternative site with a lesser impact than that proposed is not available; b) The on-site biodiversity or geodiversity benefits of the proposal including, where applicable, the overall site or wider habitats network, clearly outweigh the impacts on the notified features of the site; and c) All appropriate avoidance and mitigation measures have been proposed and secured.*
 - 6. Development proposals that are likely to result in the loss or deterioration of an irreplaceable habitat, (such as ancient woodland, ancient or veteran trees) will only be supported in exceptional circumstances, where: a) A suitable alternative with a lesser impact than that proposed is not available; b) It has been adequately demonstrated that the irreplaceable habitat cannot be retained within the proposed development scheme; c) The need and benefits of the proposed development in that location and form clearly outweigh the loss or deterioration; and d) Adequate compensation measures are provided on site wherever possible, and offsite where this is not feasible. The scale and quality of the compensation measures required will be commensurate to the loss or deterioration of the irreplaceable habitat and will be considered on a site-by-site basis, including their long-term management and maintenance.*
 - 7. Development proposals which are likely to have an adverse effect on a site of local importance (including priority species or priority habitats, and sites that meet the criteria for designation as a Local Wildlife Site or Local Geological Site) will only be supported where they accord with the following sequential approach: a) No alternative with a lesser impact is available; b) The need and benefits of the proposed development in that location and form clearly outweigh the loss or deterioration; c) All proportionate mitigation measures to minimise adverse effects are included within the development proposal; and d) As a last resort, secure appropriate compensation measures on-site wherever possible, and off-site where this is not feasible, including their long-term management and maintenance.*
- 8.50 In addition, the draft Local Plan includes Policy NE2: Biodiversity Net Gain that requires all development to deliver demonstrable net gain of 10% (unless specified in another site allocation policy). This should be -

calculated via the most up-to-date national biodiversity accounting metric and provide details of the long-term maintenance and management of the net gain. This should be delivered on site in the first instance, or through biodiversity off-setting where appropriate.

METHODOLOGY

Scoping Assessment Stage

8.51 Table 8.1 below summarises the results of the ecology consultations.

Table 8.1: Ecology Consultation Results

Date	Consultee and Issues Raised	How/ Where Addressed
25/02/2025	Natural England – SANG design and layout	Design of SANG and its location/shape were refined following consultation with NE. A number of iterations were discussed with them before the final version was agreed.
09/06/2025	Wokingham Council – SANG design and layout	Design of SANG and its location/shape refined following consultation with the Council

Assessment Methodology

8.52 This assessment takes into account the most recent published guidance from the Chartered Institute of Ecology and Environmental Management (CIEEM) for EcIA (2024), and for Preliminary Ecological Appraisal (2017). The stages of the EcIA process include -

- identifying the baseline conditions and ecological features through desk study and site surveys, taking into account potential changes in condition between the time of the assessment and the commencement of the project,
- identifying the ecological features likely to be affected by the project, including sites designated for their nature conservation or biodiversity value,
- evaluating the ecological/biodiversity importance of ecological features at the geographical scale;
- identifying the impacts on Important Ecological Features as a result of the construction or operational phases of the project,
- providing appropriate proposals to avoid, mitigate (reduce), compensate or off-set (make up for) anticipated adverse impacts, and
- assessing the anticipated effect of the identified impacts on Important Ecological Features, taking into account any measures proposed as part of the project.

8.53 The following ecology surveys were undertaken to inform the assessment of the ecology baseline of the Site. Objectives and methods of survey are summarised below and full details are provided in the survey reports at the appendices listed below.

Ecology Desk Study (Technical Appendix 8.1)

8.54 Records of protected and notable species from within the last 10 years and information on designated sites within 2 km of the Site were requested from the Thames Valley Environmental Records Centre (TVERC) in 2023. Aerial photography of the Site (Google, 2025) was also examined to determine broad habitat types in the surrounding area.

UK Habitat Classification Survey (Technical Appendix 8.1)

8.55 A UK Habitat Classification ('UKHab') survey was carried out in fine and dry weather conditions in 2023 by CSA.

Breeding Bird Surveys (Technical Appendix 8.2)

8.56 The aims of the breeding bird survey were to determine the amount of breeding bird activity on or near to the Site and identify the species of birds present. The survey followed standard territory mapping methodology outlined in Gilbert *et al.* (1998) and Bibby *et al.* (2000).

Bats - Preliminary Habitat Assessment (Technical Appendix 8.3)

- 8.57 Trees and other habitats on the Site were assessed for their potential to support roosting and foraging or commuting bats during the extended Phase 1 habitat survey. Habitats were assigned a level of suitability based on criteria of suitability published in the Bat Conservation Trust's Bat Surveys: Good Practice Guidelines (Collins, 2016) and professional judgement.

Bat Activity Survey

- 8.58 Bat activity was recorded across the Site on six occasions between April and October 2023 inclusive as per good practice guidelines at the time (Collins, 2016).

Bat Emergence Surveys

- 8.59 Bat emergence surveys were completed of the single building on the Site during summer 2024 following Good Practice Guidelines (Collins, 2016).

Badger Survey (Technical Appendix 8.4)

- 8.60 The aim of the badger survey was to confirm the presence or absence of badgers on or adjacent to the Site. Surveys were completed within good practice guidelines (CIEEM, 2017).

Hazel Dormouse Survey (Technical Appendix 8.5)

- 8.61 All dormouse surveys were undertaken following guidelines published by English Nature (Bright *et al.* 2006).

Reptile Survey (Technical Appendix 8.6)

- 8.62 The reptile surveys were carried out in accordance with the methodology outlined in the Herpetofauna Workers' Manual (Joint Nature Conservation Committee, 2003) and Froglife's Advice Sheet 10 (1999).

Great Crested Newt Survey (Technical Appendix 8.7)

- 8.63 In determining the extent of the survey area, guidance published by English Nature (now Natural England) in the *Great crested newt mitigation guidelines* (2001) was consulted. The guidelines explain that -

"Great crested newts have been found to move over considerable distances (up to 1.3km from breeding sites). However, the vast majority of newts will inhabit an area much closer to the pond, and the exact distribution and migration patterns of newts on land depends on a variety of factors. The quality of terrestrial habitat near to breeding ponds is important, as are the lack of barriers to dispersal (such as fast-flowing rivers, or very busy roads). The distribution of ponds and hibernation opportunities may also influence movements. ... but great crested newts commonly move between ponds that are within around 250m of each other." (paragraph 4.2)

- 8.64 A 2003 assessment carried out by English Nature (English Nature 2003) found that in terrestrial captures of great crested newts -

"... by far the most captures were recorded within 50m of ponds and few animals were captured at distances greater than 100m." (paragraph 5.4.7b)

- 8.65 Therefore, to take a precautionary approach and allow for some potential future movement of newts prior to the commencement of construction should permission be granted, the great crested newt survey area covered the Site plus a surrounding buffer zone of up to 500 metres (**Technical Appendix 8.7**).

White Clawed Crayfish (Technical Appendix 8.8)

- 8.66 A walkover of the banks of the Barkham Brook was undertaken to inspect for possible white-clawed Crayfish burrows. This was carried out following the standard survey method described in Monitoring the White-clawed Crayfish, Conserving Natura 2000 Rivers. Monitoring Series No. 1. (Peay S, 2003). eDNA samples were collected in line with protocols provided by the laboratory undertaking the eDNA analysis (Nature Metrics Ltd).

Invertebrate Survey (Technical Appendix 8.9)

- 8.67 Site-specific surveys comprised a series of timed samples that followed methodologies defined in Surveying Terrestrial and Freshwater Invertebrates for Conservation Evaluation (Drake et al., 2007). Surveys utilised a variety of search techniques, including sweep-netting, hand searching, spot searching and netting of flying insects.

Riparian Mammal Survey (Technical Appendix 8.10)

- 8.68 Survey for water vole was undertaken in accordance with the guidelines of best practice set out in the Water Vole Conservation Handbook – Third Edition (Strachan *et al.*, 2011). The otter surveys followed the best practice survey guidelines as set out in Monitoring the Otter *Lutra lutra* (Chanin, 2003) and the Fourth otter survey of England (Crawford, 2003).

Receptor Sensitivity

- 8.69 Recognising that it is impractical for this assessment to consider all species and habitats that may be affected by the Proposed Development, the results of the ecology baseline surveys have been used to identify 'important ecological receptors' (IERs), i.e. species and habitats that are considered to be of conservation interest in some way, which could be affected by the Proposed Development.
- 8.70 Other valued ecological features may occur on or in the vicinity of the Site; however, these have not been considered as there is no potential for them to be significantly affected by the Proposed Development.
- 8.71 The evaluation of IERs has been based on the criteria set out in Table 8.2 below.

Table 8.2: Value of Important Ecological Receptors

SENSITIVITY		TYPICAL DESCRIPTORS
Very High (International)	High	An internationally designated site or candidate site, such as a Special Protection Area (SPA), Special Area of Conservation (SAC), Ramsar site, Biosphere Reserve or an area which Natural England has determined meets the published selection criteria for such a designation, irrespective of whether or not it has yet been notified.
High (National)		A nationally designated site, e.g. Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR), Marine Nature Reserves or an area which Natural England has determined meets the published selection criteria for national designation (e.g. SSSI selection guidelines) irrespective of whether or not it has yet been notified.
Medium (Regional)		Viable areas of habitat identified in a County Biodiversity Action Plan (BAP) or designated as a Local Wildlife Site (LWS), a locally significant population of a species identified as important on a county basis, such as the County BAP.
Low (Local)		Diverse and/or ecologically valuable habitats not of county importance.
Site		Features of value to the immediate area only.
Negligible		Commonplace feature of little or no habitat/historical significance. Loss of such a feature would not be seen as detrimental to the ecology of the area.

- 8.72 In assigning a value to a site, habitat or species (population or assemblage), their distribution and status (informed by survey data and available historical records) are considered. Rarity is taken into account because of its relationship with threat and vulnerability, and the need to conserve representative areas of habitats and genetic diversity of populations and species. A species that is rare and declining is assigned a higher value than one that is rare but known to be stable.
- 8.73 The valuation of sites also takes full account of existing value systems such as site designations. Professional judgement is used for valuing sites of less than county importance, which are not covered by existing value systems.
- 8.74 Criteria for the valuation of habitats and plant communities include Annex III of the Habitats Directive, guidelines for the selection of biological SSSIs and criteria used by local planning authorities and the Wildlife Trusts for the selection of local sites. Legal protection status is also considered where the habitats or plant communities are features of statutory designated sites.

- 8.75 Other habitat or plant community criteria considered include size (extent), diversity, naturalness, rarity, fragility, typicalness, historic records, importance to the ecological functioning of a site, ecological value to species of conservation concern, condition and potential importance.
- 8.76 Species populations are valued on the basis of their size, recognised status (e.g. inclusion in lists of species of conservation concern or BAP status) and legal protection status. For example, bird populations exceeding 1% of published information on biogeographic populations are considered to be of international importance, those exceeding 1% of published data for national populations are considered to be of national importance, etc.
- 8.77 Other species related factors considered include the species' distribution and rarity and any population trends. In addition, the size of the population that would be affected is considered. For example, although great crested newt is protected under the Habitats Directive, and therefore conservation of the species is of significance at the international level, this does not mean that every population of great crested newt is internationally important. Therefore, the geographic scale at which a species is considered to be important has been considered. Professional opinion and judgement of experienced ecologists have been used to assign importance.
- 8.78 Legal protection afforded to species has been taken into account in the development of mitigation measures to be implemented during construction and operation. For European protected species there is a requirement that a scheme should not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range, i.e. to maintain favourable conservation status, a scheme should not affect the long-term availability of sufficient habitat and resources required by the population, the long-term viability of the population, or the long term natural range of the species.
- 8.79 Finally, existing and future predicted baseline conditions are considered in the assessment of values. Predicted baseline conditions are based on, for example, trends in the population size, distribution of the species, likely changes to the extent of habitats and other resources, the effects of other proposed developments or land use changes, and potential impacts of climate change.

Impact Methodology

- 8.80 In line with the CIEEM Guidelines, impact is considered to be a result of an action which leads to a change(s) to an ecological feature, for example, demolition resulting on the loss of building utilised as a bat roost.
- 8.81 The likely impacts of the Proposed Development have been assessed in terms of the -
- type – positive or negative impact on an IER,
 - magnitude - size or intensity measured in relevant terms e.g. numbers of individuals lost or gained, area of habitat lost or created,
 - extent or spatial scope,
 - likely duration,
 - reversibility – naturally reversible or through mitigation action, and
 - timing and frequency in relation to ecological changes.
- 8.82 Table 8.3 shows how the magnitude of impacts has been described in this assessment.

Table 8.3: Magnitude of Impacts

SENSITIVITY	TYPICAL DESCRIPTORS
High	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements (Adverse).
	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial).
Medium	Loss of resource but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements (Adverse).
	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality (Beneficial).
Low	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements (Adverse).

SENSITIVITY	TYPICAL DESCRIPTORS
	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial).
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements (Adverse). Very minor benefit to or positive addition of one or more characteristics, features or elements (Beneficial).
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

8.83 Conservation status is described by the CIEEM guidance (2024) as -

- Habitats – conservation status is determined by the sum of the influences acting on the habitat that may affect its extent, structure and functions as well as its distribution and its typical species within a given geographical area,
- Species – conservation status is determined by the sum of influences acting on the species concerned that may affect its abundance and distribution within a given geographical area.

8.84 The assessment of whether the favourable conservation status of an IER is likely to be compromised has been made using professional judgement based on an analysis of the predicted impact of the Proposed Development (including consideration of parameters outlined above). For designated sites that are affected by the Proposed Development, the focus has been on the impacts on the integrity of the Site, i.e. the ability of the Site to continue to maintain conditions which will allow the key species and habitats for which it was designated to flourish. In assessing impacts on these sites, the focus has been on impacts on the key species and those habitats and resources/features of value to them.

8.85 In assessing the magnitude of impacts, consideration has been given to the fragility/stability of the habitats and the sensitivity of the species potentially affected by the Proposed Development. Fragile habitats are those which are readily damaged by human activity. Fragility is to some degree the inverse of stability, which can be defined as the ability of an ecosystem to maintain some form of equilibrium in the presence of perturbations. Fragility and stability can be expressed in terms of the degree of change in species abundance and composition following disturbance. Sensitive species are highly susceptible to disturbance. This may be direct disturbance as result of human activity, noise etc, or disturbance as a result of a change in habitat or resource that the species is particularly associated with or reliant on.

8.86 Where likely adverse impacts have been identified, mitigation or compensation measures have been incorporated/embedded into the design of the Proposed Development where practicable.

Effect Significance

8.87 In line with the CIEEM Guidelines, effect is considered to be an outcome resulting from an impact acting upon the conservation status or structure and function of an ecological feature. For example, killing/injury of bats and reducing the availability of breeding habitat as a result of the loss of a bat roost may lead to an adverse effect on the conservation status of the population concerned.

8.88 The significance and scale of the effects on the identified IERs has been assessed in terms of the value and sensitivity of the sites, habitats and species that will be affected and the predicted magnitude of impact.

8.89 Effects has been classified as adverse, beneficial or neutral. The significance of effect is classified as not significant or significant at the Local Level, District Level; etc.

8.90 Levels of significance are defined as -

- Very large: Only adverse effects are normally assigned this level of significance and they should be considered to represent key factors in the decision-making process. Effects are likely to be significant on one or more receptors at a national, UK, European or international scale,
- Large: Effects are considered to be very important considerations and are likely to be material in the decision-making process. Such effects are likely to be significant for one or more receptors at a regional scale,
- Moderate: Effects may be important but are not likely to be key decision-making factors. Such effects are likely to be significant for one or more receptors at a County or Unitary Authority Area scale,

- Slight: Effects are not likely to be important in the decision-making process but are to be considered in enhancing the design of the project. Such effects are likely to be significant for one or more receptors at a local scale.

8.91 Effects of 'moderate' or greater significance are considered to be significant in terms of the EIA Regulations. Beneficial effects are also considered in the assessment. Effects that too low to be considered material to a decision are those that are assessed as 'slight' or neutral and are not considered in this assessment.

8.92 Table 8.4 provides a guide to the assessment of ecological significance of effects based on the value of an IER and magnitude of impact, as described above.

Table 8.4 Significance of Effects

Sensitivity/ value of a Receptor	MAGNITUDE OF EFFECT			
	High	Medium	Low	Negligible
Very High	Substantial	Substantial	Moderate	Slight
High	Substantial	Moderate	Slight	Negligible
Medium	Moderate	Slight	Negligible	Negligible
Low	Slight	Negligible	Negligible	Negligible

8.93 Considering the methodology of assessment summarised in Table 8.4, habitats, sites or species of less than district level importance are not considered to be IERs for the purpose of this assessment since even major impacts on these features will result in a slight effect only and, therefore, not significant in EIA terms.

Timescale of Effects

8.94 Time frames referred to in this assessment are -

- short-term - one to three years,
- medium-term - four to nine years, and
- long-term - greater than nine years.

Limitations of the Assessment

8.95 There are no limitations to the assessment of ecological effects. The Site has been subject to thorough ecology surveys over several years such that there is a good understanding of the current baseline.

BASELINE CONDITIONS

Existing Baseline

Statutory Designated Sites

8.96 The desk study identified one national statutory site within 3km of the Site, as well as a single local statutory designation. These were the Long Moor Bog SSSI and Longmoor Bog LNR, both of which are located 230m south of the Site.

8.97 A single international statutory designation was identified within 10km of the site. This was the Thames Basin Heaths SPA, the closest parcel of which is 3.45km south west of the Site.

Non-statutory designated sites

8.98 A total of 12 non-statutory designations were identified within 2km of the Site. These are all Local Wildlife Sites (LWS) as described in Table 8.5.

Table 8.5: Statutory and Non-Statutory Designations Within the Search Area

Site Name and Designation	Approx. distance and direction from survey area	Special interests or Qualifying features
Thames Basin Heaths SPA (international designation within 10km)	3.45 km south-west	Supports nationally important breeding populations of Dartford warbler <i>Sylvia undata</i> , nightjar <i>Caprimulgus europaeus</i> and woodlark <i>Lullula arborea</i> .
Longmoor Bog SSSI (National designation within 3 km)	230 m south	Valley mire, wet heathland and mixed woodland supporting common and rare plants and invertebrates and a diverse assemblage of breeding birds.
Longmoor Bog LNR (Local designation within 3 km)	230 m south	See above.
Longmoor Bog and Woodland California Country Park LWS	320 m south	This is the part of California Country Park that lies outside the Longmoor Bog SSSI.
The Coombes LWS	480 m north	A parcel of Lowland Mixed Deciduous Woodland with features indicative of a long-established woodland, with a stream running through it. Two small areas of grassland indicative of Lowland Meadow and acid grassland present.
Brook Farm Meadow LWS	690 m east	Two wet grasslands, with aspects of neutral and acid marshy grassland, remnant rush pasture and a pond.
Longmoor Lake LWS	760 m south-east	A large lake and some mixed woodland with wetland and heathland species.
Hazeltons Copse	870 m north-west	An area of ancient woodland and lowland mixed deciduous woodland
Bearwood Estate – Woods and lakes LWS	1.14 km north	An extensive area of broadleaved woodland with a large lake.
Hogwood Shaw LWS	1.18 km south-west	A small woodland with a small pond.
Long Copse (south) and Robin Hood Copse (LWS)	1.24 km west	Two parcels of ancient woodland
Spring Copse and Long Copse (north) LWS	1.2 km west	Two almost continuous areas of semi-natural ancient woodland.
Spring Copse and Long Copse (north) Extension Proposed LWS	1.27 km west	A proposed extension of the above containing areas of lowland mixed deciduous woodland.
Shepperlands Copse LWS	1.27 km south	Contains mixed woodland, heathland restoration and unimproved wet meadows.
The Moors (including Sand Martins Golf Club Edge) LWS	1.37 km east	An area of wet woodland, marsh and marshy meadows, including the adjacent golf course where there is a long-established sand martin <i>Riparia riparia</i> colony.

8.99 Sites designated due to their importance at an international level (i.e. SACs, SPAs, Ramsar sites) are considered to be of very high (international) value for the purpose of this assessment, and sites designated at the national level (i.e. SSSIs) are considered to be of high (national) value.

8.100 Due to the level of protection afforded to the non-statutory designated sites, the LWSs listed in Table 8.5 above are considered to be of medium (regional) value.

Protected Species

8.101 Records of protected species reported within 2km of the Proposed Development Site over the last ten years are summarised below (also refer to **Technical Appendix 8.1**). No records were reported for the Site -

- 463 records of bats within the search area between 1994 to 2020,
- 78 records of badger within the search area between 1995 to 2021,
- No records of dormouse within the search area,
- 4 records of water vole within the search area between 1996 and 1998,
- 1 record of otter within the search area in 2016,
- 390 records of 54 bird species within the search area between 1995 to 2020,

- 831 records of reptiles ,
- 41 records of amphibian, including 4 records of great crested newt,
- 190 records of 18 invertebrate species, including one records of white clawed crayfish.

UK Habitat Classification Survey (Technical Appendix 8.1)

8.102 The results of the UK Habitat Classification Survey are summarised below.

Ancient woodland

8.103 Several small parcels of semi-natural ancient woodland listed on the Ancient Woodland Inventory are located within the Site, the largest of which extends northward from a portion of the southern boundary. Discreet parcels connected to the Barkham Brook, which bisects the Site from the northern to the southern boundary, were shown on MAGIC mapping, however, this woodland was found to be one contiguous parcel during the habitat survey. A further two areas are mapped as disconnected parcels of woodland within the wider Site.

8.104 Several veteran and notable trees identified within the Ancient Tree Inventory are present within or in close proximity of the Site's boundary vegetation, including a cluster containing pedunculate oak *Quercus robur*, silver birch *Betula pendula* and wild cherry *Prunus avium* within a small parcel of woodland along the Boundary B9; a line of oak *Quercus* sp. trees running along Boundary B17 parallel to Commonfield Lane; and some scattered oak trees along Boundaries B1 and B7 adjoining the neighbouring Arborfield Green development.

8.105 Given the value of ancient woodland (even if it poor condition as here), this IER is considered to be high (national) value.

Grassland

8.106 The majority of the Site is dominated by species-poor modified grassland with a uniform short sward. The fields are rotationally used for sheep grazing, silage, and horse grazing, with narrow field margins where they are present. Field F1 has previously been used as a polo green. Coarse grasses including cock's-foot *Dactylus glomerata*, Yorkshire fog *Holcus lanatus*, perennial rye grass *Lolium perenne*, and bent grass *Agrostis* sp. are present in all fields. While the dominating species varies between fields, the species composition remains consistent throughout. Herbs are infrequently present and include creeping buttercup *Ranunculus repens*, ragwort *Senecio jacobaea*, meadow buttercup *Ranunculus acris*, chickweed *Stellaria media*, creeping thistle *Cirsium arvense*, cow parsley *Anthriscus sylvestris*, cleavers *Galium aparine*, ribwort plantain *Plantago lanceolata* and vetch *Vicia* sp.

8.107 Scattered bracken *Pteridium aquilinum* is encroaching along the southern boundary of Field F2 alongside dock *Rumex* sp. and spear thistle *Cirsium vulgare*. Tufted hair grass *Deschampsia cespitosa* and timothy are additionally present to the south of Field F4.

8.108 Due to the limited species diversity, limited ground cover and extent of the habitat, the grassland on the Site is considered to be of low (local) value, which is not relevant in EIA terms. It is therefore not considered further in this assessment by itself although is considered with respect to other IERs that it supports.

Woodland

8.109 Several parcels of woodland are present within the Site, four of which are mapped as ancient woodland and Priority Lowland Mixed Deciduous Woodland within the MAGIC database (see Appendix C; Priority Habitats Map). Log piles, standing deadwood and laying deadwood are frequently present throughout the woodland parcels (see Target Note 2; Appendix A of **Technical Appendix 8.1**).

8.110 As a Priority Habitat, the non-ancient woodland present on the Site is considered to be of medium (regional) value.

Dense Scrub

8.111 Dense scrub is scattered across the Site, primarily along field boundaries. The majority of this scrub is dominated by bramble *Rubus fruticosus* agg., with occasional hawthorn and blackthorn present. A larger area of bramble scrub is present at the north-eastern corner of Field F9, south of Woodland W5 which present by P3.

8.112 Due to the limited species diversity, limited ground cover and extent of the habitat, the scrub on the Site is considered to be of low (local) value, which is not relevant in EIA terms.

Rivers and Streams

- 8.113 Barkham Brook runs through the Site from the northern boundary of Fields F6 and F8 to the southern extent of Woodland W2. It is c. 1-2m wide along its length and has a slow flow leading north to the River Loddon. Negligible aquatic and marginal vegetation was identified. Fallen deadwood is present within the channel and on the bank tops from the surrounding parcel of woodland. The Barkham Brook is considered to be of medium (regional) value.
- 8.114 Ditches are present throughout the Site, the majority of which are associated with linear boundary vegetation. A ditch runs along the northern fence line of Field F1, which contained vegetation consistent with the adjacent grassland, suggesting that it is dry most of the year. The ditch which runs through Woodland W1 was wet at the time of the survey and directly connects to the Barkham Brook to the east. The vegetation present within this ditch was consistent with the surrounding woodland, suggesting that it is seasonally wet. Due to the limited species diversity and lack of aquatic/marginal vegetation the ditches on the Site are considered to be of low (local) value, which is not relevant in EIA terms.

Standing Water – Ponds

- 8.115 Three ponds were found to be present within the Site. Pond 1 P1 is a large man-made pond located in the south-east corner of Field F4. The banks were highly eroded which may be a result of cattle poaching. Large areas of aquatic vegetation were present including a number of pond weeds *Potamogeton* spp. Given its size and aquatic vegetation population, Pond P1 is considered to be of medium (regional) value.
- 8.116 Pond P2 is a small natural pond located centrally within one of the woodlands and is likely to dry out following periods of dry weather, evidenced by a lack of aquatic and marginal vegetation. P3 is a small natural pond located within woodland W5. The other ponds, given their seasonal nature, are considered to be of no more than low (local) value.

Hedgerows and Tree Lines

- 8.117 The Site is bounded on many aspects by native hedgerows and treelines, the majority of which are associated with ditches. Hawthorn, hazel, ash *Fraxinus excelsior* and blackthorn are frequently present accompanied by areas of dense bramble. Mature standard trees are present in many of the boundaries, most frequently oak trees. The hedgerow network on the Site is considered to be of medium (regional) value.

Protected Species

Breeding Birds (Technical Appendix 8.2)

- 8.118 A total of 30 species were recorded during the survey. Of these species, 18 were confirmed to be breeding. Of the remaining 12 species, eight were of non-breeding status, either passing through the Site or using the Site for foraging and four of possible breeding status. Six of the species considered to be breeding or possibly breeding on the Site had some status as species of conservation concern. These comprised greenfinch, marsh tit, stock dove, dunnock, woodpigeon and wren. Higher levels of activity were recorded along hedgerows, scattered trees, and woodland edges.
- 8.119 Any breeding population identified within the survey area is considered to be of national importance if it exceeded 1% of the national population. No breeding population of any species within the survey area approaches the 1% level of the national population.
- 8.120 The number of species recorded in an area is a simple measure of diversity that can indicate its importance at each season of the year. Fuller (1980) gives the following breeding diversity criteria which are presented in Table 8.6.

Table 8.6: Breeding Diversity Criteria (Fuler 1980)

National	Regional	County	Local
85+	0-84	50-69	25-49

- 8.121 Based on Fuller's criteria, the breeding bird assemblage of the survey area in 2018 (30) is of low (local) value. However, it should be noted that Fuller's analysis was developed in the 1970's. Since then, species diversity has declined significantly (Eaton *et al.*, 2015). As a result, Fuller's thresholds are considered to be too high for today's breeding bird populations. Therefore, for the purpose of this assessment, the breeding bird assemblage across the whole survey area is considered to be of medium (county) value.

Bat Surveys - Activity (Technical Appendix 8.3)

- 8.122 Static monitoring of bat activity over the Site identified nine species of bat using the Site -
- Common pipistrelle (1 point)
 - Soprano pipistrelle (1 point)
 - Noctule (2 points)
 - Leisler's (3 points)
 - *Myotis* spp. (3 points)
 - Daubenton's (2 points)
 - Brown Long-eared (1 point)
 - Barbastelle (4 points)
- 8.123 The points in parenthesis above relate to the valuation of the species according to the rarity category for southern England set out in Reason and Wray (2023). This gives an assemblage score of 17 points, the threshold for County value (i.e. 45% out of a theoretical maximum of 45 points) set out in Reason and Wray (2023) is 20 points with the threshold for Regional (i.e. Medium value used in this ES) 25 points. Although well below the Regional threshold given in Reason and Wray (2023), given the presence of the rare barbastelle within the assemblage, on a precautionary basis, the assemblage is valued at medium (regional) value.
- 8.124 Although barbastelle were recorded using the site on most months, this was only for one or two passes. Given this low level of usage, it is not considered necessary to assess this species as a separate IEF with the treatment of the overall assemblage as being of higher value than suggested by Reason and Wray (2023) providing sufficient precaution in the assessment of effects on bats.

Bat Emergence

- 8.125 No bat roosts were observed during the surveys of the building on the Site. As such, roosts within buildings are not considered further in this assessment.

Hazel Dormouse Surveys (Technical Appendix 8.5)

- 8.126 No signs of dormice were recorded during the survey, indicating likely absence of the species on the Site. Therefore, the species is not considered to present a constraint to the Proposed Development and is not considered further in this impact assessment.

Reptile Surveys (Technical Appendix 8.6)

- 8.127 A reptile presence/ absence survey was undertaken across the Site over 2023 and 2024, during which six grass snakes, four adults and two juveniles, and one adult slow worm were recorded. With four adult and two juvenile grass snakes recorded on the Site, the overall count of six means that the Site is estimated to have a good population of grass snake. One adult slow worm was recorded during the surveys, indicating an estimated low population size of slow worm. As the Site only supports two reptile species it does not qualify as a Key Reptile Site (Froglife 1999).
- 8.128 Considering the very small size of the reptile population recorded on the Site, reptiles are considered to be of low (local) value only, which is considered not significant in EIA terms and, therefore, reptiles are not considered further in this assessment. However, due to the level of protection afforded to reptiles under the Wildlife and Countryside Act 1981 (as amended), reptiles are taken into account in the mitigation strategy.

Great Crested Newt Surveys (Technical Appendix 8.7)

- 8.129 The results of the HSI assessments of 19 ponds (ponds accessible within 500 m of the Site) reported three as having excellent suitability, three as having good suitability, four as having average suitability, five as having below average suitability and three as having poor suitability. Nine ponds were surveyed for eDNA, primarily those with HSI scores of average or above. None of the ponds sampled returned a positive result.

- 8.130 However, during eDNA collection from Pond 1, a single GCN egg was located on aquatic vegetation confirming presence. On this basis, therefore, further population estimate surveys were undertaken. No further evidence of GCN were located. A further eDNA sample was also taken at the end of the population estimate work which also returned a negative result. Therefore, on the basis of a single GCN egg confirming presence of this species in Pond 1, and no further evidence, this suggests that the population present is very small. Given the size of Pond 1, it is possible that GCN were present within the depth of the main water body. However, this would be very unusual for this species which is usually observed towards the edge of water bodies where the water is warmer and generally clearer.
- 8.131 The project will enter into the GCN District Level Licence (DLL) for the Berkshire area. As such, any potential impacts/effects to this species that might arise as a result of the Proposed Development will be appropriately addressed through the inclusion of the project within the DLL. On this basis, therefore, GCN are not considered further in this assessment, on the basis of inclusion in the DLL.

Invertebrates (Technical Appendix 8.9)

- 8.132 The grassland, woodland, scrub and hedgerows were surveyed for invertebrates by an experienced entomologist. The majority of grassland was of low invertebrate potential.
- 8.133 The areas of high invertebrate interest are distributed throughout the Site. The ancient woodland had an abundance of English oak as well as large variety of shrub and tree species, which gives it a high potential for invertebrates. The large pond present to the south and the stretch of the Barkham Brook which runs through the Site has a wide composition of vegetation and clean water providing this habitat with a high potential for invertebrates. No species identified during the invertebrate assemblage surveys were of particular interest or conservation concern. Therefore, the species is not considered to present a constraint to the Proposed Development and is not considered further in this impact assessment.
- 8.134 Outside of the ancient woodland and Barkham Brook (which are already considered of medium value), given the above, the invertebrate population of the Site outside of these areas is considered to be of low (local) value only which is not significant in EIA terms.

Riparian Mammals (Technical Appendix 8.10)

- 8.135 There is limited optimal habitat present on-site to support riparian mammal species, this includes the section of the Barkham Brook that runs centrally on the Site, and this is sub-optimal to support riparian mammal species. A walkover survey to identify presence/likely absence of riparian mammals on the Site was undertaken and no evidence to the presence of riparian mammals were found. Therefore, water vole/otter are not considered to present a constraint to the Proposed Development and is not considered further in this impact assessment.

White Clawed Crayfish (Technical Appendix 8.8)

- 8.136 All eDNA samples taken from the watercourse within the Site boundary were negative for white-clawed crayfish eDNA. During the walkover survey no evidence of burrows were detected and the habitat was considered unsuitable for white-clawed crayfish due to heavy trampling by cattle and sub-optimal bank profiles. As such, this species is not considered further within the assessment.

Hedgehog

- 8.137 There is the potential for hedgehog to be using areas of rough grass and scrub around the boundaries of the Site. Hedgehog is listed in Section 41 of the NERC Act 1992 and has experienced a dramatic population decline in recent years. Therefore, although not considered as an IER, hedgehog is considered in the mitigation strategy.

Important ecological receptors

- 8.138 Table 8.7 sets out the Important Ecological Receptors to be carried through into the assessment.

Table 8.7: Important Ecological Receptors

IER	Value
Thames Basin Heaths SPA	Very high (international)

Longmoor Bog SSSI	High (national)
Longmoor Bog LNR	Medium (regional)
Various LWS listed in Table X.5	Medium (regional)
Ancient woodland	High (national)
Woodlands	Medium (regional)
Hedgerows	Medium (regional)
Barkham Brook	Medium (regional)
Pond 1	Medium (regional)
Breeding birds	Medium (regional)
Bats	Medium (regional)

- 8.139 Other species that were not recorded during the survey but are considered in the mitigation strategy but not considered to be IERs for the purpose of this assessment are hedgehogs and amphibians (including great crested newt).

Future Baseline

- 8.140 It is assumed that in the case of no development, the existing land use would continue, i.e. grazing by horses and sheep. The intensity of grazing recorded during the ecology surveys restricted the ecological value of the grassland and boundary habitat on the Site. Over the proposed timescale of construction, changes to grazing management are likely to have the greatest influence on the biodiversity value of the Site, i.e. grass cover and plant species diversity, which impact upon other species including invertebrates, foraging bats and breeding birds.
- 8.141 Over the longer term, the main changes that would be expected without the Proposed Development, should grazing continue at the intensity reported during the ecology surveys, could result in greater loss of scrub and hedgerow cover as well as grassland plant species diversity. Mature trees may also develop more features of potential value to roosting bats.

Climate Change

- 8.142 In the medium to long-term there is the potential for changes in baseline conditions to occur as a result of climate change. The UK Climate Change Risk Assessment (Defra 2017) identified several potential threats and opportunities for the natural environment due to climate change. Key risks were -
- to species and habitats due to inability to respond to changing climatic conditions,
 - to wildlife from water scarcity and flooding,
 - to soils from increased seasonal aridity and wetness,
 - to natural carbon stores and carbon sequestration, and
 - due to land management practices exacerbating flood risk.
- 8.143 Potential opportunities identified included opportunities from new species colonisations.
- 8.144 The Terrestrial Biodiversity Climate Change Impacts Report Card 2012 -13 (Living with Environmental Change (LWEC) Partnership, 2013) provides qualitative assessments of likely biodiversity change. It is recognised that ecological responses are likely to be complex with a large range of possible outcomes.
- 8.145 Observations and predictions for some of the habitats on the Site include -

- Increasing temperatures have enabled earlier spring greening of grasslands and a longer growing season,
- Reduced precipitation in summer months may adversely affect wetland habitats,
- Leafing has advanced by 2–3 weeks since the 1950s in response to increased temperatures and this may be having a negative impact on woodland flora, particularly spring-flowering species,
- Pests and diseases affecting woodlands/trees may be increased by interactions with climate change effects on tree function,
- Ground flora in deciduous woodlands may change due to earlier leafing of the tree canopy as a result of rising spring temperatures.

8.146 The potential effects of these main risks from climate change on the future ecological baseline should be considered recognising that ecosystems are complex and are affected by a wide range of factors, and that there are limited data and modelling capability.

EMBEDDED MITIGATION

8.147 A CEMP and Ecological Management Plan (EMP) will be produced post consent and will be based on the outline mitigation strategy for the scheme described below. For the purpose of this assessment, the strategy has been separated into measures of avoidance, mitigation, compensation and enhancement, to take into account the mitigation hierarchy outlined in the NPPF.

8.148 The overall assessment is made/based on the Parameter Plans, as set out in Chapter 5 of this ES.

Designated Sites

8.149 In accordance with guidelines published in the Local Plan for residential development, the following mitigation measures will be set in place to prevent a significant adverse impact on international / European designated sites due to an increase in visitor pressure -

- SANG and recreational routes: new or improved open space and recreational routes of a quality and type suitable to attract residents who might otherwise visit the European nature conservation sites ... SANG could consist of - new areas of publicly accessible natural green space; enhanced (character and accessibility) existing areas of public open natural green space of SANG quality; and improved walking routes and connectivity between local green spaces,
- Management of access and visitor numbers, and modification of visitor behaviour to reduce the potential for harmful recreational impacts,
- A contribution towards monitoring of the impacts of new development on the European nature conservation sites and establishing a better evidence base to reduce uncertainty and inform future refinement of mitigation measures.

8.150 The proposed SANG will be located along the eastern side of the Site and will cover approximately 13.23ha. Other areas of Public Open Space will cover approximately 11.77ha and be located throughout the remainder of the Site and along corridors across the centre of the Site to connect the east with the west of the Site.

8.151 Although primarily for recreational purpose, SANG and Public Open Space will be managed to maximise their benefit to biodiversity (as described below), which in turn is expected to enhance their recreational value.

Ecology Management Plan

8.152 A site-wide EMP will be produced and agreed with Natural England and the Council, as necessary, prior to the commencement of construction. The plan will detail all ecology measures required to be undertaken prior to, during construction and after construction. Measures will include the establishment and long-term management of the SANG and Public Open Space, as well as other measures described in this chapter. The plan will include and/or refer to the detailed requirements of any potential protected species licences and method statements, and other related documents including the Landscape Management Plan.

8.153 Requirements of the plan will include annual monitoring to inform ongoing management. Monitoring results will be assessed against Indicators of Success listed in the plan. The plan will be flexible so as to enable amendments to be made to take into account results of monitoring. The plan will also include requirements for reporting and responsibilities.

- 8.154 The EMP will detail all works that are to be undertaken and supervised by an appropriately experienced ecologist. In addition, the EMP will require that all site works be carried out by appropriately experienced and where necessary, qualified professionals.
- 8.155 Due to the mobile nature of certain species, the following species-specific pre-construction surveys will be undertaken -
- Bat roosts (trees): to locate any bat roosts in trees to be felled, pruned or that could be disturbed during construction,
 - Badger: to locate any active setts that would need to be protected or would require a licence to disturb or close. Where practicable, should a badger sett be located in areas of dense scrub adjacent to the northern boundary of the site, the access road from the A31 will be realigned to avoid disturbance or damage to the sett. However, should this not be practicable, measures described below (Mitigation for - *Error! Reference source not found.*) will be set in place.
- 8.156 Surveys are typically considered to be out-of-date after 2-3 years; it was agreed during pre-application consultation with the Council's ecology team that, given the nature of the Site, there was no requirement to update surveys prior to submission of the outline application. However, all previously undertaken surveys, or as otherwise agreed with Natural England and the Council, will be repeated prior to any reserved matters application so as to ensure that any changes to the baseline are taken into account in the mitigation strategy.
- 8.157 Most bat species are light intolerant. Although bats hibernate during the winter months, they will wake from hibernation during milder weather to forage. Therefore, the construction lighting strategy for the Proposed Development will ensure that the SANG, areas of Public Open Space and site boundary hedgerows and scrub remain unlit to enable the continued movement and foraging of bats across the Site and wider landscape.
- 8.158 The construction lighting design will be in line with *Guidance Note 08/18 Bats and artificial lighting in the UK* (Bat Conservation Trust and the Institute of Lighting Professionals 2018). Light fittings will be directional and will prevent upward light spill. Security lighting set on motion-sensors and short (1min) timers where practicable and safe to do so.
- 8.159 Should there be the need to fell, prune or to work within close proximity to (e.g. within approximately 10 metres) any trees that are of potential value to roosting bats (i.e. as identified during pre-construction surveys) the following measures will be undertaken -
- Tree climbing surveys will be undertaken by a Natural England licensed bat worker and qualified tree climber. The licenced surveyor will inspect all features of potential value as a roost site using an endoscope to identify evidence of a roost, if present.
 - Any trees with a confirmed / potential roost site (confirmed during aerial roost inspections or ground-level surveys if unsuitable for climbing) will be surveyed around dusk and/or dawn in accordance with bat survey guidelines published by the Bat Conservation Trust (Collins 2016). The number of survey visits will depend on the potential value of the tree to roosting bats, (e.g. trees with confirmed roost or of high potential value to roosting bats require three survey visits, and trees of moderate potential value require two visits). The purpose of the surveys will be to confirm the presence or likely absence of a roost and if present, identify the type of bat roost, species and numbers of bats present. If a bat roost is located, survey results will inform an application to Natural England for a bat licence under the Conservation of Species and Habitat Regulations 2017 (as amended). The licence application would include a detailed method statement covering restrictions on the timing of any works that could affect the roost, the potential need to soft fell, and the requirement for an ecologist named on the licence to carry out and/or supervise works. Mitigation detailed in the method statement would include the installation of bat roost boxes suitable for the species recorded during the surveys.
- 8.160 Given the low population of grass snake and slow worm recorded on the Site (Reptile Survey Report, **Technical Appendix 8.6**), protective measures will include habitat management to deter animals. These will be detailed in the EMP and will involve either areas around perimeter hedgerows being retained such that reptiles can be left *in situ* or, if areas require clearance, the clearance of above-ground vegetation habitat of potential value to reptiles during the reptile active season (i.e. late March/April – October inclusive, dependent on local weather conditions) in two-phases to minimise the potential for injuries or fatalities. The first phase of clearance will comprise cutting vegetation to approximately knee height, then after 24 hours vegetation will be cut to ground-level. An Ecology Clerk of Works (ECoW) will be present to capture any reptiles disturbed in the process and relocate them to appropriate retained habitat at a suitable distance from the works area. Ideal receptor areas would be in the SANG (close to areas of rough grassland, scrub or hedgerows and constructed refugia, described below, or Site

boundary hedgerows and scrub). Should vegetation clearance be undertaken outside of this period, i.e. when reptiles are hibernating, this two phased clearance will not be required. However, any clearance or disturbance of features of potential value to hibernating reptiles should not be cleared during the hibernation season.

Woodland, Trees, Hedgerows and Scrub

- 8.161 Where practicable, hedgerows and areas of scrub will be retained and enhanced and new areas of woodland, trees, scrub and hedgerows will be planted around the Site boundaries, and across the SANG and Public Open Space to provide additional and enhanced habitat corridors / ecological networks across the Site and wider landscape.

Watercourses and Waterbodies (SUDS)

- 8.162 The Barkham Brook will be retained and appropriately protected. Ditches will also be retained, although one section of ditch where it passes beneath access roads is likely to be culverted. Measures to enhance the biodiversity value of the un-culverted sections of the ditch will be undertaken such as channel re-profiling to create a more diverse profiles including features that create variations in flow and widened, deepened areas that hold water for longer, ledges along the banks at varied heights to create a diversity of microhabitats of value to aquatic, semi-aquatic, marginal plants, and aquatic and semi-aquatic fauna including invertebrates. Care would be taken to prevent the spread of invasive plants whilst this is being undertaken. Works would be undertaken in accordance with a detailed method statement. Detailed designs and a management plan will be included in the EMP.
- 8.163 Attenuation / infiltration basins will be constructed to the west of the SANG in areas of Public Open Space. Although the primary purpose of these basins will be as part of the Sustainable Urban Drainage System (SUDS), the features will be designed in consultation with an appropriately experienced ecologist to maximise their benefit to biodiversity, as described below. As set out in various guides (e.g. RSPB 2012), it is possible to ensure that the SUDS are effective with respect to their primary role in water attenuation while also being significant features with respect to biodiversity, if appropriately designed as such.

Species Habitat Creation

- 8.164 Artificial nest boxes for birds, hedgehogs and invertebrates, and roost boxes for bats will be installed in appropriate locations, and features of potential value as hibernacula and/or refuges of potential value to reptiles, amphibians and invertebrates will be constructed in appropriate locations.

Grassland

- 8.165 The loss of improved grassland, with poor diversity of plant species and sward height, will be mitigated by the enhancement of retained grassland. Retained grassland will be enhanced by creating species-rich and floristically-diverse grassland within the SANG and 7.25ha of species-diverse habitats that will include grassland within Public Open Space.
- 8.166 Areas of enhanced grassland will be managed in accordance with the requirements of the EMP, to encourage a diversity of plant species and sward heights, as described under Operation below.
- 8.167 In addition, flowering grassland seed mixes, where possible comprising seeds of local provenance, will be used to seed new lawns within the development (e.g. Emorsgate seed mix EL1), to provide a richer nectar source for invertebrates than standard species-poor amenity grassland mixes.

Construction Environment Management Plan

- 8.168 As described in Chapter 5, construction works will be undertaken in accordance with a CEMP and associated documents including for example, a SWMP, which will be referred to in the CEMP. All documents will be produced prior to the commencement of construction. Measures detailed in the CEMP and/or associated documents will include best-practice measures to control noise, light, vibration, and airborne and waterborne pollutants. Measures / requirements will include -

- A pollution incident response method,
- Appropriate dust control measures, as set out in Chapter 12 ,
- Fires will only be lit in secure compounds and not allowed to remain lit during the night,
- Works (including surveys and monitoring visits) will be undertaken in accordance with a biosecurity risk assessment and safe system of work. The risk assessment and safe system of work will take

into account species-specific guidelines for management and control of non-native invasive species produced by the Non-Native Species Secretariat (NNSS) and Natural England,

- Typical working hours will be between 08.00 and 18.00. Therefore, lighting will likely be restricted to dusk and dawn in late autumn - winter. The use of temporary lighting will be minimised wherever practical and as required for health and safety, security or other reasons. Light fittings will be directional so as to minimise light spill on to retained habitat of value to biodiversity (i.e. including SANG, Public Open Space and site boundary hedgerows and scrub),
- Works-free buffer zones around retained hedgerows, scrub and trees, in particular 15m from the ancient woodland on site, will be marked out on-site using protection fencing or a suitable equivalent, e.g. high visibility tape (in accordance with BS5837:2012 or subsequent equivalent) The locations of protection measures will be agreed in advance with the ECoW. Protection zones will exclude all works, the tracking of vehicles, and any storage areas (including storage of vehicles machinery, equipment and soils),
- Whenever practicable, to avoid impacts on breeding birds, clearance of vegetation of potential value to nesting birds (i.e. trees, hedgerows, scrub and areas of rough grassland located adjacent to scrub/hedgerows) will be completed outside of the bird-breeding season (considered to be between mid-February and August inclusive). However, should it not be possible to avoid this season, vegetation will be inspected/surveyed by an appropriately experienced ecologist immediately before clearance (i.e. the morning of clearance works, or late in the day prior to clearance works) in order to confirm the absence of active nests. Should an active nest be located in the vegetation to be cleared or close by (depending on the species of bird) measure will be set in place as advised by the ecologist to prevent damage or disturbance to the nest until it can be confirmed by the ecologist that the nest has been abandoned or any young have fully fledged and left the nest. Protective measures will include the establishment of a works-free buffer zone around the nest.

Ecological Enhancement

Woodland, Hedgerows, Scrub and Trees

- 8.169 With the exception of the Barkham Brook corridor, habitat connectivity across the Site is generally sparse. One of the aims of species-rich woodland, scrub and hedgerow planting described under mitigation above, will be to enhance the habitat corridors / ecological networks across the Site, and provide enhanced connectivity to surrounding habitats. In particular, the planting of woodland has been located to relink the blocks of ancient woodland and to recreate areas of woodland within the SANG that would have previously been Kidgem Copse.
- 8.170 Of particular value would be the strengthening of the Barkham Brook corridor through the planting of woodland, scrub and hedgerows along the west boundary of the SANG along with the public open space corridor across the central part of the Site. The design and management of these habitat corridors / ecological networks will be detailed in the EMP.

Bats

- 8.171 The planting of woodland and wide corridors of scrub and hedgerows along the west boundary of the SANG and in areas of Public Open Space will enhance the Site for bats by providing additional foraging and commuting corridors and potential long-term future roosting opportunities.
- 8.172 In addition to the three bat roost boxes installed to mitigate the loss of any trees of potential value to roosting bats, additional bat roost boxes, suitable for the species of bats recorded on the Site will be integrated into the brick work of new buildings. The boxes will be installed with the advice of a suitably experienced ecologist. Boxes could include the 2F Schwegler bat box, Beaumaris Woodstone bat box, 1FR Schwegler bat tube and the Ibstock enclosed bat box 'C'.

Reptiles and Amphibians

- 8.173 Hibernacula suitable for reptiles and amphibians will be constructed close to the north, east and/or south-east boundaries of the SANG and in suitable areas of Public Open Space. The features will be located close to hedgerows, scrub and rough grass margins and away from built-up areas and paths. They will be constructed according to detailed designs provided in the EMP. The broad design will be as described below.
- 8.174 Pits will be excavated approximately 0.5m in depth and profiled to prevent water logging, filled with mixed size items such as rubble, sections of timber and/or piping, to create pockets in which reptile and

amphibians can rest and provide a means of air flow. Excavated subsoil and turf will be replaced over the buried features, leaving some gaps for animals to access and exit the internal spaces. Brash could be spread sparsely over the turf to provide cover for emerging and basking animals whilst the turf beneath establishes into a tall dense ground cover on south to south-west facing aspects to provide good basking opportunities.

Hedgehogs

- 8.175 As soon as practicable and when it can be confirmed that on-going construction will not present a risk of damage or disturbance, artificial hedgehog houses will be installed in suitable discrete locations close to the Site boundaries, including in areas of the SANG, and away from paths. Suitable habitat will be in concealed areas of dense scrub and at the base of wide dense hedgerows with adjacent rough grassland, well hidden from nearby paths. Boxes will be installed under the advice of an appropriately experienced ecologist. The design and locations of the boxes will be confirmed in the EMP.

Other invertebrates

- 8.176 Insect nest boxes, including those suitable for a range of bee species, will be installed across the Site, including in built-up areas to enhance their value to invertebrates (and to help encourage residents to install their own boxes). Boxes will be installed under the guidance of an appropriately experienced ecologist. Final box designs and locations will be confirmed in the EMP. Suitable designs could include -
- Schwegler long-lasting woodcrete insect nesting aid: for species of solitary Hymenopterans, such as wild bees, sand wasps and common wasps,
 - Schwegler long-lasting woodcrete clay and reed insect nest: for a diversity of harmless insects,
 - Schwegler long-lasting woodcrete insect house with removable front panel for educational use: for a range of species including solitary bees, wasps, spiders,
 - Solitary beehive: for non-swarming bees,
 - Pollinating bee log: for solitary bees as well as a variety of overwintering insects,
 - Bug box: for a range of species including solitary bees, over-wintering ladybirds and lacewings.

IMPACTS

Construction Phase

Statutory Designated Sites

- 8.177 Airborne pollutants / dust deposition impacts have been assessed in Chapter 12. Results of the assessment confirm that at distances greater than 50m from the construction site, dust deposition will not be sufficient to result in a significant impact on a habitat. The closest statutory designated site is circa 230m from the Proposed Development; therefore, **no significant** effect on statutory designated sites is expected due to airborne pollutants / dust deposition arising from works on the Site.
- 8.178 Taking into account measures to control pollutants, the air quality assessment reported in Chapter 12 confirms that there will be no expected significant impact on statutory designated sites from changes in air pollution arising from construction traffic (such as nitrogen oxides, nutrient nitrogen deposition and nitrogen acid deposition).
- 8.179 Considering the distance from the Proposed Development, there will be no expected impacts from lighting, noise and vibration.
- 8.180 Due to the nature of construction, there will be no expected increase in visitor pressure on statutory designated sites.
- 8.181 Therefore, taking into account construction measures that will be detailed in the CEMP and the distance from the Proposed Development, there will be no expected impact from construction on statutory designated sites of high - very high (national - international) value; therefore, the effect of construction will be of **no** ecological significance and **not significant** in EIA terms. A detailed assessment of the impacts on statutory designated sites is provided in the Habitats Regulations Assessment (**Technical Appendix 8.12**).

Non-Statutory Designated Sites

- 8.182 The closest non-statutory designated site to the Proposed Development is Longmoor Bog and Woodland California Country Park LWS, which is approximately 320m away. Considering the distance over which airborne pollutants can have a significant impact (i.e. 50m), and pollution control measures that will be referred to in the CEMP, it is expected that there will be no impact on non-statutory designated sites from airborne/dust pollutants.
- 8.183 Due to the distance from the Site, and considering measures to control noise and light spill, which will be detailed in the CEMP, there will be no expected impacts on non-statutory designated sites from lighting, noise and vibration.
- 8.184 Due to the nature of construction, there will be no expected increase in visitor pressure on non-statutory designated sites during construction.
- 8.185 Therefore, the impact of construction on non-statutory designated sites (LWSs) of medium (county) value is expected to be **Negligible** in the short-term, which will be of **no** ecological significance and **not significant** in EIA terms.

Ancient Woodland

- 8.186 Both blocks of ancient woodland on the Site will be protected during construction with appropriate buffers; such buffers will be suitably fenced. Appropriate pollution control measures (including with respect to dust generation) will also be implemented with details of both the buffers and pollution control measures to be set out within the CEMP. The woodland will be appropriately fenced off during construction to prevent construction worker access avoiding any visitor pressure.
- 8.187 Therefore, the impact of construction on the ancient woodland of high (national) value is expected to be **Negligible** in the short-term, which will be of **no** ecological significance and **not significant** in EIA terms.

Non-ancient Woodland

- 8.188 The main blocks of non-ancient woodland on the Site occur within the SANG area and will be incorporated into the design of that area. As such, no woodland loss is anticipated. They will be protected during construction as per the CEMP to ensure no pollution/dust etc.
- 8.189 Therefore, the impact of construction on non-ancient woodland of medium (regional) value is expected to be **Negligible** in the short-term, which will be of **no** ecological significance and **not significant** in EIA terms.

Barkham Brook

- 8.190 The Brook is located within the SANG area and is therefore suitably buffered from the areas where construction will take place. It will be protected from pollution etc, as detailed in the CEMP to ensure that both chemical and dust/sediment pollution events are avoided.
- 8.191 There will need to be a minor incursion into the banks of the Brook in order to install the outflow from the SuDS for the Proposed Development. The location of this outfall will be chosen during detailed design but will avoid the ancient woodland surrounding the Brook. The installation will be subject to an appropriate method statement to ensure that sediment etc. is controlled.
- 8.192 Therefore, the impact of construction on Barkham Brook of medium (regional) value is expected to be **Negligible** in the short-term, which will be of **no** ecological significance and **not significant** in EIA terms.

Pond P1

- 8.193 The Pond P1 will be retained and protected during construction. It is located within the public open space between the two blocks of ancient woodland on the Site. As such, appropriate fencing will be used to protect it and will be protected from pollution etc, as detailed in the CEMP to ensure that both chemical and dust/sediment pollution events are avoided.
- 8.194 Therefore, the impact of construction on Pond P1 of medium (regional) value is expected to be **Negligible** in the short-term, which will be of **no** ecological significance and **not significant** in EIA terms.

Hedgerows

- 8.195 The hedgerow network on the Site will be largely retained and incorporated into the public open space. There will be some loss of species-poor hedgerow to facilitate site access off Langley Common Road (circa 150-200m) and a further gap within the hedgerow across the centre of the Site to link the two

development parcels, albeit this second gap would be less. All other hedgerows will be protected with appropriate buffers, as set out in the CEMP.

- 8.196 Therefore, the impact of construction on hedgerows (of medium (regional) value) is expected to be Low Adverse, which will be of **Negligible** effect in the medium term and **not significant** in EIA terms.

Breeding Birds

- 8.197 Considering the retention of areas of boundary scrub and hedgerows, as well as hedgerows in the south-east of the Site, the creation of SANG and Public Open Space alongside the Site boundaries, the use of directional lighting, installation of nest boxes, and pre-construction surveys to protect bird nests, and taking into account the location of the construction site, which currently provides low value foraging and minimal nesting opportunities for birds, the impact of construction on breeding birds (medium (regional) value) largely as a result of habitat loss, is expected to be Medium Adverse, which will be a **Slight Adverse** effect in the medium-term and **not significant** in EIA terms.

Bats

- 8.198 Taking into account the retention of boundary trees of potential value to roosting bats, the use of directional lighting to minimise potential disturbance, installation of bat roost boxes and pre-construction surveys, the impacts of construction, primarily as a result of the loss of scrub and hedgerows and low value grassland, on bats (of medium (regional) value) is expected to be Medium Adverse, which will be of **Slight Adverse** effect in the medium term and **not significant** in EIA terms.

Operational Phase

Statutory Designated Sites

- 8.199 The potential impact of airborne pollutants from the Site and access roads has been assessed with regard to the following designated sites, which are located within 200m of an affected road (Chapter 12) - the Thames Basin Heaths SPA and SSSI. The assessment considered potential impacts from nitrogen oxides (NO_x) and in particular critical loads of nutrient nitrogen deposition and nitrogen/acid deposition. The conclusion of this assessment set out in Chapter 12 was that the change in air quality at the SSSI as a result of the Project would be very small and less than 1% of the relevant critical load/level and, as such, not significant.
- 8.200 Taking into account the distance from the Site of the closest statutory designated sites (more than 200m from the Site), there would **no** expected impacts due to noise or lighting.
- 8.201 The mitigation strategy has been developed in accordance with the Thames Basin Heaths SPA delivery framework for Wokingham Borough. The requirements include the provision of SANG and Public Open Space to deter potential visitors from European/Statutory designated sites, as well as a financial contribution to the management and monitoring of visitor impacts on the sites (Strategic Access Management and Monitoring, SAMM). By designing the SANG and Public Open Space to incorporate measures to enhance the Site's value to biodiversity, it is expected that there would be no significant impact on the statutory designated sites.
- 8.202 Therefore, the impact of operation on statutory designated sites (of high – very high (national – international) value) is expected to be to be Negligible, which will be **Minor Adverse** in the long-term, and **not significant** EIA terms. A detailed assessment of the impacts on statutory designated sites is provided in the Habitats Regulations Assessment (**Technical Appendix 8.12**).

Non-statutory Designated Sites

- 8.203 Considering the distance between the Site and the closest non-statutory designated site (i.e. approximately 300m), there would be no expected impact from nitrogen oxides (NO_x) and in particular critical loads of nutrient nitrogen deposition and nitrogen/acid deposition, which are considered to have potential significance over a distance of up to 200m (Chapter 12).
- 8.204 Considering the distance over which dust pollutants can have a significant impact (i.e. 50m), no significant impact from dust pollutants on non-statutory designated sites will be expected.
- 8.205 The provision of SANG and Public Open Space is expected to deter visitors from nearby statutory designated sites. Considering that non-statutory designated sites are located a greater distance from the Site than statutory designated sites, the SANG and Public Open Space are expected to deter visitors from non-statutory designated sites also.
- 8.206 Therefore, the impact of operation on non-statutory designated sites (LWSs) of medium (regional) value is expected to be Negligible, which will have a **Minor Adverse** effect in the long-term and will be **not significant** in EIA terms.

Ancient Woodland

- 8.207 The two blocks of ancient woodland will be incorporated into the SANG and Public Open Space within the Proposed Development and, as such, there will be an increase in public access within them. However, given the very degraded nature of both blocks in the baseline, due to a combination of over grazing and associated eutrophication, the implementation of an appropriate management plan, as set out in the EMP, will ensure that the woodlands are in better overall condition. In addition, the planting of new woodland blocks to increase connectivity between the existing two areas of ancient woodland will increase the overall resilience of the woodland resource on the Site.
- 8.208 As such, the impact of operation on ancient woodland of high (national) value is expected to be Low Positive, which will have a **Slight Positive** effect in the long-term and will be **not significant** in EIA terms.

Woodland and Hedgerows

- 8.209 The planting of species-diverse, native woodland, trees, scrub and hedgerows and management of this habitat in accordance with the EMP to benefit biodiversity, will mitigate the loss of hedgerows during construction. Therefore, the impact of operation on non-ancient woodland and hedgerows (of medium (regional) value) is expected to be Low Positive, which will be a **Slight Positive** effect in the long-term and **not significant** in EIA terms.

Barkham Brook, Watercourses and Waterbodies (SUDS)

- 8.210 The Barkham Brook will form part of the SANG and will therefore be subject to a degree of recreational pressure. However, it is anticipated that the management plan for the SANG will incorporate features such as controlled dog access and improved planting to ensure that, overall, there is no effect from parching etc as a result of the Proposed Development. Removing parching in this manner would be an overall benefit for the Brook, given the intense parching that occurs due to sheep grazing in the baseline.
- 8.211 Taking into account the proposed SUDS control measures for waterborne pollutants, as well as measures to enhance the biodiversity value of retained watercourses and waterbodies (SUDS), and the long-term management of these to benefit biodiversity in accordance with the EMP (either as the primary (watercourses) or secondary objective (SUDS)), the operational phase is expected to result in a long-term Low Positive impact on watercourses and waterbodies (of medium (regional) value), which will have a **Slight Positive** effect in the long-term and is **not significant** in EIA terms.

Breeding Birds

- 8.212 Considering in particular the planting of woodland, trees, scrub and hedgerow, the creation of species-rich/diverse grassland to replace ecologically-poor grassland, the provision of nest boxes, and the use of directional lighting, the impact of operation on breeding birds (medium (regional) value) is expected to be Low Beneficial, the effect of which will be of **Slight Positive** significance in the long-term and **not significant** in EIA terms.

Bats

- 8.213 Considering in particular - the enhancement of the existing low value grassland on the Site, which will benefit invertebrates and in turn foraging bats; the planting of new or enhancement of existing woodland, scrub and hedgerows, which will provide enhanced habitat corridors / ecological networks across the Site of value to foraging and commuting bats; the use of directional lighting; and installation of bat roost boxes, the impact of operation on bats (medium (regional) value) is expected to be Low Positive, which will be **Slight Positive** in the long-term, which is **not significant** in EIA terms.

Reptiles (and Amphibians), Hedgehogs

- 8.214 The long-term management of woodland, scrub, hedgerows and species-rich/diverse and rough grassland areas, and provision of artificial hibernacula, refuges and nest boxes will benefit reptiles, amphibians and hedgehogs (of low (local) value) that may use the Site. The Proposed Development will also enable species to benefit from a larger area of grassland, as the current heavy grazing and poor ground cover is likely to deter animals from much of the open grassland areas. Therefore, the impact of operation on these species is expected to be Low Positive, which will have a **Negligible – Slight Positive** effect in the long-term and be **not significant** in EIA terms.

ADDITIONAL MITIGATION, COMPENSATION AND ENHANCEMENT MEASURES

- 8.215 No additional mitigation measures are considered necessary.

RESIDUAL EFFECTS

- 8.216 Overall, when the mitigation proposed is included, the Proposed Development would have an overall **Slight Positive** long-term impact on biodiversity.

CUMULATIVE IMPACTS

- 8.217 The schemes considered as part of this assessment are -
- South of Cutbush Lane, Shinfield – part of the Lodden Garden Village proposed allocation to include open space and SANG provision,
 - East of Shinfield (phase 2), south of Church Lane, Shinfield (172450) – application for 473 dwellings as part of the wider Shinfield West development. The project is located circa 4km west of the Site and included the provision necessary SANG,
 - Hall Farm/Lodden Garden Village (243188; 252498) – Proposal for 2,800+ homes on farmland circa 1.85km north of the Site. It includes significant open space and SANG provision,
 - South Wokingham SDL (including extension) (south of Waterloo Road) – proposed allocation for 2,975 dwellings circa 3.2km north east of the Site. Proposal includes full SANG necessary.
- 8.218 All four of the proposals considered in the nearby vicinity will include appropriately designed SANG and areas of Public Open Space, or will contribute to appropriate off-site mitigation, to prevent significant visitor impacts on designated sites.
- 8.219 Due to the distance from the Proposed Development **no significant** cumulative impact from pollution, noise or light spill on habitats or species on the Site would be expected at the construction phase.
- 8.220 Due to the distance from the Proposed Development **no significant** cumulative impact from pollution, noise or light spill on habitats or species on the Site would be expected at the operational stage/completed Proposed Development. It is also assumed that necessary mitigation as referenced above (SANG provision) is incorporated into operational design to prevent significant cumulative visitor impacts on designated sites.

SUMMARY

- 8.221 The Site was subject to a range of ecology surveys through 2023 and 2024 according to good practice guidelines. The results of these surveys are set out in **Technical Appendices 8.1 – 8.11**. The surveys identifies that the Site comprises a three species-poor grassland fields used for sheep grazing. Two areas of ancient woodland are present on Site - one block on the southern border adjacent to the Arborfield Studios and the second running along the Barkham Brook that runs through the centre of the Site, flowing from south to north. The surveys also found the Site to support a range of bird and bat species along with small numbers of slow worm and grass snake. Surveys of the pond on Site identified great crested newt eggs but no other survey (including eDNA) found this species.
- 8.222 No nature conservation designations occur on the Site. Within 2km of the Site, there are two statutory designated sites (Longmoor Bog SSSI and Longmore Bog LNR, both 230m south), and twelve non-statutory sites. In addition, the Thames Basin Heaths Special Protection Area (TBHSPA) occurs 3.45km south-east of the Site.
- 8.223 Mitigation considered as part of the Proposed Development design (embedded mitigation) included the provision of a CEMP to control potential effects during construction (such as pollution, dust generation etc.) and an EMP to detail all ecology measures required to be undertaken prior to, during construction and after construction. In addition, the Proposed Development includes the provision of SANG which will ensure that new residents do not increase recreational pressure on the Thames Basin Heath SPA and other designated sites in the area. Details of how the SANG will be established and managed are set out in the SANG Management Plan submitted with the Application.
- 8.224 The Proposed Development will provide substantial new areas of woodland and meadow grassland along with an improved management regime for both areas of ancient woodland on the Site. This will ensure that at least 10% biodiversity net gain is delivered, in line with national and local policy.
- 8.225 The assessment of effects considered those associated with both construction and operation of the Proposed Development. This included from habitat loss, changes in air quality, pollution etc. With the application of the mitigation designed into the Proposed Development, **no significant** adverse residual effects on any important ecology features were identified.
- 8.226 Table 8.8 provides a summary of the assessment and residual ecological effects.

Table 8.8: Summary Table of Ecological Residual Effects

Description of Likely Significant Effects	Significance	Description of Additional Mitigation	Description of Residual Effects	Significance
Demolition/Construction Phase				
Statutory designated sites - Pollution	None	N/A	N/A	N/A
Statutory designated sites - Visitor impact	None	N/A	N/A	N/A
Non-statutory designated sites - Pollution	None	N/A	N/A	N/A
Non-statutory designated sites - Visitor impact	None	N/A	N/A	N/A
Ancient woodland – Pollution, dust	Negligible	N/A	N/A	Negligible
Ancient woodland – Visitor impact	Negligible	N/A	N/A	Negligible
Non-ancient woodland – Pollution, dust	Negligible	N/A	N/A	Negligible
Non-ancient woodland – Visitor impact	Negligible	N/A	N/A	Negligible
Barkham Brook - Pollution	Negligible	N/A	N/A	Negligible
Pond P1 – Pollution	Negligible	N/A	N/A	Negligible
Hedgerows – Habitat loss	Negligible	N/A	N/A	Negligible
Breeding birds – Habitat loss	Slight	N/A	N/A	Slight Adverse
Bats – Habitat loss	Negligible	N/A	N/A	Negligible
Bats – Disturbance from light	Negligible	N/A	N/A	Negligible
Operational Phase				
Statutory designated sites – Air Quality	Negligible	N/A	N/A	Negligible
Statutory designated sites - Visitor impact	Minor	N/A	N/A	Minor adverse
Non-statutory designated sites – Air Quality	Negligible	N/A	N/A	Negligible
Non-statutory designated sites - Visitor impact	Negligible	N/A	N/A	Minor Adverse
Ancient woodland – Visitor impact	Negligible	N/A	N/A	Negligible
Ancient woodland – Connectivity	Slight	N/A	N/A	Slight Positive
Non-ancient woodland and hedgerows – habitat creation	Negligible	N/A	N/A	Slight Positive
Barkham Brook - pollution	Negligible	N/A	N/A	Negligible
Barkham Brook – habitat management	Negligible	N/A	N/A	Slight Positive
Breeding birds – habitat creation	Slight	N/A	N/A	Slight Positive
Bats – habitat creation	Slight	N/A	N/A	Slight Positive
Cumulative - Construction				
As Alone Assessment	Negligible	N/A	N/A	Negligible
Cumulative - Operation				
As Alone Assessment	Negligible	N/A	N/A	Negligible

9 HISTORIC ENVIRONMENT – ARCHAEOLOGY

INTRODUCTION

- 9.1 This chapter of the ES has been prepared by RPS and presents an assessment of the likely significant effects of the Proposed Development with respect to archaeology. Mitigation measures are identified, where appropriate, to avoid, reduce or offset any significant adverse effects identified and/or enhance likely beneficial effects.
- 9.2 This ES Chapter addresses archaeological matters only and is supported by the following Technical Appendices –
- **Technical Appendix 9.1:** Archaeological Desk Based Assessment: Land at Barkham Road, Barkham, Berkshire (RPS December 2024).
 - **Technical Appendix 9.2:** Geophysical Survey: Land at Barkham Road, Barkham, Berkshire (RPS/Magnitude Surveys October 2024).

CONTEXT

Legislation

- 9.3 National legislation regarding archaeology, including scheduled monuments, is contained in the Ancient Monuments and Archaeological Areas Act 1979, amended by the National Heritage Act 1983 and 2002, and updated in April 2014.

Planning Policy

National Planning Policy Guidance (December 2024)

- 9.4 Section 16 of the NPPF, entitled 'Conserving and Enhancing the Historic Environment' provides guidance for planning authorities, property owners, developers and others on the conservation and investigation of heritage assets. Overall, the objectives of Section 16 of the NPPF can be summarised as seeking the –
- Delivery of sustainable development,
 - Understanding the wider social, cultural, economic and environmental benefits brought by the conservation of the historic environment,
 - Conservation of England's heritage assets in a manner appropriate to their significance, and
 - Recognition that heritage makes a contribution towards our knowledge and understanding of the past.
- 9.5 Section 16 of the NPPF recognises that intelligently managed change may sometimes be necessary if heritage assets are to be maintained for the long term. Paragraph 207 states that planning decisions should be based on the significance of the heritage asset and that level of detail supplied by an applicant should be proportionate to the importance of the asset and should be no more than sufficient to review the potential impact of the proposal upon the significance of that asset.
- 9.6 Heritage Assets are defined in Annex 2 of the NPPF as: a building, monument, site, place, area or landscape identified as having a degree of significance meriting consideration in planning decisions, because of its heritage interest. It includes designated heritage assets and assets identified by the local planning authority (including local listing).
- 9.7 Annex 2 also defines Archaeological Interest as a heritage asset which holds, or potentially holds, evidence of past human activity worthy of expert investigation at some point.
- 9.8 A Nationally Important Designated Heritage Asset comprises a: World Heritage Site, Scheduled Monument, Listed Building, Protected Wreck Site, Registered Park and Garden, Registered Battlefield or Conservation Area designated under the relevant legislation.
- 9.9 Significance is defined as: The value of a heritage asset to this and future generations because of its heritage interest. This interest may be archaeological, architectural, artistic or historic. Significance derives not only from a heritage asset's physical presence, but also from its setting.
- 9.10 Setting of a heritage asset is defined as: The surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve. Elements of a setting may make a positive or negative contribution to the significance of an asset, may affect the ability to appreciate that significance or may be neutral. In short, government policy provides a framework which –

- Protects nationally important designated Heritage Assets,
- Protects the settings of such designations,
- In appropriate circumstances seeks adequate information (from desk-based assessment and field evaluation where necessary) to enable informed decisions,
- Provides for the excavation and investigation of sites not significant enough to merit in-situ preservation.

9.11 The NPPG reiterates that the conservation of heritage assets in a manner appropriate to their significance is a core planning principle, requiring a flexible and thoughtful approach. Furthermore, it highlights that neglect and decay of heritage assets is best addressed through ensuring they remain in active use that is consistent with their conservation. Importantly, the guidance states that if complete, or partial loss of a heritage asset is justified, the aim should then be to capture and record the evidence of the asset's significance and make the interpretation publicly available. Key elements of the guidance relate to assessing harm. An important consideration should be whether the proposed works adversely affect a key element of the heritage asset's special architectural or historic interest. Additionally, it is the degree of harm, rather than the scale of development, that is to be assessed. The level of 'substantial harm' is considered to be a high bar that may not arise in many cases. Essentially, whether a proposal causes substantial harm will be a judgment for the decision taker, having regard to the circumstances of the case and the NPPF. Importantly, harm may arise from works to the asset or from development within its setting. Setting is defined as the surroundings in which an asset is experienced and may be more extensive than the curtilage. A thorough assessment of the impact of proposals upon setting needs to take into account, and be proportionate to, the significance of the heritage asset and the degree to which proposed changes enhance or detract from that significance and the ability to appreciate it.

9.12 The **Wokingham Borough Core Strategy** was adopted by the Council on 29th January 2010. It contains the following policy relating to archaeology and heritage -

CP3 - General Principles for development

Planning permission will be granted for proposals that:

...c) Have no detrimental impact upon important ecological, heritage, landscape (including river valleys) or geological features or water courses.

9.13 The **Managing Development Delivery Local Plan**, adopted in February 2014, contains the following policy relating to archaeology and heritage -

Policy TB25: Archaeology

1. Areas of high archaeological potential are shown on the Policies Map.

2. In areas of high archaeological potential, applicants will need to provide a detailed assessment of the impact on archaeological remains.

3. Where development is likely to affect an area of high archaeological potential or an area which is likely to contain archaeological remains, the presumption is that appropriate measures shall be taken to protect remains by preservation in situ. Where this is not practical, applicants shall provide for excavation, recording and archiving of the remains.

9.14 The **Arborfield and Barkham Neighbourhood Plan 2019-2036** (Adopted April 2020) contains the following policy relating to the historic character of the area -

Policy IRS4: Protection and Enhancement of the Historic Character of the Area

1. Development proposals will need to demonstrate how they protect or enhance the historic and natural character of the area, specifically:

a) Arborfield Cross Conservation Area

b) Chamberlain's Farm Area of Special Character

c) The Barkham Street Area of Special Character

d) The local historic environment, including the setting of Listed buildings, Scheduled Monuments and other historically significant buildings

2. Locally valued heritage assets have been identified in the plan as follows and development proposals should protect and enhance them where possible:

a) The historic chestnut avenue in Arborfield, linking The Old Rectory to the remains of the old church.

b) The lime grove at Nashgrove Ride in Barkham.

c) Carters Hill

d) The granary in Barkham Street

METHODOLOGY

- 9.15 The study area for archaeology receptors comprises the Site and a 1km buffer around the Site boundary. This 'study area' has been defined on the basis of professional judgement and best practice in the context of the heritage sensitivity of the surrounding area, and the scale and nature of the Proposed Development. The study area and Berkshire Historic Environment Record Data for the study area includes all designated and non-designated archaeological heritage assets that are relevant to this assessment.
- 9.16 No standard EIA methodologies exist for archaeological assessment; however, the assessment methodology of this ES Chapter has been guided by various published documents including - Historic England's Conservation Principles, Policy and other guidance , including the Historic Environment Good Practice Advice Planning Advice Note 3 and the Design Manual for Roads and Bridges 2020. Although the latter was designed as best-practice for road development schemes, it is accepted as best-practice for EIA cultural heritage assessment, in relation to archaeology, listed buildings and historic landscapes.
- 9.17 The assessment of archaeological importance and effects is a qualitative one, and the evaluation of significance is ultimately a matter of professional judgement. The three-stage approach presented below is adopted to reach an understanding of the significance of any effect that the Proposed Development may have on an archaeological receptor. It is necessary to understand the importance/significance of the archaeological asset and the proposed impact and impact magnitude on the asset to assess the overall scale of effect on identified assets and effect significance.
- 9.18 Using a matrix that measures both asset importance (significance in the context of the NPPF terminology) and impact magnitude produces an assessment of the scale of the effect of the Proposed Development on identified archaeological receptors. This approach, including the matrices themselves, is set out below in Tables 9.1-9.4.
- 9.19 This ES chapter has been prepared in accordance with the standards and guidance issued by the Chartered Institute for Archaeologists (CIfA), the requirements of the EIA Regulations, guidance in the NPPF and the NPPG, Historic England guidance (Good Practice Advice Documents 2015 & 2017), and current best practice.
- 9.20 Heritage assets are recorded in national and/or local historic environment record databases, in this instance the National Heritage List held by Historic England (HE), and the Berkshire Historic Environment Record (HER). These data sources have been used in the preparation of this ES chapter, its supporting **Technical Appendix 9.1** and to inform the approach towards archaeology at the Site.
- 9.21 Listed below are the main data sources consulted during the compilation of the Site baseline for archaeology -
- Berkshire HER,
 - Historic England National Heritage List, and
 - The results of previous archaeological investigations within the Site and vicinity.
- 9.22 The HER is not considered to be an exhaustive list of non-designated heritage resources and the data received are therefore subject to amendment based on the findings of, for example, additional desk-based research and/or archaeological walkover.
- 9.23 There would be no change expected to the below ground conditions within the Site without the Proposed Development commencing, and therefore any archaeological remains would remain unchanged from the existing baseline conditions.

- 9.24 In relation to the wider understanding of archaeology in the area, should new information come to light in the course of archaeological investigations associated with the relevant cumulative schemes, this may enhance the understanding of the baseline conditions at the Site.

Significance Criteria

Enabling and Construction

- 9.25 This assessment considers the nature, scale and significance of the effects to archaeological receptors that will arise during enabling and construction of the Proposed Development, with the effects defined on the basis of any changes compared to the baseline (i.e. changes to the conditions which would otherwise exist if the Proposed Development did not go ahead). There are known instances of archaeological evidence recorded within the Site and other, presently unknown evidence may be present. The scale of the Proposed Development indicates that any buried archaeological remains which may be present within the Site, specifically within construction footprints, would be unlikely to survive the construction process.
- 9.26 Accordingly, this assessment has considered the following potential effects -
- Direct effects on buried archaeological remains, and
 - Direct effects on the settings of heritage assets of archaeological interest outside the site boundary.
- 9.27 The identification of physical impacts on archaeological evidence within a site takes into account any activity which would entail ground disturbance, for example enabling works, remediation, landscaping and the construction of foundations, laying of services etc. These are described in detail in ES Chapter 5. Any significant adverse effects will be offset by a programme of pre-construction archaeological investigation, recording, publication and dissemination secured through a planning condition.

Assumptions and Limitations

- 9.28 This assessment of the scale of effects, and so effect significance, is based on extensive professional experience gained on other major developments across southern England.
- 9.29 This assessment assumes the accuracy of the available datasets reviewed in its supporting **Technical Appendix 9.1**. The information presented in this ES chapter and its appendix provide an indication of below ground archaeological assets present or likely to be present, rather than a definitive list of all assets which are, or may be, present.
- 9.30 The principal limitation to the assessment of effects upon below ground archaeological evidence is the nature of the archaeological resource, which is buried and therefore not visible. This means it can be difficult to accurately predict the presence and likely importance of below ground archaeological evidence, and the likely impact (and resultant effects) of the Proposed Development.

Summary of Consultation

- 9.31 RPS has overseen the undertaking of a geophysical survey across the Site. Following the undertaking of the geophysical survey, RPS will consult Berkshire County Council Archaeological Service on the provision of a written scheme of investigation for the archaeological evaluation of the Site. Berkshire County Council Archaeological Services will sign off the scope and timing of the archaeological investigation of the Site prior to the construction phase and, depending on the nature of the investigation results, will be further consulted to agree the need and scope for further mitigation. **[consultation not yet taken place]**.

Methodology for Defining Effects

Receptors and Receptor Sensitivity

- 9.32 Archaeological receptors are either known designated or non-designated heritage assets (which applies to both archaeological and built heritage receptors), or a perceived potential for archaeological evidence to be present.
- 9.33 Determination of the importance of an archaeological heritage asset is based on existing statutory designations and, for undesignated assets, the DCMS non-statutory criteria for Scheduling Monuments, Historic England's Conservation Principles, the heritage interests defined by the NPPG and professional judgement. The NPPF and the NPPG introduce criteria for the assessment of the significance (importance) of heritage assets, and these have been factored into this assessment. The criteria outlined by the DCMS include period, rarity, documentation, group value, survival/condition, fragility/vulnerability, diversity and potential, and can be used as a basis for the assessment of the importance of historic

remains and archaeological sites. However, the document also states that these criteria "should not be regarded as definitive; but as indicators which contribute to a wider judgment based on the individual circumstances of a case".

- 9.34 The importance or sensitivity of a heritage asset is defined as Very High, High, Medium, Low, or Negligible in DMRB methodology. In addition, the below ground nature of archaeological remains necessitates the addition of an Unknown / Uncertain level of importance or sensitivity. The criteria to establish the importance or sensitivity of heritage assets are described in Table 9.1.

Table 9.1: Criteria to Determine the Importance/Sensitivity of Heritage Assets

Sensitivity of Receptor	Receptor type
Very High	World Heritage sites or equivalent sites with international importance.
High	Sites or monuments of national importance, including Scheduled Monuments and archaeological sites and remains of comparable quality, assessed with reference to the Secretary of State's non statutory criteria.
Medium	Medium or high importance and rarity, regional scale, limited potential for substitution. Includes non-designated archaeological remains and archaeological sites and remains which, while not of national importance, score well against most of the Secretary of State's criteria.
Low	Locally important archaeological assets compromised by poor preservation and/or poor survival of contextual associations.
Negligible	Areas in which investigative techniques have produced no or only minimal evidence for archaeological remains, or where previous large-scale disturbance or removal of deposits can be demonstrated.

Direct and Indirect Effects

- 9.35 Effects on archaeological receptors can be direct or indirect -
- Direct impacts: are defined as an impact caused by an action, which generally occurs at the same time and place as that action. Direct impacts are generally associated with the construction, operation or maintenance of a facility or activity, and are usually obvious or quantifiable, and
 - Indirect impacts: are defined as changes resulting from direct impacts. These changes can be short or long-term depending on persistence or duration.
- 9.36 As set out above, this assessment has considered the following potential effects -
- Direct effects on buried archaeological remains, and
 - Potential effects on the settings of archaeological heritage assets outside the site boundary. Built Heritage matters have been scoped out of the EIA.

Magnitude of Impact

- 9.37 The magnitude of impact is assessed without regard to the importance of the asset. In terms of the judgment of the magnitude of impact, this is based on the principle (established in the NPPF) that preservation of the asset and/or maintenance of its setting is preferred, and that total physical loss of the asset is the least preferred. Determining the magnitude of impact is based on an understanding of how, and to what extent, the Proposed Development would impact on the buried archaeological assets, and/or on the setting of the heritage assets. The magnitude of impact is rated as Major, Moderate, Minor, Negligible or No Change in DMRB methodology. Major, Moderate, Minor or Negligible impacts can be either adverse or beneficial.
- 9.38 Impacts may be comprised of physical impacts, on monuments, boundaries, buildings or buried remains, including destruction, compression, vibration, or drying out (where waterlogged). Setting impacts may arise from a reduction of the appreciation of the resource by visual intrusion, noise and dust for example, or by severance (i.e. removal of the monument or site from its context).
- 9.39 The survival of archaeological remains is often uncertain without archaeological evaluation, and in these circumstances the magnitude of impact can only be estimated or stated as unknown. The magnitude of change resulting from the impact may vary depending on the nature of past development or management effects (e.g. extent of truncation and made ground, and the various forms of impact).

Table 9.2: Criteria for Assessing Magnitude of Impact

Magnitude of Impact	Impact Description
Major	Adverse: Complete removal of an archaeological site or a comprehensive transformation of the setting of an archaeological site such that the ability to appreciate its importance is removed completely. Beneficial: Arrest of physical damage or decay to archaeological remains or archaeological site, its cultural heritage amenity and access or use.
Moderate	Adverse: Removal of an important part of an archaeological site and loss of research potential. The partial transformation of the setting of an archaeological site e.g. the introduction of significant noise or vibration levels to an archaeological monument leading to changes to amenity use, accessibility or appreciation of an archaeological site or heritage asset such that the ability to appreciate its importance is reduced. Beneficial: Land use change resulting in improved conditions for the protection of archaeological remains plus interpretation measures (heritage trails, etc). A significant reduction or removal of visual or noise intrusion on the setting of an archaeological site or monument.
Minor	Adverse: Removal of an archaeological site where a small part of its total area is removed but the site retains a significant future research potential. A small change to the setting of an archaeological site or heritage asset, such that the ability to appreciate its importance is reduced. Beneficial: Land use change resulting in improved conditions for the protection of archaeological remains. A decrease in visual or noise intrusion on the setting of a building, archaeological site or monument. The Improvement of the wider landscape setting of an archaeological site or monument.
Negligible	Adverse: Very minor impact from changes in use, amenity or access. Very minor change in the ability to understand and appreciate the resource and its historical context and setting. Beneficial: Very minor improvements from changes in use, amenity or access. Very minor improvements in the ability to understand and appreciate the resource and its historical context and setting.

Geographic Extent of Effects

- 9.40 The geographic extent of the effects is also identified. At a spatial level, 'site' or 'local' effects are those affecting the Site and nearby assets – effects to archaeological assets are typically limited to the area of the physical impact, i.e. the Site. Effects to extant heritage assets are typically limited to those physical or environmental changes within its setting. The setting of a heritage asset can be limited or can be vast. Depending on the importance of an archaeological asset identified on Site, or a heritage asset proximate to the Site, the effects upon archaeological resources or heritage assets could result in a wider geographic extent, i.e. at a 'district / borough' level (Wokingham District); at a 'regional / county' level (Berkshire); whilst those which affect different parts of the country, or England, are considered being at a 'national' level.

Effect Duration

- 9.41 Effects to buried archaeological receptors will typically be permanent and long term. For extant heritage assets beyond the Site boundary, the nature of effects will change depending on the stage of the Proposed Development. Construction effects are typically short-term and temporary. Changes arising from the completed development, including changes to land use and visual changes, are typically permanent and long term.

Defining Effects

- 9.42 The scale of the effect of the Proposed Development on archaeological assets is determined by -
- The importance of the asset as per Table 9.1, and
 - The magnitude of impact to the asset as per Table 9.2.
- 9.43 Effects can be adverse or beneficial. Adverse effects are those that create new or amplify existing impacts upon the importance/sensitivity of heritage assets and/or their setting; and remove or limit the ability to understand and appreciate the importance of the heritage asset. Beneficial effects are those that mitigate existing impacts and help to restore or enhance the importance / sensitivity of heritage assets or their setting, therefore allowing for greater understanding and appreciation of them.

- 9.44 Table 9.3 presents a matrix that demonstrates how the scale of effect has been assessed in line with DMRB methodology. Given the absence of any World Heritage sites or sites of equivalent international significance, the Very High sensitivity/value of a receptor is not included in the matrix.

Table 9.3: Criteria for Assessing the Scale of Effect

Sensitivity/value of a Receptor	Magnitude of Impact			
	Major	Moderate	Minor	Negligible
High	Large	Moderate to Large	Slight to Moderate	Negligible
Medium	Moderate to Large	Moderate	Slight	Negligible
Low	Slight to Moderate	Slight	Negligible to Slight	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

Categorising Likely Significant Effects

- 9.45 Generally, any effects that are identified as Large Adverse / Beneficial are considered to be ‘significant’ effects, whilst those that are identified as Neutral, Slight or Moderate Adverse/ Beneficial are considered to be ‘not significant’ effects. In those instances where two possible levels of effect are given, professional judgement /or relevant guidance/legislation where applicable has been used to determine whether an effect is significant or not. These Scale of Effect categories are summarised in Table 9.4.

Table 9.4: Scale of Effect Categories

Scale of Effect	Level of Effect
Large	Where the Proposed Development is likely to cause a considerable change from the baseline conditions and the receptor has limited adaptability, tolerance or recoverability or is of the highest sensitivity.
Moderate	Where the Proposed Development is likely to cause either a considerable change from the baseline conditions at a receptor which has a degree of adaptability, tolerance or recoverability or a less than considerable change at a receptor that has limited adaptability, tolerance or recoverability.
Slight	Where the Proposed Development is likely to cause a small, but noticeable change from the baseline conditions on a receptor which has limited adaptability, tolerance or recoverability or is of the highest sensitivity; or where the Proposed Scheme is likely to cause a considerable change from the baseline conditions at a receptor which can adapt, is tolerant of the change or/and can recover from the change.
Negligible	Where the Proposed Development is unlikely to cause a noticeable change at a receptor, despite its level of sensitivity or there is a considerable change at a receptor which is not considered sensitive to a change.

BASELINE CONDITIONS

- 9.46 The RPS Archaeological Desk-Based Assessment is included at **Technical Appendix 9.1** and the Geophysical Survey is included at **Technical Appendix 9.2**.
- 9.47 The Site comprises an area of enclosed agricultural land bound by tree and hedge lines. The Site is divided into distinct fields by tree and hedge lines. The Site has been in agricultural/cultivation use throughout its recorded history. Much of the Site was cultivated as a coppice/plantation woodland, with the remainder being varyingly cultivated for arable and pasture.
- 9.48 Geologically the Site is mapped to be underlain by London Clay Formation (Clay, Silt and Sand) with Bagshot Formation (Sand) present within the south-eastern part of the Site parcel.
- 9.49 In terms of relevant nationally significant designated heritage assets, no World Heritage Sites, Historic Wreck or Historic Battlefield study sites have been identified within the Site, or within the vicinity of the Site.
- 9.50 The nearest Scheduled Monuments include a Moated site north of the Moat House (SM Ref. 1009886) over 500m southwest of the Site and a Moated site and associated enclosure at Church Farm (SM Ref. 1013181) c. 650m to the east of the Site.

- 9.51 There are no locally designated archaeological sites on or particularly near the Site as designated by Wokingham Borough Council.
- 9.52 There are 5 records held on the Berkshire Historic Environment Record that are located within the Site (see Figure 2b of **Technical Appendix 9.1**). These comprise -
- EWK205 - A watching brief undertaken for Arborfield/Barking Relief Sewer Scheme recorded a possible section of a prehistoric burnt mound within the Site (MWK7238),
 - EWK28, EWK31 and EWK32 - Between 1990 and 1993 the Berkshire Field Research Group undertook systematic fieldwalking within the Site,
 - ERM278 - During the 1980s a survey of East Berkshire's archaeology was undertaken with the aim to obtain a fuller picture of past human activity in the area. Fieldwalking and Aerial Photographic interpretation was undertaken. No finds were retrieved during the fieldwalking (the entry shown on Figure 9.1, MWK8592, is erroneous and refers to an Iron Age coin found in a back garden).
- 9.53 A geophysical survey has been undertaken on the Site during September 2024 (RPS/Magnitude Surveys October 2024: see **Technical Appendix 9.2**). The survey included areas of land which are no longer included within the Site. A focus of possible archaeological activity was identified within the Site and possibly denotes partial enclosures. Elsewhere on the Site, historical agricultural activity has been identified in the form of former mapped and unmapped field boundaries. Modern agricultural activity was also recorded as drainage systems and ploughing regimes. Multiple anomalies have been identified throughout the survey area that are difficult to ascertain from the magnetic background or lack a diagnostic morphology. These have been ascribed an "undetermined" origin. Modern interference in the data is present as areas of green waste which may have complicated the identification of anomalies, as well as magnetic disturbance from fencing and from buried services.
- 9.54 As mentioned above, later prehistoric activity in the form of a burnt mound with residual flint has been identified within the Site (Figure 2a, **Technical Appendix 9.1**, MWK7238). This evidence was found during archaeological monitoring for the Arborfield to Barkham Relief Sewer Scheme in 1992 (Figure 2b, **Technical Appendix 9.1**, EWK205). Although that site was excavated, the excavation was restricted to within the construction easement. Troughs and water pits usually associated with burnt mounds were not identified. Generally dating to the Bronze Age, burnt mounds are generally not found in association with settlement, they tend to be isolated features located adjacent to natural water channels.
- 9.55 Based on the results of baseline survey, the Site is considered to have a high potential for further evidence of late prehistoric burnt mounds, a moderate potential for the remains of late prehistoric occupation and a moderate potential for Iron Age and Roman field ditches. A potential is also identified for Medieval and Post-Medieval field boundaries and drainage ditches and a low archaeological potential is identified for all other periods.

Receptors and Receptor Sensitivity

- 9.56 Table 9.5 below details the known archaeological assets, and potential archaeological assets identified from baseline surveys.

Table 9.5: Archaeological Heritage Resources and Importance

Archaeological Resource	Importance
Potential for Palaeolithic and Mesolithic stray finds	Low/Negligible significance
Potential for Neolithic stray finds	Low/Negligible significance
Known remains of late prehistoric burnt mounds	Low to Medium significance
Possible Late prehistoric enclosures evidencing occupation/activity	Medium significance
Possible Iron Age enclosures	Low to Medium significance
Possible Iron Age and Roman field ditches	Low significance

Archaeological Resource	Importance
Medieval, Post-Medieval and modern field and drainage ditches	Low/Negligible significance

Future Baseline

- 9.57 There will be no change to the archaeological baseline of the Site and the surrounding area in the absence of the Proposed Development. The archaeological baseline would remain as currently understood and as presented within this ES chapter.
- 9.58 It is also recognised that new archaeological investigations in the surrounding area may produce information which enhances the understanding of the likely archaeological conditions at the Site.
- 9.59 In the longer term, the significance of any remains may be affected by erosion caused by ploughing or chemical degradation (e.g. microbial activity and soil acidity/alkalinity) as well as changes in moisture levels as a result of climate change.

IMPACTS

- 9.60 Potential adverse impacts to presently unknown archaeological evidence within the Site may occur through direct physical effects such as vibration, plant and vehicle movement, changes in water movement/drainage, the cutting of foundations and services etc. Such direct effects may, without mitigation measures, damage, destroy or remove archaeological evidence. Adverse impacts to any archaeological evidence present within the Site would need to be addressed through a pre-construction phase programme of archaeological investigation. The scope and timing of any such investigation will be agreed in advance with the Local Planning Authority and their Archaeological Advisors at Berkshire County Council. The Site will, as a minimum, be subject to an archaeological evaluation (trial trenching and reporting of results) in advance of any construction activity. The nature of any further mitigation will be agreed with the Local Planning Authority and their Archaeological Advisors at Berkshire County Council based on the extent and importance of any archaeological evidence that is revealed by archaeological evaluation.
- 9.61 No potential in-direct impacts arising from changes to the setting of any designated archaeological asset, such as a Scheduled Monument or World Heritage Site are anticipated to occur as a result of the Proposed Development.
- 9.62 A parcel of land to the east of Barkham Street that was included in the geophysical survey (**Technical Appendix 9.2**) has been excluded from the Proposed Development to avoid impact and harm to archaeological remains of probable Medieval date and forming part of the setting of the Scheduled Monument moated site at Church Farm (SM Ref. 1013181).

Construction Impacts

- 9.63 Site works involving ground establishment works and construction activities associated within building foundations, will have a direct, major magnitude of impact to below ground known and potential resources. This may also include changes to drainage patterns within the Site or immediate area as a result of construction works. All relevant construction activities have been considered and a worst-case scenario is assumed as part of this assessment of potential effects, comprising the complete loss of archaeological remains during these works.
- 9.64 The above effects would be permanent as direct impacts on archaeology cannot be reversed. Any effects identified as Large, or Very Large would be significant, whilst those identified as Moderate, Slight or Negligible would be not significant.
- 9.65 Mitigation of potential direct adverse archaeological impacts will take place prior to the commencement of enabling and construction activities. Following an appropriate agreed scope of archaeological investigation and mitigation, no construction phase impacts/effects are anticipated to occur in the construction phase.
- 9.66 **No** potential indirect construction phase archaeological effects have been identified as arising from the Proposed Development.

Operational Impacts

- 9.67 **No** potential adverse operational phase impacts on archaeological evidence within the Site are identified as arising from the operational phase of the Proposed Development.

- 9.68 The operational phase of the Proposed Development has been assessed as **not** having the potential to affect the importance of any designated archaeological asset through the alteration of its setting.

MITIGATION

- 9.69 Environmental assessment should incorporate a hierarchical system of mitigation, beginning with avoidance and prevention of the effect, followed by reduction to lessen the significance of the effect, and finally through to remediation to offset the effect. This may include embedded mitigation within development design proposals, for example to preserve archaeological remains in situ as part of an area of open space. It may also include essential mitigation which will reduce and/or offset significant adverse effects. In the case of archaeological remains, it is an accepted practice that, where preservation in situ is not considered to be necessary, a programme of archaeological evaluation and mitigation works should be undertaken to ensure the preservation by record of those remains prior to any adverse effect. Whilst these mitigation measures do not reduce the adverse effect upon the archaeological resource, they ensure that archaeological resources are not lost without record.
- 9.70 A parcel of land to the east of Barkham Street has been excluded from the Proposed Development to avoid impact and harm to the archaeological remains of Medieval date and the setting of the scheduled moated site at Church Farm.

Construction Mitigation

- 9.71 Archaeological investigation will take place prior to the construction phase in order to clarify the presence, extent and importance of any archaeological evidence within the Site. This investigation will initially comprise a geophysical survey and an archaeological evaluation. The geophysical surveying of the Site and reporting of results will take place prior to the determination of the Proposed Development. The detailed scope and timing of the archaeological evaluation will be agreed in advance with the Local Planning Authority and their Archaeological Advisors at Berkshire County Council, though it is anticipated that the archaeological evaluation will be secured by condition to the granting of any forthcoming planning permission.
- 9.72 In the highly unlikely event that the archaeological investigation of the Site reveals archaeological evidence of national (high) or international (very high) importance, a scheme of further mitigation, that may include, but is not limited to, preservation in-situ will be agreed with the Local Planning Authority and their Archaeological Advisors.
- 9.73 Where archaeological evidence of negligible to medium importance is revealed within the Site, such evidence will be preserved by record, the analysis and reporting of the results occurring off site and the results being published in a variety of technical and non-technical formats. The preservation by record of archaeological remains does not reduce the effect upon those remains, as they will still be subject to total loss – this loss remains an adverse residual effect.
- 9.74 Opportunities for public outreach and heritage interpretation works will be explored as part of a package of heritage enhancement measures. This may include programmes designed to inform the new community of the archaeological interest of the Site. Any such measures could also be secured by planning condition and delivered in a manner proportionate to the results of archaeological investigation within the Site. The dissemination of information from archaeological fieldwork to the local community in order to enhance an understanding of the history of the local area would be considered a broad, beneficial residual effect. This does not however remove or negate the adverse effect from the loss of the archaeology.

Operational Mitigation

- 9.75 **No** direct or indirect adverse effects arising from the operational phase of the Proposed Development have been identified, all archaeological investigation and mitigation taking place prior to the construction phase.

RESIDUAL IMPACTS

- 9.76 Residual effects are those that are predicted to remain after implementation of any mitigation measures. It is important to demonstrate that any measures included as part of the mitigation package to respond to adverse effects can be delivered in practice. The proposed measures correspond with relevant guidance, best practice and planning policy and, therefore, there can be a high degree of confidence that these measures will be fully implemented. Such mitigation measures are secured through the implementation of the Proposed Development (Embedded Mitigation), or via planning condition attached to the granting of planning permission.
- 9.77 Given the currently unknown nature of potential archaeological evidence within the Site, there is the possibility of significant effects on archaeological remains of a potentially medium or greater importance

as a result of the Proposed Development. The ability to undertake archaeological fieldwork does not reduce the adverse effect upon the archaeological remains, however it is accepted industry practice to undertake appropriate fieldwork followed by dissemination of the acquired data in instances where preservation in situ is not considered to be necessary. Where additional mitigation measures, such as preservation in-situ become necessary in the highly unlikely event of archaeological evidence of high or very high importance being revealed within the Site, the scope of any such mitigation will be agreed in advance with the Local Planning Authority, their archaeological advisors and Historic England as appropriate.

Table 9.6: Residual Archaeological Effects of the Proposed Development

Archaeological Resource	Importance	Residual Effect
Potential for Palaeolithic and Mesolithic stray finds	Low/Negligible significance	Negligible
Potential for Neolithic stray finds	Low/Negligible significance	Negligible
Known remains of late prehistoric burnt mounds	Low to Medium significance	Slight Adverse
Possible Late prehistoric enclosures evidencing occupation/activity	Medium significance	Slight Adverse
Possible Iron Age enclosures	Low to Medium significance	Slight Adverse
Possible Iron Age and Roman field ditches	Low significance	Negligible
Post-Medieval and modern field and drainage ditches	Low/Negligible significance	No effect

CUMULATIVE IMPACTS

- 9.78 The implementation of the cumulative schemes would degrade the archaeological resources within the wider area of the Siet by removing archaeological remains within the footprint of each development. The impacts of the identified cumulative developments would be mitigated in each instance through archaeological investigation, preservation by record, and other archaeological work, which is considered to do less harm than unmonitored removal, however, would still contribute to the gradual removal and destruction of the underlying archaeological resource of the area.
- 9.79 There may be some cumulative effects on archaeological receptors as a result of the interaction of the Proposed Development with other cumulative schemes. Indeed, it is acknowledged that any archaeological remains within the Site would form part of a wider archaeological landscape. These remains can be linked to form a reconstruction of the landscape at a particular point in human history and to understand how that landscape was being exploited by humans at that time. However, given the generally small scale and localised nature of archaeological sites; as well as the anticipated low to medium importance of any archaeological evidence within the Site; it is very unlikely that the enabling and construction works associated with the Proposed Development would give rise to any significant cumulative effects when assessed alongside the identified cumulative schemes.
- 9.80 Overall, cumulative effects on archaeological receptors are **not** considered to be **significant**. This assessment is based on a professional judgement and an assessment of the likely relationship between any archaeological remains within the Site and those within the nearby area, as well as the likely importance of that evidence.

SUMMARY

- 9.81 Table 9.7 provides a summary of the effects, receptors, residual effects and conclusions of significance considered within the Chapter. The table also provides a summary of cumulative impacts.
- 9.82 As explained within the Chapter all impacts on archaeological assets will occur during the construction phase of the Proposed Development; based on the available information, these impacts are not considered likely to be significant in EIA terms.

- 9.83 Based on current information, any residual and cumulative impacts following the completion of the Proposed Development are considered to be no more than **slight adverse** and therefore **not significant**.

Table 9.7: Summary Table of Archaeological Residual Effects

Description of Likely Significant Effects	Significance	Description of Mitigation	Description of Residual Effects	Significance
Demolition/Construction Phase				
Loss of Archaeological Remains	Low to Medium significance	Investigation and Recording, analysis and publication Public Engagement	Archaeological remains preserved by record	Slight Adverse
Operational Phase				
Loss of Archaeological Remains	Low to Medium significance	Investigation and Recording, analysis and publication Public Engagement	Archaeological remains preserved by record	Slight Adverse
Cumulative - Construction				
As main assessment		As main assessment	As main assessment	Not significant
Cumulative - Operation				
As main assessment		As main assessment	As main assessment	Not significant

10 LANDSCAPE AND VISUAL

INTRODUCTION

- 10.1 This chapter of the ES identifies and describes the nature and significance of the effects likely to arise as a result of the Proposed Development on the existing landscape and the visual amenity of people, identified through a Landscape and Visual Impact Assessment (LVIA).
- 10.2 This ES chapter is supported by the following technical appendices, which are referenced as required throughout this chapter -
- **Technical Appendix 10.1:** Glossary of Terms
 - **Technical Appendix 10.2:** Methodology
 - **Technical Appendix 10.3:** Planning Policy and Guidance
 - **Technical Appendix 10.4:** Supporting Figures
 - **Technical Appendix 10.5:** Viewpoint Photographs - Winter
 - **Technical Appendix 10.6:** Viewpoint Photographs - Summer
 - **Technical Appendix 10.7:** Schedule of Likely Landscape Effects
 - **Technical Appendix 10.8:** Schedule of Likely Visual Effects
 - **Technical Appendix 10.9:** Discounted Viewpoints
- 10.3 The chapter provides a description of the methods used in the assessment, followed by a description of the relevant baseline conditions of the Application Site and surrounding area. An assessment is then presented of the likely effects of the Proposed Development during demolition / construction works and once the Proposed Development is completed and operational. Mitigation measures are identified, where appropriate, to avoid, reduce, or offset any adverse effects, together with an assessment of the significance of any likely residual effects.
- 10.4 The landscape and visual effects have been considered in relation to the proposed land uses and the parameters that are defined by the submitted Parameter Plans, as well as the Illustrative Masterplan (refer to Design and Access Statement which has been submitted as a separate document as part of the planning application). The description of the Proposed Development is set out in Chapter 5 of this ES.
- 10.5 To aid the reader, a glossary of terms is provided at **Technical Appendix 10.1**, a detailed methodology is provided at **Technical Appendix 10.2** and a detailed review of planning policy of relevance to the consideration of landscape and visual value and suitable mitigation is provided in **Technical Appendix 10.3**.

POLICY CONTEXT

- 10.6 This section considers planning policy and guidance relevant to landscape and visual effects. A detailed review of all planning policy has been undertaken and those of greatest relevance to the Application Site, the Proposed Development and the LVIA are included at **Technical Appendix 10.2**. In summary, these include the relevant parts and policies of the following -
- NPPF,
 - PPG,
 - Wokingham Borough Local Development Framework, Adopted Core Strategy Development Plan Document (January 2010),
 - Wokingham Borough Development Plan, Adopted Management Development Delivery Local Plan (February 2014),
 - Arborfield & Barkham Neighbourhood Plan 2019-2036 (Made Version April 2020),
 - Wokingham Borough Local Plan Update 2023 – 2040 Proposed Submission Plan,
 - Supplementary Planning Documents (SPDs),
 - Village Design Statements, and
 - Supplementary guidance documents.

10.7 Table 10.1 provides a summary of planning policy pertinent to the LVIA, with further details contained within **Technical Appendix 10.3** and illustrated on **Figure 10-5** at **Technical Appendix 10.4**. To avoid duplication, overarching policies are addressed in Chapter 4 of this ES and the Planning Statement.

Table 10.1: LVIA Planning Policy

Planning Policy	Key Provisions
NPPF (updated February 2025)	The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and provides a framework within which the appropriate local council can produce local and neighbourhood plans. The NPPF is material consideration in making planning decisions. The NPPF sets out three objectives to achieve sustainable development that are economic, social and environmental. Well-designed places and conserving and enhancing the natural environment are repeating themes in the NPPF. The NPPF highlights to support the Government's objective of significantly boosting the supply of homes, it is important that a sufficient amount and variety of land can come forward where it is needed, that the needs of groups with specific housing requirements are addressed and that land with permission is developed without unnecessary delay. Those policies relevant to this LVIA are listed in Technical Appendix 10.3
Wokingham Borough Local Development Framework Adopted Core Strategy Development Plan Document (January 2010)	Current strategic planning policy for Wokingham Borough Council (WDC) is made of a collection of planning documents. The Core Strategy was adopted on 29 January 2010. It sets out development strategy, planning policies, and overall spatial vision for Wokingham up to 2026. The following policies are relevant to the assessment of the LVIA, a description is provided in Technical Appendix 10.3: • Policy CP1 - Sustainable Development • Policy CP3 - General Principles for development • Policy CP7 – Biodiversity • Policy CP8 – Thames Basin Heaths Special Protection Area • Policy CP11 – Proposals outside Development limits (including countryside) • Policy CP18 – Arborfield Garrison Strategic Development Location
Wokingham Borough Development Plan, Adopted Managing Development Delivery Local Plan (February 2014)	The Managing Development Delivery Local Plan builds on the strategy set out in the Core Strategy and sets out more detailed policies for managing development. It was adopted by the Council on 21 February 2014. The following policies are relevant to the assessment of the LVIA, a description is provided in Technical Appendix 10.3: • Policy CC02 - Development Limits • Policy CC03 – Green Infrastructure, Trees and Landscaping • Policy TB08 – Open Space, sport and recreational facilities standards for residential development • Policy TB21 – Landscape Character • Policy TB23 – Biodiversity and Development • Policy TB24: Designated Heritage Assets (Listed Buildings, Historic Parks and Gardens, Scheduled Ancient Monuments and Conservation Areas) • Policy TB26 – Area of Special Character
Arborfield & Barkham Neighbourhood Plan 2019-2036 (Made Version April 2020)	The Arborfield and Barkham Neighbourhood Plan was made (adopted) by the council on 22 April 2020. The following policies are relevant to the assessment of the LVIA, a description is provided in Technical Appendix 10.3: • Policy IRS1 – Preservation of Separation of Settlements • Policy IRS2: Recognise, respect and preserve identity and rural setting of settlements • Policy IRS3: Protection and enhancement of the natural environment and green spaces • Policy IRS4: Protection and enhancement of the historic character of the area • Policy AD3: High quality development with generous open space, properly landscaped
Wokingham Borough Council Design SPD (June 2012)	The Design Guide SPD brings together a number of topics in relation to various aspects of future development within the Council and aims to bring forward well designed developments which complement and build upon the character of the immediate area.
Wokingham Borough Council, Play Space Design Guide: Technical Note SPD (March 2018)	The Play Space Design Guide SPD provides guidance on the amount of play provision required in new developments, alongside the following adopted policies: WBC Core Strategy CP3: General Principles for Development

	WBC Core Strategy Appendix 4 – Guidelines for the Provision of Public Open Space associated with Residential Development WBC MDD DPD Policy TB08: Open Space, Sport and Recreational Facilities Standards for Residential Development
Barkham Village Design Statement (August 2007)	The Barkham Village Design Statement (VDS) has been produced by the people of the parish, following an assessment of local character. It is intended for use in the development control process, to encourage sympathetic design criteria for any development in the village. The Barkham VDS is a means for local people to contribute to the planning process and to help manage change in their community.
EMERGING POLICY	
Wokingham Borough Local Plan Update 2023 – 2040 Proposed Submission Plan	Work is currently underway on a new local plan for Wokingham Borough, referred to as the Local Plan Update, which will put in place a new planning strategy for the period to 2040. Once adopted, it will replace the current Core Strategy and Managing Development Delivery Local Plans. Whilst these policies are not currently adopted, some weight will be attached to them in determining this planning application. The following policies are relevant to the assessment of the LVIA, a description is provided in Technical Appendix 10.3: • Policy SS1: Sustainable development principles • Policy SS2: Spatial strategy and settlement hierarchy • Policy SS3: Development within or adjacent to major and modest settlements • Policy SS11: Arborfield Green Strategic Development Location • Policy C4: Green and blue infrastructure and public rights of way • Policy NE1: Biodiversity and geodiversity • Policy NE3: Thames Basin Heaths Special Protection Area • Policy NE4: Trees, woodland, hedges and hedgerows • Policy NE5: Landscape and design • Policy NE6: Valued Landscapes • Policy DH1: Place making and quality design • Policy DH5: The historic environment

METHODOLOGY

Scope of Assessment

- 10.8 The assessment considers the potential landscape and visual effects as a result of the Proposed Development upon -
- Landscape character, including physical landscape resources, and
 - Views and visual amenity experienced by people.
- 10.9 To define the spatial scope of the assessment, Zones of Theoretical Visibility (ZTV) have been modelled digitally to identify those areas of the landscape that theoretically would be visually connected to the Proposed Development.
- 10.10 Figure 10.2 and 10.3 in **Technical Appendix 10.4** illustrate potential areas of visibility, taking account of the effect that settlements and woodland blocks / belts would have on views toward the Proposed Development. The ZTV (Figure 10.2 and 10.3) represents the maximum Proposed Built form within the Site that would theoretically be visible, based on the Building Heights Parameter Plan (Figure 5.5).
- 10.11 The 2km extent of the study area has been determined by considering together a preliminary study area, the results of the ZTV modelling and the findings of the baseline appraisal. It is considered that any direct or indirect landscape or visual impacts arising as a result of the Proposed Development at a distance greater than this radius would be negligible at worst and therefore are not considered further as part of this assessment.

Reference Material and Data Sources

- 10.12 In order to capture a comprehensive description of the baseline position for landscape and visual receptors, information has been collated using desk study and field survey. The desk study identified potential sensitive / designated landscape resources by reference to national Geographic Information

System (GIS) databases, OS maps, existing published landscape character studies, relevant planning policies / guidance and / or designated or protected views.

- 10.13 This stage has also enabled the identification of potential visual receptors such as PRow, residential properties or designated areas.
- 10.14 Sources of baseline data (planning policy documents already listed under context) referred to during this process include -
- Natural England, The Character of England : Landscape, Wildlife and Natural Features (2014),
 - Natural England National Character Areas No 115: Thames Valley,
 - Natural England National Character Areas No 129: Thames Basin Heath,
 - Wokingham Borough Landscape Character Assessment (November 2019),
 - Valued Landscapes Assessment, Wokingham Borough Council (September 2024),
 - Ordnance Survey Mapping at 1:25,000 scale,
 - Aerial photography of the site and wider area (Google Earth, www.maps.google.co.uk and www.bing.com/maps),
 - Multi Agency Geographic Information for the Countryside (MAGIC) interactive mapping (www.magic.gov.uk),
 - Natural England Green Infrastructure interactive mapping (<https://designatedsites.naturalengland.org.uk/GreenInfrastructure/Map.aspx>),
 - National Heritage List for England Map Search, English Heritage (<http://www.english-heritage.org.uk/>),
 - National Cycle Network mapping (www.sustrans.org.uk),
 - British Geological Survey, Geology of Britain Viewer (<https://www.bgs.ac.uk/>),
 - Ancient Tree Inventory. Woodland Trust (<https://ati.woodlandtrust.org.uk/>).
- 10.15 During field work, a series of representative photographs were taken using a digital camera with a 50mm lens (equivalent focal length) at approximately 1.6m in height. These are presented as a series of panoramic viewpoints, included to illustrate landscape character in the area and also as specific representative viewpoints. These have been used to inform the assessment of both landscape and visual impacts.

Assessment Methodology

- 10.16 The assessment was undertaken in accordance with the principles of good practice set out in the following published guidance, produced by the relevant professional organisations concerned with landscape and visual impact assessment -
- Guidelines for Landscape and Visual Impact Assessment, Third Edition (2013), (GLVIA3), Landscape Institute and the Institute of Environmental Management & Assessment,
 - GLVIA3 Statements of Clarification (2013 - 2015), Landscape Institute,
 - An Approach to Landscape Sensitivity Assessment (Natural England, 2019),
 - Natural England's 'An Approach to Landscape Character Assessment' (2014),
 - Landscape Institute (2019), Technical Guidance Note 06/19, Visual Representation of Development Proposals, and
 - Landscape Institute Technical Guidance Note 02/21: Assessing Landscape Value Outside National Designations (LI, 2021).
- 10.17 Full details of the methodology are included at **Technical Appendix 10.2**. The approach used to identify and assess landscape and visual effects is summarised as follows -
- Determine the scope of the assessment,
 - Collate baseline information for landscape and visual receptors, including completing desk study research, undertaking field survey work, identifying appropriate receptors and establishing their value,

- Review the type of development proposed and determine the susceptibility of the landscape and visual receptors to the type of change proposed,
- Combine value with susceptibility to determine the sensitivity of landscape and visual receptors to the nature of the development proposed,
- Describe the nature and magnitude of change (impact) likely to be experienced by landscape and visual receptors as a result of the Proposed Development,
- Judge the combination of sensitivity and impact to assess the scale of effects for landscape and visual receptors without mitigation measures,
- Describe any measures (mitigation) to avoid or reduce the magnitude of any adverse impact,
- Assess the importance of effects for landscape and visual receptors in relation to the Proposed Development, through a clear description of judgements on sensitivity and magnitude of impact, and
- Identify those effects that are considered significant and therefore relevant to decision making.

Significance Criteria

- 10.18 Following the methodology summarised above, the following steps are applied to derive the significance of any landscape or visual effects.

Sensitivity

- 10.19 The sensitivity of a landscape resource or visual receptor is derived by determining its value (defined by qualities including whether it is a protected landscape or view, its level of tranquillity, cultural associations, condition etc.) and combining this with its susceptibility to the nature of development proposed (ability of the landscape or view to accommodate the change proposed). Tables A.01 and A.02 at **Technical Appendix 10.2** define the criteria for determining the value of landscape and visual receptors, whilst Tables A.03 and A.06 define the criteria for determining the susceptibility of landscape and visual receptors. Table 10-2 below defines how these criteria are combined to derive the sensitivity of landscape or visual receptors.

Table 10.2 Matrix for determining sensitivity of landscape or visual receptors

SUSCEPTIBILITY	VALUE					
		Very Low	Low	Medium	High	Very High
	Very Low	Negligible	Low	Low	Medium	Medium
	Low	Low	Low	Medium	Medium	High
	Medium	Low	Medium	Medium	High	High
	High	Medium	Medium	High	High	Very High
	Very High	Medium	High	High	Very High	Very High

- 10.20 The magnitude of impact for landscape or visual change is influenced by a number of factors, including the extent to which landscape features are lost and / or altered, the introduction of new features into the landscape and the resulting change in the physical and / or perceptual characteristics of the landscape or view. It is determined by, but not limited to -
- the size and scale of the impact,
 - the extent of the geographical area over which the change is likely to be felt,
 - the duration of the impact and its potential reversibility, and
 - the proximity of the receptor to the change and the nature of the effect.

- 10.21 Tables A.05 and A.08 at **Technical Appendix 10.2** define the criteria for determining the magnitude of impact on landscape and visual receptors. As an example, Table 10.3 below provides the criteria for determining the magnitude of impact for landscape change.

Table 10.3 Criteria for determining magnitude of impact for landscape change

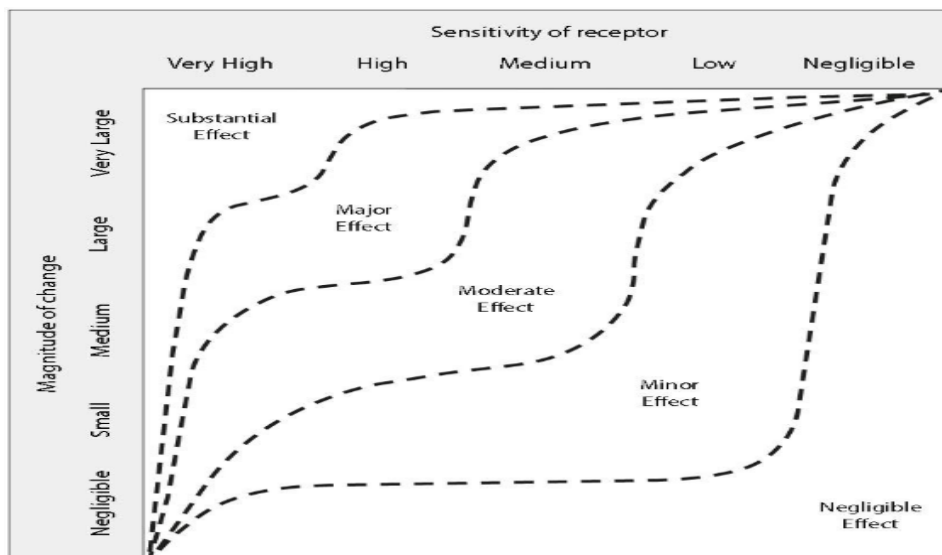
MAGNITUDE	CRITERIA
Very Large	The size and scale of change is considered to be very high due to the total loss of or alteration to existing landscape character or highly distinctive / important features and elements, and / or the addition of uncharacteristic conspicuous features and elements, resulting in a complete change to key aesthetic or perceptual qualities.
	The geographical extent of change would influence the landscape at a national level.

	Impacts would be considered long term and would either be irreversible or very difficult to reverse in practical terms.
Large	The size and scale of change is considered to be high due to the notable loss of or alteration to existing landscape character or distinctive / important features and elements, and / or the addition of uncharacteristic noticeable features and elements, degrading the integrity of key aesthetic or perceptual qualities. The geographical extent of change would influence the landscape at a regional level. Impacts would be considered long term and would either be irreversible or very difficult to reverse in practical terms.
Medium	The size and scale of change is considered to be medium due to the partial loss of or alteration to existing landscape character or features and elements, and / or the addition of uncharacteristic features and elements, resulting in key aesthetic or perceptual qualities out of scale or at odds with the local pattern and landform. The geographical extent of change would influence the landscape at a local level. Impacts would be considered medium term and / or potentially reversible, although it may not be practical to do so.
Small	The size and scale of change is considered to be low due to minor loss or alteration of existing landscape features and elements, resulting in a discernible negative effect to key aesthetic or perceptual qualities. The geographical extent of change would influence the immediate setting of the proposed development. Impacts would be considered short term and / or potentially reversible and in practical terms would easily be achievable.
Negligible	The size and scale of change to existing landscape features and elements is considered to be barely discernible. The geographical extent of change would influence the site only. Impacts would be considered short term / temporary and / or easily reversible and in practical terms would very easily be achievable.

Significance evaluation

- 10.22 The final conclusion for both landscape and visual effects are based on a combination of sensitivity and magnitude of change (impact). The overall judgement on the nature and level of these effects, referred to as significance, is based on the sequential combination of each criterion, leading to a balanced justification as described by the criteria provided in the Tables A.10 and A.11 at **Technical Appendix 10.2**, with professional judgement applied to inform this determination. The matrix in Table 10.4 provides an indication of how significance is determined by this combination of sensitivity and magnitude but it is not applied without due consideration of the specific details of the Site and development under consideration.
- 10.23 Describing effects likely to arise as a result of the Proposed Development and determining their significance requires the application of professional judgement to weigh the findings of the sensitivity of receptors against the predicted magnitude of change (impact), which can be beneficial, adverse or neutral.

Table 10.4 Criteria for determining magnitude of impact for landscape change



- 10.24 For the purpose of this assessment, effects are described in relation to their relevance to decision making and have been defined as follows -
- Substantial – Considerable effect (by extent, duration or magnitude of impact) of more than local importance or in breach of recognised acceptability, legislation, policy and / or standards. Considered to be very important and material to decision making,
 - Major – Obvious effect (by extent, duration or magnitude of impact) considered to be important and material to the decision-making process,
 - Moderate – Potential to be material to decision making,
 - Minor – Slight, very short or highly localised effect, not important for decision making,
 - Negligible or Neutral – No important effect, not relevant to decision making.

Geographical Scope

- 10.25 A study area of 2km from the Site boundary has been identified and agreed with the Council through the EIA scoping process, to conduct baseline studies and assessment work.

Temporal Scope

- 10.26 This assessment considers landscape and visual effects at the following stages of the Proposed Development -
- Effects during construction: Assesses the likely impact of temporary construction activities and considers the changing nature of the Site itself, with the anticipated year of commencement of construction in 2027 and running for approximately 8 year,
 - Effects during operation at Year 1: Assesses the completed development assuming structural landscape treatments would have been implemented and would be establishing, albeit not to a level sufficient to provide a screening function,
 - Effects during operation at Year 15: Assumes structural landscape treatments would have reached a sufficient level of maturity, allowing for an assessment of likely landscape and visual effects that takes established mitigation measures into account,
 - Effects during summer and winter are considered where these would substantially differ as a result of vegetation growth or leaf cover.
- 10.27 It is assumed that the landscape proposals would be implemented as early as possible in the construction programme however, it is unlikely that this would be sufficiently established during the construction phase to contribute to mitigation of impacts on landscape and visual receptors. Therefore, the assessment of likely effects during construction assumes the worst-case scenario, without landscape mitigation in place.

Consultation

- 10.28 An EIA Scoping Opinion was received from the Council on the 28 of January 2025 which has been used to inform the scope of this LVIA chapter.
- 10.29 As stated in the scoping report, the LVIA considers the potential landscape and visual effects as a result of the Proposed Development upon -
- Landscape character, including physical landscape resources and published landscape character assessments, and
 - Views and visual amenity experienced by people which have been identified and agreed with WBC.
- 10.30 The LVIA has been carried out in accordance with the industry best practice standards, including GLVIA3.
- 10.31 The assessment considers cumulative effects which may arise from the Proposed Development in conjunction with other committed development.

Assumptions and Limitations

- 10.32 Landscape results from the interplay between the natural, physical and cultural components of the environment and as such the assessment of landscape and visual effects is a process closely linked with other topics, notably ecology and the historic environment. The LVIA considers the contribution heritage and ecological features make to the character and value of the landscape and visual receptors,

along with an assessment of the likely effect of the Proposed Development on the landscape character and views associated with heritage features. The LVIA has been carried out in landscape and visual terms only, as an assessment of effects on heritage assets and their wider cultural setting (e.g. impacts on cultural and historic associations) are considered to be beyond the remit of this LVIA. The LVIA does not assess direct or any other indirect effects on heritage or ecological resources, which have been assessed within Chapter 8: Ecology and Chapter 9: Historic Environment – Archaeology of this ES, and the separate Heritage Setting Assessment.

- 10.33 The LVIA is based on views from publicly accessible locations. Where an impact on residential and other private views (e.g. commercial properties) is noted, this has, necessarily, been estimated. The viewpoints identified in the LVIA are illustrative of the worst-case potential impact from a representative range of receptors including residences, rights of way, public open spaces, private open space, commercial operations, the road and rail network etc. This LVIA does not necessarily identify all locations from where the Proposed Development would potentially be visible.
- 10.34 In the absence of a detailed design and layout the effects of lighting cannot be accurately determined however an assessment is provided on: the likely effects of temporary lighting resulting from construction; the change to the baseline sky glow; and the change to the landscape and views as a result of the introduction of lighting as part of the Proposed Development.
- 10.35 The construction work for the Proposed Development is anticipated to commence in 2027 and extend over an 8-year period and thus the anticipated year of completion/operation for the ES purpose is 2035. However, for assessment purposes, to avoid over-complication in interpretation of the LVIA, it is assumed that all construction work would commence and be completed at the same time. As a result, the post-completion (Year 0) and post mitigation establishment (Year 15) stages are assumed as being achieved concurrently around the Site.

BASELINE CONDITIONS

Current Baseline

Site Location and Context

- 10.36 The Site is located adjacent to the northern boundary of Arborfield Green and circa 1km south-west of Barkham Village. Wokingham lies to the north-east at circa 2km and Reading a circa twenty-minute drive to the north.
- 10.37 Arborfield Green is a strategic development site (the regeneration of the former Arborfield Garrison), where Crest are the lead developer, with planning permission for circa 2,000 dwellings and associated infrastructure and facilities – including a district centre. It is currently under construction.
- 10.38 The Site comprises two land parcels, separated by Barkham Brook, referred to as follows (as illustrated in **Technical Appendix 10.4** on Figure 10.1: Site Location and Study Area) –
- Site Parcel A: Land to the west of Barkham Brook off Langley Common Road,
 - Site Parcel B: Land to east of Barkham Brook off Common Field Lane.
- 10.39 Due to the scale of the Site (approximately 44.89 hectares) and distribution of parcels, as noted above, these references are used through this LVIA chapter to refer to specific areas.
- 10.40 The Site is presently comprised of poor-quality agricultural grassland, with a DEFRA Agricultural Land Classification Grade 4. The Site parcels are relatively physically unconstrained, however the Barkham Brook corridor separates Parcels A & B – which lies within Flood Zone 3 and flows northwards into the River Loddon. The remainder of the Site lies within Flood Zone 1. There is sporadic mature tree coverage across the Site, including veteran trees and parcels of ancient woodland. Ditches within the Site are associated with linear boundary vegetation, which includes native hedgerows, and a series of three ponds are found within the Site. The Site is currently private and inaccessible to the public.
- 10.41 **Site Parcel A** is located to the west, between Langley Common Road on its north western boundary and Barkham Brook corridor to the east. The Site Parcel features two arable fields bound and enclosed by hedgerow and woodland vegetation. The Site Parcel is physically and visually separated centrally, by a hedgerow and ditch boundary that runs north / south. The Parcel features, predominantly on its boundaries, areas of Ancient Woodland (an irreplaceable habitat) as well as hedgerow, deciduous woodland and open water (ponds) these are all priority habitats.
- 10.42 **Site Parcel B** is located to the east, between the Barkham Brook corridor to the west and Commonfield Lane and the residential curtilage and parkland of Barkham Square (Grade II) to the east. The Site Parcel features grassland pastures, currently used for grazing livestock. The Parcel features areas of Ancient Woodland (an irreplaceable habitat) as well as hedgerow, deciduous woodland and stands of trees,

predominantly on its boundaries. Existing residential development (associated with Arborfield Green) is located adjacent to and fronting onto this Parcel's southern boundary.

Physical Landscape Resource

Topography and landform

- 10.43 The Site features a gently undulating landscape between circa +50 and +60m AOD. The western part of the Site (Site Parcel A) features a localised plateau area at circa +55m AOD, beyond the central hedgerow / ditch line, with landform sloping gently downhill eastwards towards the Barkham Brook corridor. This eastern part of the Site (Site Parcel B) features a localised ridgeline at circa +60m AOD, running east / west centrally through the parcel. The landform slopes gently downhill in a westerly direction towards the Barkham Brook corridor. In the wider context, the shallow valley landscape between Barkham and Arborfield is set within a backdrop of wooded rising ground (at circa +80m AOD) at Barkham Hill and Edneys Hill, which are known locally as 'The Coombes' (as illustrated on Figure 10.4: Topography and Hydrology in **Technical Appendix 10.4**).

Hydrology and Water Features

- 10.44 The Site lies in the Loddon Valley, which features Barkham Brook, a tributary that flows into the River Loddon. The wooded sand and gravel hills in the north descend to level clay land in the south, drained by the Barkham Brook. Within the Site, a shallow wooded valley follows the course of Barkham Brook and also features ditches and open water bodies, resulting from the clay and loamy soil which impede drainage (as illustrated in **Technical Appendix 10.4** on Figure 10.4: Topography and Hydrology).

Vegetation

- 10.45 The landscape surrounding the Site is wooded in character, with historic settlements of Arborfield and Barkham located in, what was once a part of the Windsor Great Park Forest. The surrounding landscape comprises historic farmland, wooded areas and ancient hedgerows, interspersed with residential areas of variable age and style. Barkham's earliest recorded name - in a Saxon charter of AD 952 of "Beorchamme" (birch tree meadow) - suggests that it began as a clearing in the wood. Barkham probably means 'Birch Home', which referred to the birch trees growing on the edge of Windsor Forest.
- 10.46 Ancient Woodland - Historic OS mapping 1892 - 1908 indicates that the Site once featured 'Kidgem Copse' - which overtime has been cleared, but remnants remain as part of the blocks of Ancient Woodland along the Site's southern boundary and along the Barkham Brook corridor.
- 10.47 Ancient / Veteran Trees - A review of the Woodland Trust Ancient Tree Inventory (Woodland Trust, 2024), as of 26/06/2024, highlighted several veteran trees located on the north eastern boundary and several 'notable' trees on the southern boundary of Site Parcel A. The Arboricultural Impact Assessment (AIA) highlights from survey work, there are no ancient or veteran trees on the site but notable and mature specimen trees present will be retained and protected.
- 10.48 Tree Preservation Order (TPOs) - The Wokingham Borough Tree Preservation Orders map, highlights there are a number of single trees covered by TPO - along the southern boundary of Site Parcel A, southern boundary of Site Parcel B and a woodland TPO on the northern boundary of Site Parcel A.
- 10.49 Barkham Brook and associated wetland - provide important ecological habitats including wet meadow and BAP priority habitat wet woodland.

Environmental Designations

- 10.50 The environmental designations of relevance are summarised below and illustrated on Figure 10.7: Environmental Designations in **Technical Appendix 10.4**.
- 10.51 The Thames Basin Heaths SPA lies within 10km, the closest part of the SPA being within 3.5km to the south-west of the Site - therefore in accordance with Local Plan Policy CP8, Proposed Development of the Site will require the provision of SANG, to divert pressure of public recreation on the SPA.
- 10.52 The Longmoor Bog SSSI and the Longmoor Bog LNR are circa 230m to the south of the Site. There are also 12 non-statutory designations within 2km of the Site, predominantly woodland habitats.

Heritage Designations

- 10.53 The heritage designations of relevance are summarised below and illustrated on Figure 10-6: Heritage Designations in **Technical Appendix 10.4**. The LVIA considers the contribution of heritage assets on the character of the landscape and views but does not assess direct or any other indirect effects on heritage resources, which have been assessed within Chapter 9 of this ES and separately in a Heritage Setting Assessment.
- 10.54 There are no statutory heritage designations covering any part of the Site.

- 10.55 Listed Buildings - Barkham Square Farmhouse (Grade II) and associated parkland setting are located beyond the agricultural fields north of Site Parcel B. Further afield (in the village of Barkham), are the Church of St James and Church Cottage (both Grade II). The northern part of Barkham village (at the junction between Barkham Street and Barkham Road) includes several other Grade II listed buildings including Sparks Farmhouse, The Bull Public House and Barkham Manor.
- 10.56 In the wider study area, there are several other listed buildings and heritage designations however, due to the extent of intervening built form, topography and vegetation, it is considered that the nature of the Proposed Development on Site Parcel A (or any associated green infrastructure requirements on other parcels) would not have any impact on these receptors.

Access and Recreational Routes

- 10.57 The access and recreational routes, including major and local roads and Public Rights of Way (PRoW) of relevance are summarised below and illustrated on Figure 10.8: Access and Water in **Technical Appendix 10.4** -
- There is an existing access into the Site from Commonfield Lane to the east,
 - The Site is currently private land and not accessible to the public,
 - There is an existing public footpath (ref: BARK FP 7/1) adjacent to northern Site boundary (running alongside the north east boundary of Parcel A). There are currently proposals to upgrade this route to a public bridleway - which would provide off road access to horse riders and cyclists,
 - Commonfield Lane and Barkham Ride are both part of 'The Round Berkshire Cycle Route' - a road-based cycling route that broadly traces the perimeter of the county for around 140 miles,
 - There is a well-used extensive PRoW network beyond the boundaries of the Site, used by walkers, cyclists and horse riders, providing onward connections to key GI destinations,
 - There is the opportunity to connect the Site proposals to Arborfield Green, to the south.

Landscape Character Baseline

- 10.58 Published landscape character assessments relevant to the Proposed Development and wider study area have been reviewed and their extents illustrated on Figure 10.9 in **Technical Appendix 10.4**. These assessments include -
- National Character Area Profile (Natural England), and
 - Wokingham Borough Landscape Character Assessment (2019)
- 10.59 Valued Landscapes Assessment, Wokingham Borough Council (September 2024). The published assessments provide a hierarchical appraisal of the character of the Site, its surroundings and the wider region through a recognised process of landscape characterisation. It should be noted that there are often subtle differences between and within individual landscape character areas that can give rise to variations in both actual and perceived value, quality, condition and susceptibility to change. Furthermore, boundaries between character areas do not always follow recognised features within the landscape such as rivers, settlement edges or field boundaries where there is a gradual change in character and is often the case with landscapes at the national and regional level.
- 10.60 Character areas at the national level have been reviewed as part of the assessment. It is considered that, whilst these assessments inform the context for local character assessments, they do not provide a sufficient level of detail appropriate to the nature of effects likely to arise at a local level as a result of the Proposed Development.
- 10.61 In addition, given the scale of these character areas and the local scale of effects likely from the Proposed Development, any effects on the national character areas would be negligible at most. Therefore, in line with the recommendations of GLVIA3, to ensure that the scale of assessment is appropriate and proportionate to the scale of the Proposed Development, national character areas have not been considered further as part of the assessment.

Borough Landscape Character

- 10.62 At a borough level, as illustrated on Figure 10.9 in **Technical Appendix 10.4**, the study area and the Site falls within the published Landscape Character Assessment: Wokingham Borough Landscape Character Assessment (2019).
- 10.63 The Site is wholly located within LCT J: Settled and Farmed Clay, characterised by a shelving and undulating landform underlain by London Clay, with large tracts of post-war settlement, connected by

both major and minor roads cutting across the landscape. Areas of large arable fields remain, as well as tributaries draining towards the Loddon.

10.64 The Site is wholly located within LCA J2: Arborfield Cross and Barkham Settled and Farmed Clay which is described as *"a gently undulating landscape, principally in agricultural use. Large arable fields bound by hedgerows dominate, with smaller fields of sheep pasture and horse paddocks close to settlements"*. Key characteristics, of relevance to the Site and immediate study area, include -

- A gently undulating landscape between +50m and +65m AOD, underlain by London Clay with localised areas of River Terrace Gravels. Shallow wooded valleys follow the course of the Barkham Brook,
- Consistent pattern of water bodies including streams, drainage channels, ditches and open water bodies of various sizes resulting from the clay and loamy soils which impede drainage,
- Wooded context provided by characteristic mature hedgerow and in-field trees, combined with woodland belts, with BAP priority habitats and ancient woodland - and the wooded horizons of the surrounding hills. This creates a loose sense of enclosure, provides a wooded character and visual interest within the landscape,
- Fields are large and geometric, bound by fragmented hedgerows supported by post and wire,
- A dense settled character influenced by modern development including the new garden village on the site of Arborfield Garrison,
- Older scattered settlement of farms, hamlets and small nucleated villages at Barkham and Arborfield Cross,
- A network of busy local roads cross the area. They tend to be rural in character, with ditches, hedges and hedgerow trees, sometimes opening directly onto the arable fields,
- Public rights of way run between the settlements and provide access for recreation.

10.65 A number of landscape management objectives are set out for the LCA, those of relevance to the Site include -

- Conserve the scenic quality and naturalistic character of the Barkham Brook,
- Conserve woodlands, including ancient woodland, BAP priority habitats and remnant standard trees.
- Increase the extent of native deciduous woodland, using locally occurring native species, in order to provide screening of roads and development and linking woodland habitats,
- Conserve the open and rural qualities of the farmed landscape, which provides a physical and visual separation or gap between settlements,
- Conserve and manage hedgerows with standard trees as important wildlife habitats and landscape features, as well as the links they provide across the landscape and between areas of woodland,
- Conserve and enhance the integration of urban edges through wooded boundaries and large-species trees to provide visual screening and create a positive interface between the built up and rural areas,
- Maintain and enhance the character of rural lanes, resisting unsympathetic highway improvements, infrastructure and signage - particularly in the most rural areas.

Valued Landscape Areas

10.66 At a borough level, as illustrated on Figure 10.9 in **Technical Appendix 10.4**, the study area and a small part of the Site falls within the area of Valued Landscape identified by the published Wokingham Borough Council – Valued Landscape Assessment (September 2024).

10.67 This assessment has been prepared to help understand the landscape characteristics and attributes of Wokingham Borough, and whether there is evidence to support identification as a 'valued landscape'. In total thirteen areas have been identified as valued landscapes.

10.68 In relation to the Site, this includes the Barkham Brook corridor and associated ancient woodland within the Site. Beyond the Site, the pastoral landscape to the immediate north and Barkham Hill are also designated Valued Landscapes. This area is defined on the policies maps as the Bearwood and Barkham 'Valued Landscape', which the policy states *"are designated as valued landscapes in recognition of their distinctive character to the borough's landscape"*.

10.69 In the north, the Barkham and Bearwood Valued Landscape centres on the Registered Park and Garden of Bearwood, and in the south of the area it centres on the ancient Langley Common and course of the

Barkham Brook, many of the landscape features of which appear on Norden's 1607 map of the Royal Forest of Windsor.

- 10.70 Whilst the landscape of the J2 'Arborfield Cross and Barkham Settled and Farmed Clay' Landscape Character Area is described as being of only moderate scenic quality, the LCA (2004) does pick out the 'notable characteristics of the Barkham Brook' and a wide range of habitats. In terms of wildlife and biodiversity the Barkham and Bearwood Valued Landscape is identified as providing an important mix of habitats, including and of relevance to the Site, lowland mixed-deciduous woodlands and riverine habitat along the Barkham Brook.
- 10.71 The Valued Landscape Assessment states *"Barkham Brook, its associated wetland and other habitats provide important ecological habitats and ecosystem services"*.
- 10.72 The Valued Landscape Assessment has informed emerging Policy NE6 Valued Landscapes of the Wokingham Borough Local Plan Update 2023 – 2040 Proposed Submission Plan. The policy requires development proposals within or affecting a valued landscape to have regard to the following attributes –
- Landscape quality (condition),
 - Scenic quality,
 - Rarity,
 - Representativeness,
 - Conservation interests,
 - Recreation value,
 - Perceptual aspects. and
 - Associations.
- 10.73 Emerging local plan policy NE6 also states "development proposals affecting valued landscapes will only be supported where they protect and, where appropriate, integrate with and/or enhance the special features, characteristics and qualities of the landscape, unless the benefits of the development in that location clearly outweigh the harm".

Visual Amenity Baseline

- 10.74 The visual baseline identifies views toward the Site with the potential to be impacted by the Proposed Development.
- 10.75 The baseline situation for these views is described through a series of viewpoint photographs, taken from publicly accessible locations which, alongside representing the views experienced by people at the viewpoint, are also representative of potential views for other receptors in its vicinity.
- 10.76 Viewpoint Photographs are contained in **Technical Appendices 10.5 and 10.6**, with the viewpoint locations illustrated on Figure 10.10 in **Technical Appendix 10.4**. A detailed description of each baseline view assessed is included in **Technical Appendix 10.8** and should be read with reference to these photographs and their relative positions within the ZTV, as illustrated on Figures 10.2 and 10.3 in **Technical Appendix 10.4**.
- 10.77 Viewpoint photographs were taken in April and July 2022 and represent the respective winter and summer view from each location.
- 10.78 Views from each viewpoint may be representative of more than one receptor, for example, a viewpoint taken from a PRoW will be representative of views experienced by users of the PRoW, however it may also be representative of views experienced from nearby roads or the vicinity of nearby residential properties - receptors which are considered to be represented by each viewpoint location are noted in **Technical Appendix 10.8** and on each viewpoint photograph sheet in **Technical Appendices 10.5 and 10.6**. The nature and value of these views is relative to the type of receptor experiencing the view, as reflected in the visual baseline and determination of sensitivity provided in **Technical Appendix 10.8**.

Visibility of the Site

- 10.79 The process used to determine the ZTV and visual envelope for the Proposed Development is described in the LVIA Methodology in **Technical Appendix 10.2**.
- 10.80 The ZTV represents the starting point for understanding the visual baseline for the Application Site and the Proposed Development. The findings of the ZTV were verified during field survey, which in turn led

to the selection of receptors appropriate to assess the likely visual effects of the Proposed Development.

- 10.81 It is impractical, and disproportionate to the LVIA (as required by GLVIA3) to assess views from all receptors within the study area, therefore representative viewpoints have been selected. These viewpoints are chosen to represent views experienced from the location of the viewpoint, and for other similar views within the study area. During the field survey, some locations which appeared on the ZTV were found to have no visibility of the Site and no likely visibility of the Proposed Development, viewpoint photography for these 'none-visible viewpoints' was captured and has been included in **Technical Appendix 10.9** to provide contextual information on the study area only, these locations will not be assessed for impacts as part of this assessment.
- 10.82 Site Parcel A is generally visually well contained by existing tree, woodland and hedgerow boundaries, resulting in limited intervisibility with the wider landscape.
- 10.83 The majority of views towards the Site are enclosed, beyond anything more than near views, particularly from the north and south - with the exception of middle to long distance views experienced from Edneys Hill in the north east and Arborfield Court in the west (due to the elevated, open, less vegetated nature of the pastoral landscapes in these locations).
- 10.84 The mature wooded nature of the area (provided by characteristic mature hedgerow and in-field trees, combined with woodland belts and ancient woodland) and the wooded horizons of the surrounding hills (Barkham Hill and The Coombes), creates a sense of enclosure and limits intervisibility with the Site.

Views from Residential Receptors

- 10.85 Residential receptors on Langley Common Road (on the northern side facing Site Parcel A), currently experience heavily filtered views through the existing boundary vegetation of Site Parcel A, during the winter (**Viewpoint 5**). Several properties on the southern side of Langley Common Road, whose properties back onto Site Parcel A, experience direct to partial filtered views over this parcel from their upper storeys (albeit from less frequently habitable rooms). There are also direct views from a residential property, into Site Parcel A, located on the northern boundary of the parcel.
- 10.86 Residential receptors on the northern edge of Arborfield Green, adjacent to the southern boundary of Site Parcel B (on Archer Grove), currently experience partial to filtered near distance views of Site Parcel B and the agricultural land beyond - including the vegetation bordering Barkham Brook, which screens views to Site Parcel A (**Viewpoints 4a, 4b and 4c**).
- 10.87 Residential receptors on Barkham Road, close to the bridge over the Barkham Brook (approximately 300m to the north of the Site), currently experience near distance views of the hedgerow and tree vegetation associated with the northern boundary of Site Parcel A. In distant views, a large warehouse associated with Arborfield Studios is discernible along the wooded horizon, forming a visual detractor (**Viewpoint 6**).
- 10.88 A small proportion of residential receptors on the north western outer edge of Barkham Square - whose properties are located within an 'Area of Special Character' (Policy TB26 of the Local Plan), approximately 350m to the north east of the Site - currently experience near to middle distance, glimpsed / filtered views of Site Parcel A, from their upper storeys and to the rear of the properties. Beyond the Site, there are middle distance, glimpsed / filtered views of the upper limits of industrial warehouses, along the wooded skyline, associated with Arborfield Studios (Viewpoint 11).

Views from Public Rights of Way

- 10.89 Walkers on public footpath BARK 7 (adjacent to the Site's northern boundary, running east / west between Barkham Road and Barkham Street) currently experience close to near distance, filtered and glimpsed views through breaks in boundary vegetation and fencing, particularly on the western section adjacent to Site Parcel A (between **Viewpoints 1a and 1b**). As the residential element of development on the Site is located within Parcel A, and targeted green infrastructure enhancements in Parcel B, it is considered visual effects would be negligible from the eastern section of the public footpath (**Viewpoint 1c**), due to the combination of distance, landform and intervening vegetation.
- 10.90 Views into Site Parcel B from Church Lane and walkers on public footpaths BARK 9 (**Viewpoint 2a**) are heavily filtered and screened by intervening vegetation, with no views into Site Parcel A. Walkers on public footpath BARK 8 experience filtered glimpsed views of Barham Square (Grade II) (Viewpoint 2b). During winter conditions, there are filtered and glimpsed views of the upper limits of the water tower within Arborfield Studios, directly adjacent to Site Parcel A, however views towards Site Parcel A and B are screened by intervening vegetation. With residential parts of the development located within Parcel A, with targeted green infrastructure enhancements to Parcel B, it is considered visual effects would be negligible (at most) from these receptors.

- 10.91 On the outer edge of California Country Park and Longmoor Bog Nature Reserve, on public bridleway BARK 14 (approximately 500m to the south east of the Site), there are heavily filtered near to middle distance views between breaks in vegetation, of properties on Archer Grove within Arborfield Green and High Barn Farm, both off Commonfield Lane (**Viewpoint 7**). With the residential element of Proposed Development located within Parcel A and targeted green infrastructure enhancements in Site Parcel B, it is considered visual effects would be negligible (at most) from this receptor.
- 10.92 From Edneys Hill, on public footpath BARK 10 (approximately 650m to the north east of the Site), there are views across the pastoral landscape to buildings associated with Brook House, Barkham Grange and Brook Farm (in the middle distance), located on Barkham Street (**Viewpoint 9**). The water tower located within Arborfield Studios, directly adjacent to Site Parcel A, is barely visible in the distance within the wooded skyline. The Site forms a small part of a distant view and is heavily filtered, due to intervening vegetation and the undulating nature of the landscape.
- 10.93 From the edge of Arborfield Court, on public footpath ARBO 17 (approximately 900m to the west of the Site), there are views across the pastoral landscape and the settlement edge of Arborfield Cross, towards a wooded horizon in the middle to long distance views (**Viewpoint 10**). The water tower and upper extent of buildings located within Arborfield Studios, directly adjacent to Site Parcel A, are barely visible in the distance within the winter wooded skyline. There is the potential for distant, heavily filtered and glimpsed views, during winter, of the rooftops of development in Site Parcel A, however this would form a very small proportion of the overall view and would be seen in the context and to the rear of existing residential development within Arborfield Green and future consented development at Arborfield Studios, associated with Arborfield Green.

Views from Barkham old village – Area of Special Character (Policy TB26)

- 10.94 Barkham Street 'Area of Special Character' (shown on Figure 10.5 in **Appendix 10.4**) stretches from the original medieval centre of Barkham (marked by the church, a moated manor building that is still occupied and the village pond). It then extends along Barkham Street, passing Barkham Square, The Bull pub and Sparkes Farm, all of which are Grade II listed, towards Barkham Manor. Views along Barkham Street are channelled and enclosed by existing built form and vegetation, restricting views out to the surrounding landscape, including the Site (refer to **Technical Appendix 10.10** Discounted Viewpoint iv).
- 10.95 From Site Parcel A, there are views out towards Barkham old village to the north, comprising middle distance, glimpsed / filtered views of residential properties along Barkham Road and Barkham Street (all nestled within the treed and woodland horizon). These receptors have the potential for vistas of intervisibility to development on Site Parcel A, from their upper storey's and rear of properties, albeit this visual effect could be reduced and mitigated by strengthening of the northern boundary vegetation to Site Parcel A (represented by **Viewpoint 11**).

Views from Listed Buildings

- 10.96 Barkham Square Listed Building (Grade II) and associated parkland setting are located beyond agricultural land, north of Site Parcel B. The existing treed curtilage of the property, combined with the intervening landform and Barkham Brook corridor, provide substantial physical and visual separation from Site Parcel A – this, combined with targeted green infrastructure enhancements in Parcel B, ensure visual effects from this receptor would be negligible.

Views from Road Network

- 10.97 Vehicular and cyclist receptors on Commonfield Road, which abuts the eastern edge of Site Parcel B, experience enclosed and channelled views along its length, due to wooded vegetation either side of the road (Viewpoint 3). There is the potential for transient, glimpsed and filtered views into Site Parcel B, through breaks in the boundary vegetation. With the residential element of the Proposed Development located on Parcel A, with targeted green infrastructure enhancements in Site Parcel B (including substantial woodland re-planting alongside the Barkham Brook), it is considered visual effects from this receptor would be negligible (at most).

IMPACTS

Construction Impacts

- 10.98 The construction phase is likely to involve initial activities such as enabling works on Site, introduction of infrastructure as well as ongoing construction activities necessary to implement the Proposed Development.
- 10.99 Initial activities onsite are likely to include (in no particular order) -
- The installation of boundary fencing / hoarding and controlled site access measures off Langley Common Road,
 - Site clearance works,

- The establishment of tree and hedgerow protection measures and works to the existing vegetation where required,
- General earthworks such as soil stripping, soil storage and cut / fill activities to create development platforms,
- The establishment of temporary site-based compounds including site offices, car parks, and plant / materials storage,
- Utilities works (diversions, isolations, provision of new / upgrades to existing services), and
- The creation of temporary haul roads.

10.100 Ongoing construction activities are likely to include the following (in no particular order) -

- The construction of sustainable drainage systems (SuDS) and connections to the wider drainage work,
- The construction of onsite highways infrastructure and servicing, including drainage and lighting,
- The construction of public and private footways, driveways and parking facilities, and
- The building of houses / flats, schools, community infrastructure and other built form.

10.101 Both initial and ongoing construction activities would generate a variety of vehicle movements. Off-site movements are likely to include light and heavy haulage, commercial and personnel vehicles. On-site movements are likely to include haulage, general plant, forklifts, mobile lifting equipment and large cranes. Temporary signage, site hoarding, tree protection measures and marketing signage are likely to be erected and construction hazard warning lighting is likely to be visible.

10.102 The assessment of likely effects during construction deals with the worst-case scenario in terms of likely impacts on landscape and visual receptors prior to the establishment of any mitigation planting.

10.103 Details of the assessment of likely effects at the construction stage are included for landscape receptors in **Technical Appendix 10.7** and for visual receptors in **Technical Appendix 10.8**. A summary of construction effects considered to be significant (moderate and above) have been identified and are provided in Table 10.5 below.

Table 10.5 Summary of likely significant construction effects on visual receptors

Receptor	Sensitivity	Magnitude of impact	Effect significance
Viewpoint 5 Langley Common Road	Residents: Medium	Medium – Large Adverse	Moderate – Major Adverse
Viewpoint 1a Field House Farm	Residents: Medium	Medium – Large Adverse	Moderate – Major Adverse

Operational Impacts

10.104 The main elements of the development with the potential to bear an impact on the landscape and visual receptors comprise the following -

- Residential built form ranging from 2 to 3 storey development with anticipated max ridge heights of approximately 10 – 13m above finished ground level,
- Proposed Elderly dwellings at maximum 3 storey development with anticipated max ridge heights of approximately 10 – 13m above finished ground level,
- Proposed vehicular access points from Langley Common Road,
- Proposed car park access point off Commonfield Lane, and
- Proposed associated infrastructure including internal road routes.

10.105 Structural landscaping would be unlikely to be sufficiently established on completion of the built form to substantially contribute to mitigation of impacts on landscape and visual receptors. Therefore, the assessment of likely effects at completion Year 0 assume the worst-case scenario in terms of likely impacts on landscape and visual receptors.

10.106 Details of the assessment of likely effects at completion Year 0 are included for landscape receptors in **Technical Appendix 10.7** and for visual receptors in **Technical Appendix 10.8**. In accordance with the requirements of the EIA process a summary of completion Year 0 effects considered to be significant (Moderate - Major and above) have been identified and are provided in Table 10.6 below. These are all

visual effects, as all landscape effects at completion Year 0 are considered to be **Minor - Moderate Adverse or less** and not considered significant.

Table 10.6 Summary of likely significant completion Year 0 effects on visual receptors

Receptor	Sensitivity	Magnitude of impact	Effect significance
Viewpoint 1a (Field House)	Adjacent resident: Medium	Medium – Large Adverse	Moderate – Major Adverse
Viewpoint 5 (Langley Common Road)	Adjacent residents: Medium	Medium – Large Adverse	Moderate – Major Adverse

MITIGATION

- 10.107 The Proposed Development parameters have been developed in consideration of the surrounding landscape and visual context of the Site, particularly its topography and the nature / scale of existing built form in the surrounding context. With regard to the former, the tallest height parameters are proposed centrally within Site Parcel A, ensuring the tallest buildings proposed would not form prominent features on the boundary and visually exposed edges of the Site. Development within Site Parcel A transitions to a lower density and scale towards the northern and western boundaries, focusing higher density and scale centrally within Site Parcel A.
- 10.108 Regarding the interface with the existing residential receptors along Langley Common Road, proposed residential development is set back from the boundary to the rear of additional landscape buffer planting to supplement and strengthen the existing boundary vegetation.
- 10.109 Proposed Development (built form) is located within Site Parcel A and is set back from the northern and western boundaries, to allow for additional landscape buffer planting to strengthen these visually sensitive edges. Retaining, supplementing and strengthening the existing hedgerow and tree planting along these boundaries will reinforce visual enclosure and landscape assimilation, as well as providing an ecological benefit in terms of habitat enhancement / connectivity.
- 10.110 Landscape buffer/ tree planting is proposed in key locations throughout the Green Infrastructure (GI) Framework for the Site (particularly within the green links, GI destinations and green buffers) to help mitigate views of any proposed built form / development areas from the immediate surrounding landscape, elevated long-distance viewpoints from Edneys Hill in the north east and Arborfield Court in the west. Over time, a strong network of new tree canopies across the Site (woven amongst / around development on Parcel A and in targeted locations on Parcel B) will enhance the existing wooded character of Barkham Brook valley, forming a wooded backdrop to proposed development parcels and assimilating any development into the surrounding valley landscape - reducing the extent to which built form will break the existing wooded skyline.
- 10.111 To inform the master planning of the Proposed Development, the existing landscape assets on the Site were also mapped at an early stage and their value assessed as part of the various baseline environmental studies including landscape, arboriculture, ecology and heritage. Features of value have been used to inform the development of an extensive Green Infrastructure Strategy for the Proposed Development, refer to Figure 5.4 for the broad locations of green infrastructure and amenity green spaces within and to the boundaries of the Site. In summary, this incorporates the following to mitigate the impact of the development on the landscape and visual receptors -
- Existing trees and woodland blocks (including ancient woodland) retained where possible - where existing trees must be removed, compensatory tree planting will take place within the Site,
 - Existing hedgerows to be retained where possible and enhanced,
 - New structural landscape: native woodland planting to augment existing hedgerow, tree belts and varying width of native woodland,
 - A new SANG and green infrastructure parkland area in Site Parcel B (containing substantial areas of woodland planting, to reinstate part of the former wooded character flanking the Barkham Brook), and
 - On establishment, tree planting associated with the above would provide for strengthening of the vegetated skyline and softening of the Proposed Development and settlement edge, with other aspects of the above serving to reduce the landscape and/or visual effects.

RESIDUAL IMPACTS

- 10.112 Residual effects are typically defined as those that remain following the implementation of mitigation measures.

- 10.113 The initial stages of the LVIA have considered landscape and visual effects at construction and post-completion (Year 0). The mitigation related to landscape and visual matters have been incorporated into the Proposed Development as an integral part of the master planning and used to shape and influence the layout, scale, pattern, massing and height of the proposals.
- 10.114 However, at such an early stage, at Year 0 many of the proposed landscape mitigation measures associated with green infrastructure would not be sufficiently established to perform their intended landscape function or would deliver only a part of their intended function.
- 10.115 Therefore, the residual effects pertaining to landscape and visual matters are considered to be those that remain once the proposed landscape mitigation measures have established and are contributing to their intended function, for example providing a strong structural green framework, shaping places, screening or softening built form. This stage is defined as 'Post Mitigation Establishment (Year 15)'.

Post Mitigation Establishment Stage (Year 15)

- 10.116 At this stage of the Proposed Development, the green infrastructure would be establishing well, substantially increasing the landscape resource, strengthening the vegetated skyline, creating a range of public open spaces, with enhancements to ecological resources. This green infrastructure would combine with those key elements retained to enhance the character of the landscape throughout the Proposed Development and its immediate context.
- 10.117 Trees planted as part of the Proposed Development (including stands of individual trees, street trees, avenues and native woodland) would have reached between 8m - 12m in height and would provide a meaningful contribution to both visual containment and green infrastructure across the Site.
- 10.118 Details of the assessment of likely effects at completion Year 15 are included for landscape receptors in **Technical Appendix 10.7** and for visual receptors in **Technical Appendix 10.8**. In accordance with the requirements of the EIA process, a summary of completion Year 15 effects considered to be significant (Moderate – Major and above) have been identified and are provided in Table 10.6 below.

Table 10.6: Summary of likely significant Post Mitigation Establishment Year 15 effects on visual receptors

Receptor	Sensitivity	Magnitude of impact	Effect significance
Viewpoint 5 (Langley Common Road)	Adjacent residents: Medium	Medium Adverse	Moderate Adverse

CUMULATIVE IMPACTS

- 10.119 This LVIA has considered the following sites, with regard to potential for cumulative impacts in combination with the Site and Proposed Development -
- South of Cutbush Lane, Shinfield- part of Lodden Garden Village proposed allocation,
 - East of Shinfield (Phase 2), South of Church Lane, Shinfield (Planning Reference 17/2450) – committed site,
 - Hall Farm/Lodden Garden Village, proposed allocation and recent application submission, and
 - South Wokingham SDL (including extension) (south of Waterloo Road) – proposed allocation for 2975 dwellings.
- 10.120 South of Cutbush Lane, Shinfield and East of Shinfield sites lie over 3.5km to the north west of the Site, with no potential for any visual receptors to experience views of either of these sites in combination with the Proposed Development. These sites also lie close to the settlements of Shinfield and Reading, so would have no cumulative landscape impacts in combination with the Proposed Development. Therefore, it is considered there would be **no** cumulative landscape or visual impacts.
- 10.121 The South Wokingham SDL site lies over 4.5km to the north east of the Site, with no potential for any visual receptors to experience views of this site in combination with the Proposed Development. This site lies in close proximity to the settlement of Wokingham and Eastheath, so would have no cumulative landscape impacts in combination with the Proposed Development. Therefore, it is considered there would be **no** cumulative landscape or visual impacts.
- 10.122 Loddon Garden Village is identified in Wokingham Borough Council's draft Local Plan Update. Loddon Garden Village is outlined as a Strategic Development Location which could deliver at least 2,700 homes by 2040, with the eventual village size being around 3,930 homes. The Loddon Garden Village site lies 1.3km to the north west of the Site, with no potential for any visual receptors to experience views of this

site in combination with the Proposed Development, therefore there would be **no** cumulative visual impact. In terms of landscape character, the south eastern part of London Garden Village is located within the same Borough Landscape Character Type (LCT J2: Arborfield Cross and Barkham Settled and Farmed Clay) as the Site. The Proposed Development, in combination with Loddon Garden Village, would increase the urbanisation of the western part of LCT J2, however the central and north eastern parts of the LCT would remain unchanged, therefore the cumulative effect would be **minor adverse** at most, and not considered significant.

SUMMARY

- 10.123 This LVIA has been carried out in accordance with GLVIA3, with reference to other technical notes including GLVIA3 Statement of Clarification 1/13 (2013) and Landscape Institute Advice Note 06/19, Visual Representation of Development Proposals (2019).
- 10.124 The LVIA methodology, extent of Study Area (2km radius) and proposed locations for representative viewpoints have been agreed with WBC as part of the EIA Scoping process - determined through a combination of desk and field-based survey work, responding to the output of Zone of Theoretical Visibility (ZTV) modelling, and mapping of landscape and visual sensitivities.
- 10.125 The LVIA has included a review of planning policies from national to local level of relevance to landscape and visual matters; the content and recommendations of published landscape character assessment or studies; the existing key features and character of the Site and its context; a representative range of views towards the Site and Proposed Development. In relation to landscape character, the LVIA has made reference to the Wokingham Borough Landscape Character Assessment (2019).
- 10.126 The Site is located at a Borough level within LCA J2 Arborfield Cross and Barkham Settled and Farm Clay, exhibiting some characteristic features associated with its host LCA including prominence of agricultural land, undulating topography, shallow wooded valley and a strong wooded context provided by the mature hedgerows and in-field trees.
- 10.127 Views of the Site range from indirect / filtered to direct / open views from adjacent residential properties, public rights of way, public open spaces and the surrounding road network.
- 10.128 Landscape and visual effects have been assessed following three stages: during construction; immediately on completion (Year 0); and during operation after establishment of landscape mitigation (Year 15) as well as for an alternative assessment scenario based on reduced numbers of proposed residential units.
- 10.129 The LVIA draws together the landscape and visual baseline information and summarises the key mitigation and enhancement measures, forming part of the iterative design process and maximising the potential for positive influence of the Proposed Development on its surrounding context.
- 10.130 Effects on landscape character would be considered as **Minor Adverse** (not significant) during construction and immediately on completion for areas directly adjacent to and up to 500m of the Site, with all other landscape effects considered Neutral in the long term.
- 10.131 Effects on the landscape character of the Site are considered Temporary **Minor-Moderate Adverse** during construction, reducing to Short Term **Minor Adverse** on completion and improving to Long Term **Minor Beneficial** on establishment of the Green Infrastructure Framework / landscape mitigation.
- 10.132 Visual effects at the construction stage and on completion (Year 0) have been assessed to be Temporary and Short Term **Moderate - Major Adverse** to residents that directly abut the Site on Langley Common Road and at Field House. All other landscape and visual effects during construction would be insignificant, with most effects being **Negligible or Minor**.
- 10.133 Visual effects during operation, following establishment of landscape mitigation (Year 15) have been assessed to be Long Term **Moderate Adverse** to residents that directly abut the Site on Langley Common Road and at Field House, with all other Long Term visual effects considered to be insignificant / most being **Negligible**.

10.7: Summary Table of Landscape/Visual Residual Effects

Description of Likely Significant Effects	Significance	Description of Mitigation	Description of Residual Effects	Significance
Demolition/Construction Phase				
Viewpoint 1a: Field Farm House; Adjacent residents;	Moderate-Major Adverse	Delay removing existing vegetation as long as possible; Protect vegetation to be retained; Site hoardings to reduce	For the LVIA the construction effects would take account of mitigation set out in the	Moderate – Major Adverse

Views of construction activities		intervisibility of construction works but designed to minimise its own visual impact; manage lighting.	CEMP. Residual effects are as assessed.	
Viewpoint 5: Langley Common Road; Adjacent residents; Views of construction activities	Moderate-Major Adverse	Delay removing existing vegetation as long as possible; Protect vegetation to be retained; Site hoardings to reduce intervisibility of construction works but designed to minimise its own visual impact; manage lighting.	For the LVIA the construction effects would take account of mitigation set out in the CEMP. Residual effects are as assessed.	Moderate – Major Adverse
Operational Phase				
Viewpoint 1a: Field Farm House; Adjacent residents; Views of Proposed Development	Moderate-Major Adverse	Residential development set back from Langley Common Road behind strategic green infrastructure along north-western boundary, structural planting along boundaries and appropriate design and green infrastructure within development	For residential receptors in longer term, the buffer and tree planting within and along boundaries of the Site will have matured to provide additional screening and filtering of views towards the Development.	Moderate Adverse
Viewpoint 5: Langley Common Road; Adjacent residents; Views of Proposed Development	Moderate-Major Adverse	Residential development set back from Langley Common Road behind strategic green infrastructure along north-western boundary, structural planting along boundaries and appropriate design and green infrastructure within development	In long term establishment of structural planting along boundaries with Langley Common Road and internally within the Site would assist in softening and blending built form and its lighting into immediate context, however, a large proportion of receptors baseline view would be permanently lost and there would remain a noticeable change.	Moderate Adverse
Cumulative - Construction				
N/A				
Cumulative - Operation				
With Lodden Garden Village			Increased urbanisation within western part of LCA J2	Minor adverse

11 WATER/DRAINAGE/FLOOD RISK

INTRODUCTION

- 11.1 This chapter has been prepared by Ardent Consulting Engineers. It identifies key water resources and sensitivities and addresses the direct and indirect effects of the Proposed Development on these resources. The chapter also examines the potential for flood risk and is accompanied by the Flood Risk Assessment and Drainage Strategy (**Technical Appendix 11.1**). The need for mitigation measures has been addressed and any residual effects are identified.

POLICY CONTEXT

Legislation

Flood and Water Management Act (2010)

- 11.2 The Flood and Water Management Act (FWMA) 2010 received royal assent on 8th April 2010 and is largely aimed at delivering the recommendations of the Pitt Review following the 2007 floods by improving flood risk management and enhancing water resource management.
- 11.3 The FWMA defines clearer roles and responsibilities for the implementation of the SuDS in developments, by requiring drainage systems to be approved against a set of national standards. The Act requires a Lead Local Flood Authority (LLFA) to develop, maintain, apply, and monitor a strategy for the local flood risk management in its area.
- 11.4 In December 2014, the Government set out changes to planning that apply for major developments from 06 April 2015. This change confirmed that in considering planning applications, local planning authorities (LPA) should consult the relevant LLFA on the management of surface water, satisfy themselves that the proposed minimum standards of operation are appropriate and ensure through the use of planning conditions or planning obligations that there are clear arrangements in place for ongoing maintenance over the lifetime of the development.
- 11.5 In March 2015, the Government confirmed that as of the 15 April 2015, LLFAs would become a statutory consultee on all major planning applications.
- 11.6 In 2019, the Act's provisions on SuDS were enhanced, with a focus on improving surface water management through better design of urban drainage systems. Local authorities were given more authority to implement SuDS and ensure their adoption in new developments.

Planning Policy

National Planning Policy Framework (February 2025)

- 11.7 The NPPF was revised most recently in February 2025, where paragraphs 170 to 182 inclusive, establish the planning policy relating to flood risk management and surface water drainage.
- 11.8 The NPPF states that all plans should apply a sequential, risk-based approach to the location of development – taking into account all sources of flood risk and the current and future impacts of climate change – to avoid where possible, flood risk to people and property. They should do this and manage residual risk, by –
- applying the sequential test, and if necessary, the exception test as set out below,
 - safeguarding land from development that is required for current and future flood management,
 - using opportunities provided by new development and improvements in green and other infrastructure to reduce the causes and impacts of flooding (making as much use as possible of natural flood management techniques as part of an integrated approach to flood risk management, and
 - where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to relocate development including housing, to more sustainable locations.

Planning Practice Guidance – Flood Risk and Coastal Change

- 11.9 The Technical Guide to the NPPF was superseded by the PPG in March 2014, which was most recently updated in September 2025. The PPG provides guidelines for planning authorities to consider when addressing flood risk. It aims ensure that developments are safe from flooding over the course of its lifetime. The main considerations include –

- Defining the Flood Risk Zones including Flood Zones 1 (low risk), 2 (medium risk), and 3 (high risk) and outlining flood risk reduction measures, including the use of SuDS to reduce surface water flood risks and improve water management, as well as highlighting the use of flood resilient and resistant design,
- Taking flood risk into account in the preparation of strategic policies,
- Setting out the criteria for when new developments require a site-specific flood risk assessment to ensure that flood risk is assessed and where necessary, mitigated against,
- Guidance on the sequential approach to the location of development, as well as when developments should undertake the Sequential Test, prioritizing development in areas of lower flood risk. If there are no suitable sites in these areas, the Exception Test must be applied, ensuring that flood risk can be managed and that the development has wider sustainability benefits,
- The role of the Environment Agency and LLFAs in assessing planning applications,
- Addressing residual flood risk, including guidance on emergency plans, and
- Addressing sustainability and climate change adaptation. Where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to relocate development, including housing, to more sustainable locations.

11.10 In terms of reducing flood risk overall, the PPG states that this can be achieved, for instance, from the layout and form of development, including green infrastructure and the appropriate application of sustainable drainage systems, or where appropriate through designing off-site works required to protect and support development in ways to benefit the area more generally.

Wokingham Borough Council Adopted Core Strategy Development Plan Document (January 2010)

11.11 The Wokingham Borough Council Core Strategy was adopted in January 2010, guides development and sets out the Council's vision for the Borough until 2026.

11.12 The key policy relating to relating to flood risk and drainage is -

- **Policy CP1** – Sustainable development - Planning permission will be granted for development proposals that ensure the provision of adequate drainage, as well as avoid increasing (and where possible reduce) risks of or from all forms of flooding (including from groundwater).

11.13 Work is underway on a new local plan – the Local Plan Update – which will put in place a new planning strategy for the period to 2040. Once adopted, it will replace the current Core Strategy and Managing Development Delivery Local Plans. The Local Plan Update will include a vision, objectives and strategy for development and growth in the Borough.

11.14 The Examination into the Local Plan review commenced in November 2025.

Wokingham Borough Managing Development Delivery Local Plan (February 2014)

11.15 The Key policies relating go Flood Risk & Drainage are -

- Policy CC09: Development and Flood Risk,
- Policy CC10: Sustainable Drainage.

Wokingham Borough Sustainable Design and Construction Supplementary Planning Document (May 2010)

11.16 The Sustainable Design and Construction Supplementary Planning Document (SPD) provides a comprehensive approach to considering sustainable design and construction in new development. The SPD provides guidance to help improve the sustainability performance of buildings and spaces through their design and subsequent use.

11.17 Sustainability Issue 5 – Flood Risk Management requires -

- Development be designed to be resilient to flooding as appropriate. Consider change in flood risk over lifetime of development because of climate change. Consider all sources of flood risk,
- Complying with Environment Agency Flood Risk standing advice and the Council's SFRA,
- Producing Flood Risk Assessment and Surface water Drainage Strategy where required,
- Run-off from site must not increase as a result of development, and where possible it should be reduced,

- SuDS are expected to be used where appropriate,
- Green/ brown roofs should be considered on all buildings where appropriate,
- Developments with an existing or proposed garden or other green area should look to include provision for rainwater harvesting for irrigation purposes.

Wokingham Borough Council Level 1 Strategic Flood Risk Assessment (May 2023)

- 11.18 The Wokingham Borough Council Level 1 Strategic Flood Risk Assessment (SFRA) provides an overview of flood risk from all potential sources and to inform flooding policies including the allocation of land for development. The report provides an assessment of the level of flooding geographically and outlines the constraints of flooding on future development proposals.
- 11.19 The Level 1 SFRA confirms that within the study area, the primary fluvial flood risk is along the River Thames, River Loddon, River Blackwater, Emm Brook, Foudry Brook, and their main tributaries. The fluvial flood extents cover the majority of the western and northern border of the Borough and splits the area through the centre along the path of the River Loddon, which flows in a north-easterly direction through the Borough.
- 11.20 Regarding surface water flooding, there are a number of prominent overland flow routes that largely follow the topography of the watercourses within the Borough. There are also considerable flow routes following the roads through the main urban areas of Wokingham, Earley and Lower Earley, and Finchampstead which, alongside isolated areas of ponding, may affect many properties across these settlements.
- 11.21 In general, areas with greater than 50% susceptibility to groundwater flooding are along the main flow routes of the River Thames, River Loddon, River Blackwater, and Foudry Brook. There is a potential risk of flooding from reservoirs both within Wokingham Borough and those outside.
- 11.22 It is also noted that areas at risk of flooding today are likely to become at increased risk in the future and the frequency of flooding will also increase in such areas, because of climate change.

Wokingham Borough Council Local Flood Risk Management Strategy (April 2015)

- 11.23 The Wokingham Borough Council Local Flood Risk Management Strategy (LFRMS) focuses on local flood risk sources and explain the ways in which the Council will ensure flood risk is managed in an integrated and effective way. The Strategy provides a single consistent reference point for flood risk management in the Borough.
- 11.24 Its primary goals are to reduce the potential for flooding, improve resilience, and ensure public safety, while supporting sustainable development and protecting the local environment. It provides a structured approach to managing flood risks, focusing on prevention, resilience, and collaboration with the community and partners to protect people and property from flooding.

Wokingham Borough Council Preliminary Flood Risk Assessment (June 2011)

- 11.25 The Wokingham Borough Council Local Preliminary Flood Risk Assessment (PFRA) provides an assessment of past flood risk based on historical data sourced from the Council, the Environment Agency, Thames Water, and local Parish Councils, Town Councils and Residents Associations. Four historical events were identified within Wokingham for inclusion in the PFRA spreadsheet at the time of publication. These occurred in 1993, 2000, 2003 and 2007.
- 11.26 An assessment of future flood risk is provided based on modelling data from the Flood Map for Surface Water and Areas Susceptible to Groundwater Flooding, with analysis of consequences based on the National Receptor Database data.

METHODOLOGY

Baseline characterisation

- 11.27 The study area considers all sensitive receptors within the Site redline boundary. Downstream locations within 1km of the Site have been considered, particularly in relation to flood risk due to the potential impacts the Proposed Development may have on the environment in close vicinity of the Site.

Assessment methodology

- 11.28 This Chapter of the EIA has been informed by a site-specific Flood Risk Assessment (FRA) and Sustainable Drainage Strategy. The assessment considers risk of flooding to and from the Proposed

Development, from fluvial, surface water, groundwater and sewers and other artificial sources, during the construction and operation phases.

- 11.29 A flood risk desktop study, Phase 1 Desk Study and consultation has been undertaken and the following documents reviewed to form the basis of the assessment of likely significant effects on water resources, drainage, and flood risk -
- British Geological Survey (BGS) 1:50,000 scale geological mapping,
 - Open-source Flood Risk mapping and Groundwater Vulnerability Maps,
 - Site-specific flood risk data and models provided by the EA,
 - Phase 1 Desk Study.
- 11.30 The main relevant publications reviewed are -
- Wokingham Borough Council Strategic Flood Risk Assessment (2021),
 - Wokingham Borough Council Local Flood Risk Management Strategy (2014),
 - Wokingham Borough Council Flood investigation reports for winter 2013-14 (Arborfield Appendix) (2016).
- 11.31 In addition, consultation have been undertaken with the following organisations -
- Environment Agency (EA), and
 - Thames Water Utilities Ltd (TWUL/TW (Thames Water)).
- 11.32 The methodology used to identify the water resources and flood risk conditions at the Site involved the following stages -
- Identification of potential surface water and groundwater receptors and determination of their current quality, trends in quality and any links between receptors,
 - Determination of the short-term, medium-term and long-term effects of the Proposed Development on those receptors during construction and operational phases including an assessment of any residual effects following mitigation,
 - Evaluation of significance of the effects relative to the importance and magnitude of any potential change on the receptors, and
 - Identification of suitable and appropriate mitigation measures, for all phases of the Proposed Development and an indication of how these measures will affect the significance of any effects (i.e. the residual effects).

Assessment criteria

- 11.33 The assessment of flood risk and hydrology follows the guidance given in the Department for Transport (DfT) document 'Environmental Impact Appraisal' TAG UNIT A3 (2022).

Receptor sensitivity/ importance

- 11.34 The importance and sensitivity of receptors (classed as high, medium, low or negligible) has been determined in accordance 'Indicators of quality' given in TAG UNIT A3 (2022) Table 13.

Magnitude of impact

- 11.35 The magnitude of potential impact (classed as major, moderate, minor, or negligible) is determined in based on the assessor's professional judgement based upon the criteria in Table 11.1 below.

Table 11.1: Magnitude of Potential Impact

Magnitude of Impact	Criteria	Examples
Major	Results in loss of resource/receptor	Loss of European Commission (EC) designated Salmonid fishery; Change in WFD classification; Compromised employment source; Loss of flood storage/increased flood risk;

		Pollution of potable source of abstraction; and Considerable effect on a significant soil or geological unit.
Moderate	Results in impact on integrity of resource/receptor or loss of part of resource	Loss in productivity of a fishery; Contribution of a significant proportion of the effluent in the receiving river, but insufficient to change its WFD classification; Reduction in the economic value of the feature; and A limited effect on a significant soil or geological unit.
Minor	Results in minor impact on resource/receptor	Measurable change in attribute, but of limited size and/or proportion
Negligible	Insufficient magnitude to affect the use/integrity on resource/receptor	Discharges to watercourse but no significant loss in quality, fishery productivity or biodiversity; No significant effect on the economic value of the feature; No increase in flood risk; and No loss in integrity of ground conditions.

Significance Criteria

- 11.36 The significance of a potential impact (classed as major, moderate, minor or negligible) is determined by the interaction of the sensitivity of resource/receptor and magnitude of impact. An impact can be temporary, medium, or long term, with impacts quantified as being short-term (0-5 years), medium-term (5-10 years) or long-term (>10 years).
- 11.37 The significance criteria also takes into account -
- The duration involved,
 - The reversibility of the impact, and
 - The number of receptors.
- 11.38 The significance effects are classified as Beneficial, Adverse or Negligible -
- **Beneficial:** A beneficial/positive effect on water resources,
 - **Negligible:** An imperceptible effect to water resources,
 - **Adverse:** A detrimental/negative effect on water resources.
- 11.39 The Significance Level is classified as Major, Moderate, Minor or Negligible, with their definitions below -
- **Major:** A minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible/detectable but not material. The underlying character/composition/attributes of the baseline condition will be similar to the pre-development circumstance/situation,
 - **Moderate:** Loss or alteration to one or more key elements/features of the baseline, such that the post development character/compositions/attributes will be materially changed,
 - **Minor:** A minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible/detectable but not material. The underlying character/composition/attributes of the baseline condition will be similar to the pre-development circumstance/situation,
 - **Negligible:** Insufficient magnitude to affect the use/integrity on resource/receptor.
- 11.40 The impact of significance matrix for estimating the significance of any potential changes is set out in **Table 11.2**.

Table 11.2: Criteria for Estimating the Significance of Impacts

		Receptor (Sensitivity / Value / Importance)			
		Very High	High	Medium	Low
Nature of Effect (Magnitude / Probability / Reversibility etc)	High	Major	Major	Moderate	Negligible
	Moderate	Major	Moderate	Minor	Negligible
	Low	Moderate	Minor	Minor	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

- 11.41 Potential impacts that are determined as being Moderate to Major are classed as 'significant' effects. Where an effect has been anticipated to be of negligible to minor, these are classed as 'insignificant' effects.

BASELINE CONDITIONS

- 11.42 In order to assess the potential effects of the Proposed Development, it is necessary to determine the environmental conditions, resources and sensitive receptors that currently exist on the Site and in the surrounding area. These are known as 'baseline conditions.'

Hydrology

- 11.43 The Site lies in the catchment of Barkham Brook (a tributary of the River Loddon). The Barkham Brook runs through the Site while Blackwater River is located approximately 3.5km south of the Site and the Loddon River approximately 3km to the west of Site. A small watercourse is running south to north near the Site's western boundary. This outflows to the Barkham Brook near the Site's northern boundary. Additional surface water features comprise of a lake located to the south of the Site near Barkham Brook. The Barkham Brook is considered of medium importance for the discharge of surface water runoff, as is the River Loddon into which the discharge ultimately outfalls.
- 11.44 Longmore Lake is located approximately 1.2km southeast of the Site.
- 11.45 In addition to the features mentioned above, a number of watercourses and water bodies are located within the catchment of the Loddon and tributaries Management Catchment and within the Study Area. These are not in direct hydrological connectivity with the Site.

Tidal Flood Risk

- 11.46 The River Loddon, which Barkham Brook and Blackwater River flow into, is a tributary of the River Thames. The Loddon joins the River Thames near the village of Wargrave, north-east of Reading. The tidal limit of the River Thames is located at Teddington, more than 30km downstream of the Loddon confluence, and so the Site is therefore considered to be at no risk of tidal flooding, and further consideration of this risk is not considered necessary. The tidal flood risk to the Site is considered to be of low importance.

Fluvial Flood Risk

- 11.47 Following review of the data obtained from the EA, and their online Flood Map for Planning it is concluded that the majority of the Site lies in Flood Zone 1. Flood Zone 2 and 3 areas can be found on the south eastern part of the Site and are associated with the floodplain of Barkham Brook. These Flood Zones have been produced by the EA in the context of providing flood mapping for the largest watercourses, at catchment scale.
- 11.48 Site specific hydraulic modelling was undertaken by AECOM as part of the Arborfield Garrison Site, located to the south of the Site. This model and its outputs were considered when assessing the Barkham Square Site too. This is described in more detail within the Flood Risk Assessment (see **Technical Appendix 11.1**).

- 11.49 The fluvial flood risk to the Site is considered to be of low importance as the modelling has demonstrated that the developable areas are not considered to be at risk of flooding from Barkham Brook.

Surface Water Flood Risk

- 11.50 The EA Risk of Flooding from Surface Water maps show that the Site is predominantly in an area that has a 'very low' risk of flooding. There are areas shown as being 'low' to 'high' risk which are attributable to the Barkham Brook, existing watercourse and site topography.
- 11.51 The Proposed Development layout and surface water drainage strategy will be designed to minimise surface water flood risk. It will incorporate areas of open green space in areas identified as being at risk of flooding and will ensure that no surface water flooding occurs across the Site for events up to and including the 1-in-100-year return period plus 40% allowance for climate change.
- 11.52 Overall, due to the Site's proposed use, and the nature of the existing surrounding areas, the risk of pluvial flooding associated with the Proposed Development is considered 'low'.

Groundwater Flood Risk

- 11.53 Flooding from groundwater can cause waterlogging of sites for extended periods during construction and operation.
- 11.54 The Phase 1 Desk Study undertaken for the Site identifies that there is no detailed available information regarding the depths to groundwater; however, the groundwater level is likely to be subject to seasonal variations. The BGS borehole records report being dry during boring. The EA has classified the underlying strata (Alluvium) as a Secondary A Aquifer. The London Clay Formation is an Unproductive stratum and the Bagshot Formation is classified as a Secondary A Aquifer. It is possible that springlines will be present at the cohesive granular interface. The Ambient Risk Analytics dataset also indicates that the Site is at negligible to moderate risk of groundwater flooding, with the lowest risk areas confined to topographical highs.
- 11.55 There are no recorded groundwater abstraction licenses within 500m of the Site. The information available at this stage suggests a groundwater table at depth.
- 11.56 The EA records do not indicate any historical groundwater flooding on Site. Consequently, coupled with the findings of the Phase 1 Desk Study, the Site is considered to be at low risk of flooding from groundwater; groundwater flooding to the Site is considered to be of low importance.

Existing Drainage Infrastructure

- 11.57 Discussions have been held with TW, and the foul drains and sewer records have been obtained. There is an existing sewer network to the east of Barkham Brook which flows south to north. Details of the TW sewer assets are contained in the Surface Water Drainage Strategy (see **Technical Appendix 11.2**).
- 11.58 The TW assets are considered of high importance for the transfer of wastewater.

Flooding from Artificial Sources

- 11.59 EA data indicates that the Site is located to the north-west of an impounded water body called Longmoor Lake. The Environment Agency Risk of Flooding from Reservoir maps show that the eastern section of the Site is potentially at risk of flooding if the impoundment were to fail.
- 11.60 The EA states that a failure incident is very unlikely, as large reservoirs (over 10,000m³ in volume), which the lake can be considered to be due to its impoundment, are supervised and inspected by reservoir panel engineers. The consequences of a failure of Longmoor Lake reservoir would be significant although as indicated above the probability of such an event occurring is very low.
- 11.61 There are no other sources of impounded water bodies or artificial flood risk sources judged to be a risk to the Site. Flooding from Artificial Sources is considered to be of low importance.

Water Quality

- 11.62 According to the South East Rivers Trust 'State of our Rivers 2024 Catchment Crib Sheet', the Barkham Brook is classified as Medium importance/sensitivity.
- 11.63 According to the EA Catchment Data Explorer, the Barkham Brook is not designated an artificial or heavily modified water body. Its Ecological Status was classified as moderate in 2019 and 2022. Biological quality elements and physio-chemical quality elements were generally classified as Moderate. Hydromorphological Supporting Elements were classified as Good while Specific pollutants were found to be High.
- 11.64 Barkham Brook's Chemical status is reported as 'Fail'. However, this is because for the 2019 assessment of chemical status, some classification methods have changed and the evidence base has increased. Due to these changes, all water bodies now fail chemical status and this assessment is not comparable to previous years assessments.
- 11.65 The water quality is of high importance as there are water quality objectives which need to be achieved under a specific timeframe.

Contamination

- 11.66 The Phase 1 Desk Study undertaken for the Site identified various tanks in the surrounding area which could be potential sources of contamination. However, migration potential is considered to be very low given the underlying geology.
- 11.67 Historical sewage works to the immediate south of the Site were also identified which could be a potential source of contamination. An off-site rifle range and builders yard in close proximity to the Site could also be a potential source of metals and hydrocarbon contamination in near surface soils.

Nature Conservation and Fisheries

- 11.68 Several traditional orchard sites are designated adjacent to the Site. Traditional orchards are a UK BAP Priority Habitat, are hotspots for biodiversity and thus are managed in a low intensive way. Other local designated sites include The Coombes Ancient Woodland and LWS, Rook's Nest Wood Country Park LWS, Longmoor Bog Site LNR) and California Country Park LWS. All of these sites provide many ecological and recreational benefits to the neighbourhood.
- 11.69 The River Loddon has an exceptionally good quality of fish across the western side of Dinton Pastures Country Park approx. 5km north west of the Site. Barbel, Chub, Perch and Pike can be found within the river. White Swan Lake, located at Dinton Pastures Country Park is stocked with top quality Carp, Rudd and Roach. Black Swan Lake, adjacent to White Swan Lake, has been continually stocked for the past 20 years and is notable for surprising anglers with many unknown fish.
- 11.70 Longmoor Lake, located to the south east of the Site, is stocked as a general coarse fishery with good numbers of carp, pike, perch and roach and some tench.
- 11.71 The above nature conservation areas and fisheries are considered to be of medium importance due to their distance from the Site.

Water Supply Infrastructure

- 11.72 Based on the TW Asset maps infrastructure is present along Barkham Road and Barkham Street. Although not a surface water body, the TW water supply network is considered to be of high importance for the supply of water locally and regionally.

IMPACTS

- 11.73 Potential impacts of the Proposed Development on the water environment, prior to mitigation, have been identified. These are presented below. Potential pre-mitigation impacts have been split into those that may occur during construction and those that may occur during the operation of the Proposed Development.

Construction Impacts

- 11.74 Examples of potential pollution sources, pathways and receptors in the context of water resources for the construction phase are presented in Table 11.3 below.

Table 11.3: Proposed Development: Potential Pollution Sources, Pathways and Receptors

Sources
Pollution arising from site uses
Physical disturbance of aquifers and groundwater flows
Flood risk and surface water runoff
Water supply and demand
Wastewater Generation
Contamination from in-situ materials
Existing contaminated groundwater
Pathway
Creation of direct preferential pathways to ground and surface water
Lateral migration of groundwater
Site layout and topographical (hardstanding, surface water drains)
Barkham Brook
Thames Water sewerage infrastructure
Receptors
Barkham Brook / Loddon River / onsite surface watercourse / onsite pond
Groundwater
Traditional Orchard Sites / The Coombes ancient woodland and Local Wildlife Site (LWS)
Thames Water Infrastructure – Drainage and Water Supply Networks

Preferential Pathways

- 11.75 Pathways include infiltration, vertical and lateral preferential pathways and surface water runoff. Due to the lack of shallow groundwater, the main preferential pathway across the Site is via the natural topography towards the Barkham Brook. Therefore, a leakage from damage to the construction equipment/vehicles could potentially have a low magnitude effect on the Barkham Brook and subsequently the River Loddon water quality and biodiversity. The Traditional Orchard Sites and the Coombes LWS could also be impacted, due to their location downstream of the Site. The effect has been classed as moderate magnitude, due to the short-term, temporary nature of the effect, and its magnitude (i.e. localised leaks). This produces a potential effect of **Minor Adverse** significance on the medium sensitivity receptor.

Suspended Sediment

- 11.76 The release of suspended sediment from excavations would have a negligible impact upon the Site alone. However, coupled with the preferential pathway of surface water runoff this could cause increased sediment loading within the Barkham Brook and on the Site surface watercourse which could have a moderate magnitude adverse effect upon the quality of Barkham Brook and River Loddon (medium importance). This would produce a **Minor Adverse** significance impact.

Oils and Hydrocarbons

- 11.77 The release of soils and hydrocarbons through accidental spillage from plant or fuel used on the Site would have a moderate adverse effect on surface water resources in the vicinity of the Site, which are classed as 'medium' importance, giving a potential impact of **Minor Adverse** significance.

Concrete and Cement Products

- 11.78 The release of concrete and cement products could have an effect of moderate magnitude on the Barkham Brook and River Loddon water quality. This could result in a pre-mitigation effect of moderate adverse magnitude on a medium importance receptor, giving a **Minor Adverse** significance impact on the Barkham Brook and the Traditional Orchard Sites and the Coombes LWS quality and biodiversity.

Disturbance to Groundwater

- 11.79 No groundwater has been encountered during the Phase 1 Desk study. The impact on groundwater is considered to be **Negligible**.

Disturbance to Contaminated Land

- 11.80 Although some potential sources of contamination were identified during the Phase 1 Desk Study, there was no significant evidence of contamination on the Site. It is therefore considered unlikely that any works undertaken during the construction phase will disturb any contaminated land. The magnitude of the construction phase and its impact is therefore considered **Negligible**.

Flood Risk and Surface Water Runoff

- 11.81 The Site is currently located in Flood Zone 3 and is therefore identified as being an area at high risk of flooding. However, the Proposed Development and drainage features will be located outside the flood risk area. Therefore, the actual flood risk from fluvial and surface water sources posed to the Site is considered to be low.
- 11.82 During the construction phase, with workers situated on the Site, the general pre-mitigated risk/effect is considered to be of low probability, resulting in an impact of **Moderate Adverse** significance. When considering works close to the watercourse, the pre-mitigation magnitude of the risk is considered to be moderate resulting in a potential impact of **Major Adverse** significance.
- 11.83 Impermeable areas will be introduced to the Site and therefore potentially increase the rate of discharge into the Barkham Brook. The phasing strategy will ensure that the required drainage infrastructure is in place prior to the installation of impermeable areas and therefore the magnitude of the effect on local flood risk will be **Negligible**.

Water Supply and Demand

- 11.84 Processes during the construction phase of the Proposed Development, which may require additional volumes of water supply, include sanitary facilities for sites staff and water supply for wheel washing and washing down of construction areas. This additional water requirement may cause a temporary

increase in demand, having a low magnitude of effect on water supply infrastructure locally and therefore is assessed to be an impact of **Minor Adverse** significance.

Wastewater Generation

- 11.85 Wastewater generation on construction sites includes effluent from sanitary facilities provided onsite and sediment laden water from washing down and wheel wash facilities. It is expected that foul water generated at the Site will be drained via the existing TW foul water drains in the surrounding area, following treatment, if required. If dewatering is required during excavations, then dewatering effluent may be discharged to the TW network, following sediment removal. The construction activities are likely to result in an increase in the volumes of wastewater generated. An increase in wastewater volumes generated can increase pressure on the local sewer network capacity and downstream Waste Water Treatment Plant (WWTP).
- 11.86 Best-practice construction methods such as water storage and recycling will be implemented to reduce both potable and wastewater demands. Consent from TW will be required prior to any discharge into their network. This is therefore considered to be a low magnitude effect and therefore result in an impact of **Minor Adverse** significance on the TW drainage infrastructure.
- 11.87 A summary of all effects on the identified receptors during the construction phases is shown in Table 11.4

Table 11.4: Summary of Construction Effects

Sources	Temporary (Short/Medium/Long) /Permanent	Significance Effects (Adverse/Beneficial) (Major/Moderate/Minor/Negligible)	–
Preferential Pathways	Temporary – Short	Minor Adverse	
Suspended Sediment	Temporary – Short	Minor Adverse	
Oils and Hydrocarbons	Temporary – Short	Moderate Adverse	
Concrete and Cement Products	Temporary – Short	Moderate Adverse	
Disturbance to Groundwater	Permanent	Negligible	
Disturbance of Contaminated Land	Permanent	Negligible	
Flood risk and surface water runoff	Temporary – Short	Minor Adverse	
Water Supply and Demand	Temporary – Short	Minor Adverse	
Wastewater Generation	Temporary – Short	Minor Adverse	

Operational Impacts

Pollution from Site Uses

- 11.88 Typical sources of pollution from developments with residential uses include oil leaks and petrol spillages from loading/unloading facilities, which may cause polluted run-off from the site and the discharge of foul water from sanitary facilities off site. The use of chemicals on landscaped areas, such as herbicides and pesticides, may provide an additional source of contamination to runoff leaving an effect of low magnitude with an impact of **Minor Adverse** significance to watercourses and the Traditional Orchard Sites and the Coombes LWS quality and biodiversity.

Physical Disturbance of Aquifers and Groundwater Flows

- 11.89 The Proposed Development does not include any basements that could give rise to effects on groundwater levels. The Site is not within a groundwater abstraction Source Protection Zone (SPZ). Considering the use of the Proposed Development (residential dwellings), it is considered that it will have a **Negligible** impact on the disturbance or contamination of groundwater flows.

Flood Risk and Surface Water Runoff

- 11.90 The Site is currently located in Flood Zone 3 and is therefore identified as being an area at high risk of flooding. However, the Proposed Development will be location outside the flood risk areas. Runoff from the Site will be minimised by utilising SuDS measures. The peak discharge rate from the Site will be reduced to the equivalent Greenfield rates through a number of outfalls.
- 11.91 Overall, the Proposed Development will have a negligible effect on flood risk, resulting in a **Minor Adverse** impact on the flood risk associated with the Site.

Water Supply and Demand

- 11.92 Water demand for the Proposed Development will be met by the existing TW supply network. The development of the Site will increase the current water demand. This is therefore considered to be a moderate magnitude of effect and considered to have a **Major Adverse** impact on the TW water supply demand.

Wastewater Generation

- 11.93 The Proposed Development will increase the generation of wastewater for discharge to the TW foul water sewers. This is considered to have a **Major Adverse** impact upon the TW drainage network capacity.

Contamination from In-Situ Materials

- 11.94 The introduction of materials such as concrete for the foundations and tarmacadam for the road has the potential to generate contaminants in the Site. Although there is limited potential for infiltration in the Site, it is considered that the introduction of these materials could have a **Minor Adverse** impact should they be able to discharge directly into the Barkham Brook and onsite surface watercourse.
- 11.95 A summary of the effects on the sources during the operational phases is shown in Table 11.5

Table 11.5: Summary of Operational Effects

Sources	Temporary (Short/Medium/Long/Permanent)/ Permanent	Significance Effects (Adverse/Beneficial) – (Major/Moderate/ Minor/Negligible)
Pollution arising from site uses	Permanent	Minor Adverse
Physical disturbance of aquifers and groundwater flows	Permanent	Negligible
Flood risk and surface water runoff	Permanent	Minor –Adverse
Water supply and demand	Permanent	Major –Adverse
Wastewater Generation	Permanent	Major –Adverse
Contamination from In-Situ Materials	Permanent	Minor Adverse

MITIGATION

Construction Mitigation

- 11.96 The following section indicates the proposed mitigation measures for managing the potential effects of the Proposed Development.

Preferential Pathways

- 11.97 Should any preferential pathways be found, or opened up, during the construction period best practice measures will be put in place to protect waterbodies and ditches within the Site as outlined below.

Suspended Sediment

- 11.98 A number of best practice measures will be employed during construction to prevent the release of suspended sediments including -
- Site access points will be regularly cleaned to prevent build-up of dust and mud,
 - Earth movement will be controlled to reduce the risk of silt combining with the Site runoff,
 - Properly contained wheel wash facilities will be used (where required) to isolate sediment rich runoff,
 - Cut-off ditches and/or geotextile silt-fences will be installed around excavations, exposed ground, stockpiles to prevent the uncontrolled release of sediments from the Site,
 - Sediment traps will be required on all surface water drains in the surrounding region,
 - Silty water abstracted during excavations will be discharged to the settlement tanks. Cleaned runoff will be discharged through the existing foul sewer drains. A discharge consent detailing volumes and rates of discharge will be agreed with TW prior to the commencement of works, if necessary.

Oils and Hydrocarbons

- 11.99 Measures will be taken to protect controlled waters and the TW drainage network from the release of oils and hydrocarbons, which would otherwise have a moderate adverse effect on surface water resources in the vicinity of the Site. These measures comprise -
- Wherever possible, plant and machinery will have drip trays beneath oil tanks/engines/gearboxes/hydraulics which will be checked and emptied regularly and correctly disposed of via a licensed waste disposal operator,
 - Oils and hydrocarbons will be stored in designated locations with specific measures to prevent leakage and release of their contents, including the siting of the storage area away from the drainage system on an impermeable base, with an impermeable bund that has no outflow and is of adequate capacity to contain 100% of the contents. Valves and trigger guns will be protected from vandalism and kept locked when not in use, and
 - There is a risk of accidental spillage of oils and fuels. An emergency spillage action plan will be produced, which site staff will have read and understood. Onsite provisions will be made to contain a serious spill or leak through the use of booms, bunding and absorbent material.

Concrete and Cement Products

- 11.100 A number of onsite precautions will be taken to reduce the potential magnitude of an effect. These include: -
- As a standard the majority of concrete used will be pre-mixed and delivered from an offsite source, thereby negating the need to mix concrete onsite and reducing the creation of alkaline wastewater onsite,
 - Wherever possible, any mixing and handling of wet concrete that is required onsite will be undertaken in designated areas, and
 - A designated area will be used for any washing down or equipment cleaning associated with concrete or cementing processes and facilities provided to remove sediment prior to disposal of foul water.

Disturbance to Groundwater

- 11.101 No groundwater is anticipated at shallow depths across the Site. However, should groundwater be struck during any piled activities, best practice measures shall be put in place to ensure that the groundwater is not adversely affected.
- 11.102 Should dewatering be required, appropriate licenses and approvals should be obtained from the Council for discharge of the groundwater to surface waterbodies.

Disturbance to Contaminated Land

- 11.103 Although some potential sources of contamination were identified during the Phase 1 Desk Study, there was no significant evidence of contamination on the Site. Therefore, no mitigation measures are considered necessary.

Flood Risk and Surface Water Runoff

- 11.104 The Site is located in Flood Zone 3. However, there is no development proposed within the areas at risk of flooding. The risk is therefore reduced to a negligible risk during the construction process.

Water Supply and Demand

- 11.105 The mixing of concrete (which requires a significant volume of water) will be undertaken offsite and therefore will not contribute directly to the Proposed Development's supply demand.
- 11.106 It is expected that water supply to the Site during the construction phase will be provided by the existing TW network in the surrounding area, and that the supply for construction purposes will require a Building Water Supply licence from TW. The effects on water supply at the Site are likely to be of low magnitude resulting in a negligible effect.

Wastewater Generation

- 11.107 The use of water efficient fixture and fittings and the use of mitigation measures to prevent silty water ingress can help to reduce the effect on the TW foul drainage network by reducing the volume discharged and improving water quality.
- 11.108 Therefore, based on the above, it is expected that the effect of construction wastewater generation on TW sewer infrastructure will be of low magnitude once the mitigation measures are implemented, resulting an effect of Negligible significance.
- 11.109 Table 11.6 summarises the effects during construction before and after mitigation measures are implemented.

Table 11.6: Construction: Summary of Mitigated Effects

Sources	Significance Effects (Pre- Mitigation)	Significance Effects (Post-Mitigation)
Preferential Pathways	Minor Adverse	Negligible
Suspended Sediment	Minor Adverse	Negligible
Oils and Hydrocarbons	Moderate Adverse	Negligible
Concrete and Cement Products	Moderate Adverse	Negligible
Disturbance to Groundwater	Negligible	Negligible
Disturbance of Contaminated Land	Negligible	Negligible
Flood Risk and Surface Water Runoff	Minor Adverse	Negligible
Water Supply and Demand	Minor Adverse	Negligible
Wastewater Generation	Minor Adverse	Negligible

Operational Mitigation

Pollution from Site Uses

- 11.110 The main pathway for these pollutants to affect the water environment is via surface and foul water runoff. The Proposed Development will be served by a site-specific drainage system. The system will discharge into the Barkham Brook and TW sewers, respectively.
- 11.111 Any foul water leaks will be cleaned on the Site prior to discharge to the Site drainage. Surface water runoff is treated as close to source as possible to slow the runoff and remove pollutants prior to discharge into the Barkham Brook.

Physical Disturbance of Aquifers and Groundwater Flows

- 11.112 It is not anticipated that the effect of the Proposed Development on groundwater to be significant. No fundamental alternation of the groundwater regime is proposed or is expected to occur as a result of the proposals. The Proposed Development is not anticipated to present a significant impact on surrounding properties.

Flood Risk and Surface Water Runoff

- 11.113 The Site is located in Flood Zone 3, however, the Proposed Development and drainage features will be located outside the areas at risk of flooding.
- 11.114 Surface water flows are being restricted to equivalent Greenfield rates from the Site and treated through the provision of SuDS features in the form of permeable paving, detention basins and swales. This will therefore mimic the baseline scenario and have a negligible significance to the Site.

Water Supply and Demand

- 11.115 In order to minimise the demand for clean water from the TW network, the following measures will be considered in the detailed design of the water strategy for the Proposed Development -
- Water efficient and water saving fixtures and fittings in the properties, and
 - Water meters to all properties.
- 11.116 Implementation of these measures will provide reductions in the water use from the Proposed Development and will reduce the short-term effect on water supply resources in the area. However, there will be an increase in demand from existing rates and this will result in long-term effects of minor adverse nature. It should be noted that it is responsibility of TW to ensure the supply of adequate water for domestic purposes in accordance with the Water Industry Act 1991 (Amendment Order 2024).
- 11.117 The TW Water Resources Management Plan (WRMP24) sets out how it will keep taps flowing over the next 50 years, looking ahead to 2075. It also highlights the significant future shortfall in water resources in its supply area and the actions it plans to take to maintain the balance between water supply and demand. It sets out how TW is going to tackle leaks, make every drop count and invest in new water infrastructure to ensure there is the water needed for generations to come. Therefore, in the long term, the effect of the Proposed Development on the water supply will be negligible.

Wastewater Generation

- 11.118 Additional foul flows will be entering the TW foul water network as part of the Proposed Development. Any capacity issues will be dealt with through the connection arrangements by Ofwat. Therefore, in the long term, the impact of the wastewater generated from the Proposed Development will have a negligible impact on the local and wider drainage network.

Contamination from In-Situ Materials

- 11.119 No additional mitigation is required apart from the measures already incorporated into the design of the Proposed Development.
- 11.120 Table 11.7 summarises the effect on the receptors both before and after mitigation measures are implemented once the Proposed Development is completed and occupied.

Table 11.7: Operation- Summary of Mitigated Effects

Sources	Significance Effects (Pre- Mitigation)	Significance Effects (Post-Mitigation)
Pollution arising from site uses	Minor Adverse	Negligible
Physical disturbance of aquifers and groundwater flows	Negligible	Negligible
Flood risk and surface water runoff	Minor Adverse	Minor Beneficial
Water supply and demand	Major Adverse	Negligible
Wastewater Generation	Major Adverse	Negligible
Contamination from In-Situ Materials	Minor Adverse	Negligible

RESIDUAL IMPACTS

- 11.121 This section identifies all residual effects, following the implementation of mitigation and monitoring measures, known as 'residual effects' which cannot be eliminated through design changes or the application of standard mitigation measures.
- 11.122 **No** significant effects to water resources are expected to occur once the Proposed Development is complete and operational, provided that standard mitigation measures are applied, as discussed in this chapter.
- 11.123 Runoff from the Proposed Development will be minimised by utilising SuDS measures. The peak discharge rate from the Site will be reduced to greenfield runoff rates.
- 11.124 Operational effects from the Proposed Development are restricted to issues of available capacity within the downstream foul sewerage system and the resources to supply the Site with adequate water. The residual effect on this receptor is assumed to be short term, **Minor Adverse**. However, it should be noted that, in the long term, it is the responsibility of TW to ensure adequate water supplies and drainage capacity. In the long term, the effect is assessed as being of **Negligible** significance.

CUMULATIVE IMPACTS

- 11.125 The release of suspended sediment from excavations would have a negligible impact upon the Site alone as no pathway from groundwater appears to exist at shallow depths. However, should a large storm event occur whilst excavations are exposed, there is potential for the preferential pathway of surface water to cause increased sediment loading within the Barkham Brook which could have a short term minor adverse impact upon the Traditional Orchard Sites / The Coombes ancient woodland and LWS. However, the cumulative impact may extend the duration to medium term.
- 11.126 A similar pathway could also be present for oils/hydrocarbons and cement and concrete, should sufficient and appropriate mitigation measures not be undertaken.
- 11.127 Sites within close proximity to the Barkham Square were identified within the Scoping Report and advised through the Scoping Opinion, the key ones being -
- East of Shinfield (phase 2), South of Church Lane, Shinfield (17/2450,) – committed site,
 - South of Cutbush Lane, Shinfield - part of Lodden Garden Village proposed allocation,
 - Hall Farm/Lodden Garden Village, - proposed allocation and recent application submission, and
 - South Wokingham SDL, - proposed allocation.
- 11.128 Taking into consideration the development of the other committed sites in conjunction with the Proposed Development, the potential cumulative effects arising relate to the increased demand in the wastewater provision and water supply within the area.
- 11.129 TW will be/will have been consulted during in the design process for the drainage network associated with these sites and therefore any capacity issues would be resolved.

- 11.130 It is the responsibility of TW to ensure water supply is provided to all developments proposed within the Borough. It is understood from the Thames Water Resources Management Plan, which considers potential development, that actions are in place to maintain the balance between water supply and demand over the planning period of the next 50 years.
- 11.131 Given that all construction activities for the Proposed Development considered in the cumulative impact assessment should be undertaken to best management practices, the cumulative impact of these schemes are expected to be similar to the impact of the Proposed Development and therefore any cumulative impact is considered to be **Negligible**.

SUMMARY

- 11.132 There are no likely predicted significant environmental effects that will be caused by the Proposed Development in terms of the flood risk, drainage and water supply to the Site, provided the mitigation measures discussed throughout this chapter are implemented. Table 11.8 provides a summary of the overall position.

Table 11.8: Summary Table of Water/Drainage/Flood Risk Residual Effects

Description of Likely Significant Effects	Significance	Description of Mitigation	Description of Residual Effects	Significance
Demolition/Construction Phase				
Major accident disaster – flood risk due to breach of defences	Minor adverse	Avoidance of Flood zone 3 area through design	n/a	Negligible
Surface water flood event in excess of drainage design capacity	Minor adverse	Avoidance of Flood zone 3 area through design	n/a	Negligible
Aquifers and ground water flows	Negligible	Use of best practice methods/CEMP	n/a	Negligible
Water supply and demand	Minor adverse	Licence during construction	n/a	Negligible
Wastewater generation	Minor adverse	Use of portable toilets during construction	n/a	Negligible
Operational Phase				
Major accident disaster – flood risk due to breach of defences	Minor adverse	Restrictions to equivalent greenfield rates, use of Suds	n/a	Negligible
Surface water flood event in excess of drainage design capacity	Minor adverse	Design of scheme, Restrictions to equivalent greenfield rates, use of Suds	n/a	Minor beneficial
Aquifers and ground water flows	Negligible	n/a	n/a	Negligible
Increased Water supply and demand	Major adverse	Water saving devices to be fitted, water metres	n/a	Negligible
Increased Wastewater generation	Major adverse	Connection to existing sewers by TW	n/a	Negligible
Cumulative - Construction				
Water and wastewater supply/demand/generation	Minor adverse	TW duty to provide capacity and infrastructure to the developments	n/a	Negligible
Cumulative - Operation				
Water and wastewater supply/demand/generation	Major adverse	TW duty to provide capacity and infrastructure to the developments		Negligible

12 AIR QUALITY

- 12.1 This chapter of the ES assesses the likely significant environmental effects of the Proposed Development with respect to air quality. The chapter determines the Site's suitability for existing human receptors, future users and ecological receptors in relation to air quality comprising of NO_x, NO₂ and dust (PM₁₀ and PM_{2.5}), during construction and operational phases.
- 12.2 The chapter describes the methods used to assess the effects; the baseline conditions currently existing at the Site and the surrounding area; the mitigation measures required to prevent, reduce and offset any significant adverse effects, and the likely significant residual effects after these measures have been implemented.

POLICY CONTEXT

Legislation

Environmental Protection Act (1990)

- 12.3 The Section 79 of the Environmental Protection Act 1990 gives the following definitions of statutory nuisance relevant to dust and particles:

"Any dust, steam, smell or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance." and

"Any accumulation or deposit which is prejudicial to health or a nuisance."

- 12.4 Following this, Section 80 stipulates that where a statutory nuisance is found to exist, the local authority is required to serve an abatement notice. Failure to comply with such a notice constitutes an offence. If necessary, the local authority has the power to abate the nuisance directly and recover the associated costs.
- 12.5 The statutory nuisance provisions are relevant, among other matters, to the control of dust arising from demolition and construction activities. There are no statutory limit values for dust levels that automatically constitute a 'nuisance'; rather, nuisance is a subjective concept, largely dependent on existing local conditions and the degree of change experienced. The party responsible for the premises from which emissions originate must therefore employ Best Practicable Means (BPM) to prevent the occurrence of a statutory nuisance.

Environment Act 2021

- 12.6 The Environment Act 1995 is being updated to include several changes that aim to improve air quality in England. These changes include a requirement for the Secretary of State to review the National Air Quality Strategy every five years, as well as a requirement for annual reports to be made to Parliament on the progress made towards achieving air quality objectives. Additionally, changes are being made to the way Air Quality Management Areas (AQMA) are designated and managed.
- 12.7 The Environment Act 2021 established a legally binding duty on the UK government to bring forward at least two new air quality targets in secondary legislation.
- 12.8 The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023 set a new target for PM_{2.5} in ambient air to reduce air pollution's environmental and health impacts. These Regulations come into force on the day after the day on which they are made:
- The annual mean concentration target is that by the end of 31st December 2040, the annual mean level of PM_{2.5} in ambient air must be equal to or less than 10 µg/m³ ("the target level").*
- 12.9 The Environmental Improvement Plan 2023 for England set interim targets by January 2028:
- An annual average of 12 µg/m³ for PM_{2.5} is not exceeded at any monitoring station.*
- 12.10 The above targets are not intended to be applied retrospectively to planning applications submitted before the regulations came into effect. However, this assessment will be undertaken in consideration of the new PM_{2.5} legislation, ensuring that it is appropriately factored into the air quality assessment process. The assessment should clarify whether the predicted operational impacts are compared against these future targets, or only the current AQOs.
- 12.11 Table 12.1 details the current AQOs in relation to the Proposed Development and this assessment.

Table 12.1: Air Quality Objectives (England)

Pollutant	Air Quality Objectives		
	Concentration		Measured as
Nitrogen Dioxide (NO ₂)	200 µg/m ³		1-hour mean not to be exceeded more than 18 times per year*
	40 µg/m ³		Annual mean
Particulate Matter (PM ₁₀)	50 µg/m ³		24-hour mean not to be exceeded more than 35 times per year
	40 µg/m ³		Annual mean
Particulate Matter (PM _{2.5})	AQO	20 µg/m ³	Annual mean
	Interim target by 2028	12 µg/m ³	Annual mean
	Legally binding target by 2040	10 µg/m ³	

*Note: if the annual mean concentration is less than 60µg/m³ then it can be assumed that the 1-hour mean standard is likely to be met

Planning Policy

National Planning Policy Framework (December 2024)

12.12 The NPPF paragraphs 199 and 200, state that:

“Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan.

Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or ‘agent of change’) should be required to provide suitable mitigation before the development has been completed.”

Clean Air Strategy 2019

- 12.13 In 2019, the Department for Environment, Food and Rural Affairs (Defra) released the Government’s Clean Air Strategy, which sets out a comprehensive plan to reduce emissions from all sources of air pollution. The Strategy aims to enhance air quality, protect ecosystems, and promote sustainable economic development. The primary focus of air quality management has primarily been related to NO₂ and its principal source in the UK, road traffic. It also includes specific targets to limit public exposure to airborne particulate matter (PM), consistent with the guidance provided by the World Health Organization (WHO).
- 12.14 Moreover, the Strategy affirms the Government’s commitment to enacting new legislation to “*create a stronger and more coherent framework for action to tackle air pollution...in line with the risk they pose to public health and the environment, plus new local powers to take action in areas with an air pollution problem. These will support the creation of Clean Air Zones to lower emissions from all sources of air pollution, backed up with clear enforcement mechanisms.*” New enforcement powers will also be given at national and local levels, across all sectors of society.

Air quality strategy: Framework for local authority delivery

- 12.15 The Air Quality Strategy for England provides the strategic framework from Defra to guide local authorities to “...*make best use of their powers and make air quality improvements for their communities.*” The document emphasises the critical role of local governments in achieving cleaner air and highlights its commitment to prioritizing planning reforms aimed at meeting the PM_{2.5} reduction targets set out in the Environment Act 2021.

UK Air Quality Strategy 2023

- 12.16 The Government's policy on air quality within the UK is set out in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland. It provides a framework for reducing air pollution in the UK with the aim of meeting the air quality standards.

Wokingham Borough Local Development Framework: Adopted Core Strategy Development Plan Document (January 2010)

- 12.17 The Core Strategy outlines the vision for the Borough's development up to 2026, detailing how the Council plans to protect and enhance the high quality of life within the Borough.

“CP1 – Sustainable development

Planning permission will be granted for development proposals that:

- 1. Maintain or enhance the high quality of the environment;*
- 2. Minimise the emission of pollutants into the wider environment;*
- 3. [...]*
- 4. Avoid areas where pollution (including noise) may impact upon the amenity of future occupiers;”*

Wokingham Borough Local Plan Update (2023-2040): Proposed Submission Plan

- 12.18 The Council has prepared the Wokingham Borough Local Plan Update: Proposed Submission Plan. This plan sets out the vision, strategic objectives, strategy and associated policies for managing development across Wokingham Borough. The spatial strategy outlines how to address the development requirements of Wokingham Borough from 2023 to 2040, aligning with the vision and objectives of the Local Plan Update. From an air quality point of view, the following policy is key -

“Policy HC6: Air pollution and air quality

- 1. Development proposals should maintain, and where possible improve air quality.*
- 2. Development proposals should consider the prevailing air quality and potential impacts upon air quality arising from airborne particulates, dust and odour associated with the construction and operation of a proposal (including vehicular traffic).*
- 3. Air Quality Assessments can demonstrate how prevailing air quality and potential impacts upon air quality have been considered and how air quality will be maintained at an acceptable standard through avoidance and mitigation measures. Development proposals are likely to require an Air Quality Assessment where:*
 - a) The site is located within an Air Quality Management Area (AQMA);*
 - b) The development has the potential to impact on air quality within an AQMA either on its own or in combination with other development;*
 - c) It has the potential to impact on the implementation of Air Quality Action Plans or Local Air Quality Strategies, either on its own or in combination with other development;*
 - d) The site is located within or close to an urban area that is known to experience higher levels of airborne particulates from vehicle emissions;*
 - e) The site is within proximity to a source of air pollution which could present a significant risk to human health, protected species, or irreplaceable habitats; or*
 - f) The type of development would mean its occupiers would be particularly sensitive to air pollution, such as schools, health care establishments or specialist accommodations.”*

Key Guidance Documents

- 12.19 The following recognised guidance documents provide further information and guidance on air quality in relation to new developments.

Guidance on the Assessment of Dust from Demolition and Construction (IAQM, 2024)

- 12.20 This guidance provides advice, methodology and criteria to assess the dust impacts that arise from construction activities. This assessment evaluates the impact of dust soils and human health impacts during the demolition, earthworks, construction and track out activities. The methodology is replicated in **Technical Appendix 12.1**.

Land Use Planning and Development Control: Planning for Air Quality (EPUK-IAQM, 2017)

- 12.21 This guidance includes a method for screening the requirement for an air quality impact assessment and whether a detailed assessment is required.

A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites (IAQM 2020)

- 12.22 This document is designed to provide assistance into the assessment of the air quality impacts of development on designated nature conservation sites. The document focuses on air quality assessments in support of Habitats Regulations Assessments; however, it is useful when assessing the air quality impact on national or local designated nature conservation sites.

Local Air Quality Management Technical Guidance (LAQM.TG22)

- 12.23 This technical guidance is used by local authorities in their review and assessment work. LAQM is a statutory process through which local authorities are required to monitor, assess, and take actions to improve local air quality.

- 12.24 Within this guidance, Box 1.1 contains examples where air quality objectives should apply. Annual mean objectives for NO₂ and PM₁₀ should apply at locations where members of the public might be regularly exposed, including building façades of residential properties, school, hospitals and care homes.

- 12.25 The following impacts should be assessed with the consideration of cumulative effects from other planned or proposed developments within the area -

- Impact of the proposed development upon the local air quality, and
- The impact of local air quality on the receptors using the development.

METHODOLOGY

- 12.26 The scope of the assessment in accordance with the Institute of Air Quality Management (IAQM) best practice guidance includes -

- Identification of sensitive receptors (including ecological receptors),
- Review of monitoring data and background pollutant maps,
- Determination of construction related impacts,
- Detailed air quality dispersion modelling using ADMS-Roads Extra (version 5.0.1.3) for modelling traffic related emissions impacts,
- Assessment of impacts on sensitive receptors,
- Mitigation measures for construction and operational phases,
- Residual impacts for construction and operational phases, and
- Cumulative impacts for construction and operational phases.

Construction Phase Assessment Methodology

- 12.27 The effects of the Proposed Development on air quality during construction (i.e., dust) have been assessed qualitatively in accordance with the IAQM's 'Guidance on the assessment of dust from demolition and construction'. The assessment has focused on mitigation measures to be included in a CEMP.

- 12.28 The IAQM guidance provides guidance on a five-step process to assess the potential impacts of construction dust pre mitigation, provide mitigation measures specific to the risk and assess the post mitigation impacts.
- 12.29 The guidance considers the risk of dust emissions from unmitigated activities to cause human health (PM₁₀) impacts, dust soiling impacts, and ecological impacts (such as surrounding vegetation). The outcome of construction-based risks is based on the scale and types of activities and on the sensitivity of receptors. The outcome of the risk is used to determine the level of good practice mitigation required for adequate control of dust.
- 12.30 Receptors were taken into consideration up to 250 m from the Site boundary and within 500 m of track out route from the Site.
- 12.31 An assessment of the likely significant cumulative effects on the environment with respect to air quality with the identified committed developments has been undertaken for the construction phase.

Operational Phase Assessment Methodology

- 12.32 Dispersion modelling was undertaken using ADMS-Roads Extra (v5.1.0) to predict NO₂, PM₁₀, and PM_{2.5} concentrations across the site and at sensitive receptors. Input data included traffic flows, emission factors, meteorological data, and DEFRA background concentrations. Verification was completed using local monitoring data (DT16 at 130 Beccles Road), resulting in a model verification factor of **1.19**.
- 12.33 Five scenarios were modelled -
- Baseline scenario (2022): Represents anticipated traffic data for a baseline year of 2022 based on data collected from Department for Transport's Traffic Count Website. Used to compare modelled results with local monitoring data to verify model performance.
 - S2 scenario (2035): Represents anticipated traffic data with predicted variations in traffic flow patterns without the development, in 2035.
 - S3 (i.e. with development) scenario (2035): Represents anticipated traffic data with the addition of predicted variations in traffic flow patterns as a result of the proposals, for the completed development, 2035.
 - S4 – WBC Local Plan growth without the development (2040): Represents traffic conditions for the year 2040, incorporating cumulative traffic growth associated with the WBC Local Plan infrastructure projects, but excluding the proposed development.
 - S5 – WBC Local Plan growth with the development (2040): Represents traffic conditions for the year 2040, including both the cumulative growth associated with the WBC Local Plan infrastructure and the traffic generated by the proposed development.
- 12.34 Emission factors for each link were calculated using the relevant traffic flows and the Emissions Factor Toolkit (EFT) (Version 13.1) released in March 2025.
- 12.35 Traffic data for this scheme for S1 was obtained from The Department for Transport's (DfT's) Traffic Count Website. The traffic data used in the S1 modelling scenario is summarised in Tables 12.2 and 12.4.
- 12.36 Traffic data for S2 and S3 modelling scenarios was supplied by the Transport Consultants for this project, i-Transport. The traffic data used in S2 and S3 modelling scenarios is summarised in Tables 12.4-12.6.
- 12.37 Vehicle speeds were estimated based on the free flow 'potential' of each link and local speed limits. Road widths were estimated from aerial photography and UK highway design standards.
- 12.38 In accordance with the modelling methodology, different speeds for road links have been used for the base plus Proposed Development traffic approaching at busy junctions and delays during peak/off peak. The road width stayed the same for all modelling scenarios. The mean vehicular speeds stayed the same for all modelling scenarios.
- 12.39 Various building heights have been input into the model, where the building height or structure is taller than the width of the road to the opposite building or structure, creating a canyon effect. These heights will remain the same and therefore have not been altered for the modelling scenarios.

Table 12.2: Traffic Links Used in S1 Modelling Scenario

Link ID	Road Link	Average Road Width (m)	Average Canyon Height (m)	Mean Vehicle Speed (km/h)
L1	Finchampstead Road, A321	7	20	16

Table 12.3: Traffic Links Used in Modelling Scenarios

Link ID	Road Link	Average Road Width (m)	Mean Vehicle Speed (km/h)
L2	Langley Common Road	7	48
L3	Barkham Road, B3349- East of Barkham Street	8	48
L4	Barkham Road, B3349- East of Barkham street	7	48
L5	Barkham Street	6.5	64
L6	Commonfield Lane	6	40
L7	Biggs Lane	7	24
L8	Bearwood Road	6.5	48
L9	Eversley Road (Between Poperinghe Way and Observer Way)	7	50
L10	Eversley Road (Between Observer Way and Baird Road)	7.5	48
L11	Eversley Road (Towards Arborfield Cross)	8	48
L13	Langley Common Road (Between Eversley Road and Biggs Lane)	8	48
L14	Langley Common Road (Between Biggs Lane and Site Access)	7	64
L15	Langley Common Road (Between Site Access and School Road)	8	48
L16	Barkham Road (Between School Road and Barkham Street)	7	48
L17	Barkham Road (Between Barkham Street and Bearwood Road)	8	48
L18	Barkham Road (Bearwood Road and Edneys Hill)	7.5	24
L19	Observer Way	7	113
L20	Baird Road	6	20

Note: Road links shown in **bold** are included in the s4 and s5 scenarios only.

Table 12.4: Traffic Data Input into S1-S3 Modelling Scenarios

Link ID	S1		S2		S3	
	24-hour AADT Flow	HDV %	24-hour AADT Flow	HDV %	24-hour AADT Flow	HDV %
L1	14908	1	-	-	-	-
L2	-	-	11654	4	12793	4
L3	-	-	13919	4	14762	3

Link ID	S1		S2		S3	
	24-hour AADT Flow	HDV %	24-hour AADT Flow	HDV %	24-hour AADT Flow	HDV %
L4	-	-	11409	4	12547	3
L5	-	-	7711	3	8005	3
L6	-	-	1892	3	1892	3
L7	-	-	5057	4	5057	3

Table 12.5: Traffic Data Input into S4-S5 Modelling Scenarios

Link ID	S4		S5	
	24-hour AADT Flow	HDV %	24-hour AADT Flow	HDV %
L8	15499	1	15791	1
L9	19257	2	19417	2
L10	18763	1	19349	1
L11	8142	1	8364	1
L12	16980	2	17560	2
L13	12946	1	14414	1
L14	12623	1	13341	1
L15	12623	1	13341	1
L16	16836	1	17363	1
L17	15408	2	15673	2
L18	19299	2	19580	2
L19	19299	1	19580	1
L20	584	1	750	1

- 12.40 PUK-IAQM have published guidance on the consideration of air quality within the planning and development control process. This guidance includes thresholds that identify when relevant operational impacts require further assessment.
- 12.41 Additional vehicle movements associated with the operation of the Proposed Development will generate exhaust emissions, such as NO₂, PM₁₀ and PM_{2.5} on the local and regional road networks. An assessment was therefore undertaken using dispersion modelling in order to quantify potential changes in pollutant concentrations at sensitive human receptor locations in the vicinity of the Site.
- 12.42 The pollutant concentration changes on sensitive ecological receptors, due to vehicular emissions can be determined by modelling the dispersion of the emissions. This is known as the process contribution (PC). To determine the concentration and deposition rates, the PC is added to the baseline concentration and deposition rates. The concentration/deposition rate is known as the predicted environmental concentration (PEC).
- 12.43 The detailed air quality dispersion modelling has provided predictions of the annual mean concentrations of pollutants with and without the Proposed Development. The modelled annual mean concentrations are directly compared with the UK air quality objectives and be aligned with the guidance assessment criteria set out within LAQM TG.22 and the EPUK-IAQM best practice guidance.

- 12.44 An assessment of the likely significant cumulative effects on the environment with respect to air quality with the identified committed developments has been undertaken for the operational phase.
- 12.45 In line with the guidance from the EPUK-IAQM, sensitive receptors are considered for both the construction and operational phases of the Proposed Development.
- 12.46 As the Proposed Development will introduce new residential receptors into a previously unoccupied area, consideration has been given to the likely conditions for its future occupants, as well as existing receptors within the area.
- 12.47 Human sensitive receptors have been modelled at onsite and offsite locations across the modelling extent. These receptors have been modelled at 1.5m to represent human height at ground level. The locations of the sensitive receptor have been represented in Table 12.6.
- 12.48 Additionally, sensitive ecological receptor locations within and adjacent to the Proposed Development were modelled, as detailed in Table 12.7, at 0m to represent ground level and 1m.

Table 12.6: Identified Human Receptors

Receptor ID	Location	NGR (m)	
		X- Axis	Y-Axis
R1	High Barn Farm, Commonfield Lane,	478038	165898
R2	Barkham Street	478218	166288
R3	Barkham Street	478179	166470
R4	White Cottage, Barkham Street	478164	166517
R5	Brook House, Barkham Street	478138	166574
R6	Barkham Street	478154	166633
R7	Manor Cottage, Barkham Street	478074	166734
R8	The Well House, Barkham Street	478017	166860
R9	Barkham Road	477848	166928
R10	2 Bridge Cottages	477613	166921
R11	Barkham Road	477423	166891
R12	Handpost Farm	477300	166819
R13	A property east of the proposed development	477455	166702
R14	10 Langley Common Road	477298	166758
R15	3 Langley Common Road	477295	166714
R16	23 Langley Common Road	477223	166678
R17	18 Langley Common Road	477148	166669
R18	2 Langley Common Road	477082	166636
R19	28 Langley Common Road	476986	166573
R20	48 Langley Common Road	476926	166504
R21	58-62 Langley Common Road	476846	166433
R22	26 Equestrian Court	476672	166191
R23	14 Equestrian Court	476676	166168
R24	17 Equestrian Court	476686	166135
R25	Montgomery House	476706	166083
R26	3 Hill Road	476680	166036
R27	Venning Road	476708	166007
R28	93 Venning Road	476746	165980
R29	Venning Road	476804	165938
R30	44 Biggs Lane	476848	165901
R31	14 Biggs Lane	477055	165779
R32	Shelduck Drive	477120	165803
R33	1 Mandarin Grove	477157	165779
R34	14 Pintail Place	477221	165762
R35	22 Shelduck Drive	477294	165747
R36	Oak Drive	477492	165705

Receptor ID	Location	NGR (m)	
		X- Axis	Y-Axis
R37	2 Oak Drive	477530	165680
R38	Commonfield Lane	477689	165537
R39	The Finches, Commonfield Lane	477802	165618
R40	34 Archer Grove	477826	165689
R41	6 Archer Grove	477872	165787
R42	Barkham Road	478059	167014
R43	Barkham Road	478327	167126
R44	390 Barkham Road	478378	167173
R45	Onsite Receptor	477227	166225
R46	Onsite Receptor	477898	167038
R47	Onsite Receptor	477670	167091
R48	Onsite Receptor	477900	165571
R49	Onsite Receptor	478322	167219
R50	Onsite Receptor	476824	165991
R51	Onsite Receptor	478149	166489
R52	Onsite Receptor	477622	165563
R53	Onsite Receptor	477330	166795
R54	Onsite Receptor	476969	166466

Table 12.7: Sensitive Ecological Receptors

Receptor ID	Location	NGR (m)	
		X- Axis	Y-Axis
E1	Habitat: Woodland	477227	166225
E2	Ancient and Semi-Natural Woodland	477898	167038
E3	Priority Habitat Inventory – Deciduous	477670	167091
E4	Woodland	477900	165571
E5	Statutory: Longmoor Bog LNR and SSSI	478322	167219
E6	Deciduous Woodland	476824	165991
E7	Bat	478149	166489
E8	Ancient and Semi-Natural Woodland	477622	165563

12.49 The impact assessment refers to the change that is predicted to take place to both existing and future receptors from the existing condition of the environment as a result of the Proposed Development.

12.50 The significance of an effect is generally determined as the combination of the sensitivity and/or value of the affected environmental receptor and the predicted extent and /or magnitude of the impact or change. The assessment of significance ultimately relies on professional judgement, although comparing the extent of the impact with criteria and standards specific to each environmental topic can guide judgement. Details of the criteria used to assign significance can be found in Tables 12.8 to 12.10. These criteria have been further constrained to reflect details specific to this assessment, as defined in the descriptions within each table.

Table 12.8: Methodology for Determining Impact Sensitivity

Sensitivity	Examples of Receptor
High	The receptor/resource has little ability to absorb change without fundamentally altering its present character or is of international or national importance. These could include areas where a high level of amenity would be reasonably expected or where members of the public are exposed over a long time period such as residential dwellings, hospitals, care homes, hotels, schools, universities, and national parks.
Medium	The receptor/resource has moderate capacity to absorb change without significantly altering its present character or is of high importance. Indicative examples include parks and places of work, including offices and commercial premises.
Low	The receptor/resource is tolerant of change without detriment to its character, is of low or local importance. Indicative examples would include playing fields, farm land, warehouses, light industry, shopping streets and car parks.

Table 12.9: Dust Risk Methodology

Sensitivity of Area	Dust Emission Magnitude (Demolition)		
	Large	Medium	Small
High	High	Medium	Medium
Medium	High	Medium	Low
Low	Medium	Low	Negligible
Sensitivity of Area	Dust Emission Magnitude (Earthworks and Construction)		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Medium	Low
Low	Low	Low	Negligible
Sensitivity of Area	Dust Emission Magnitude (Track out)		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Low	Negligible
Low	Low	Low	Negligible

Table 12.10: Methodology for Determining Impact Magnitude

Magnitude of Impact	Criteria for Assessing Impact
Large	Total loss or major/substantial alteration to key elements/features of the baseline (pre-Development) conditions such that the post Development character/composition/attributes will be fundamentally changed. This could occur should the Development cause large changes to existing environmental conditions or irreversible change affecting receptor functioning. It would include permanent changes to the air quality at the Site or in the surrounding area, notably should the air quality exceed any of the thresholds.
Medium	Loss or alteration to one or more key elements/features of the baseline conditions such that post Development character/composition/attributes of the baseline will be materially changed.
Small	A minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible/detectable but not material. The underlying character/composition/attributes of the baseline condition will be similar to the pre-Development circumstances/situation.
Negligible	Very little change from baseline conditions. Change barely distinguishable, approximating to a 'no change' situation.

- 12.51 Sensitivity has been determined by using the terms Low, Medium and High. Whilst magnitude might be determined as Negligible, Low Medium or High at individual receptors, overall effects might not necessarily be deemed as significant in some circumstances, both quantified through the modelling completed and by applying professional judgement.
- 12.52 Site-specific mitigation measures recommended within the IAQM to reduce potential dust impacts have been identified based upon the relevant risk categories identified in Table 12.9. Where negligible effects are identified, no mitigation measures beyond those required by legislation are required to be implemented.
- 12.53 The following factors have also been considered in determining the overall significance of an effect in this assessment -
- The number of properties affected by significant air quality impacts and a professional judgement on the overall effect,
 - Where new exposure is introduced into an existing area of poor air quality, then the number of people exposed to levels above the objective has been relevant,
 - The percentage change in concentration relative to the objective and the descriptions of the impacts at the receptors,
 - Whether or not an exceedance of an objective is predicted to arise or be removed in the study area due to a substantial increase or decrease, and
 - The extent to which an objective is exceeded e.g. an annual mean NO₂ concentration of 41µg/m³ is less significant than an annual mean of 51 µg/m³, as set out in the IAQM guidance.
- 12.54 For ecological receptors, IAQM guidance (2020) states the PC must meet both of the following criteria for Ramsar, European and national designated sites to avoid further assessment -
- The short-term PC is less than 10% of the short-term environmental standard, and
 - The long-term PC is less than 1% of the long-term environmental standard.

- 12.55 For local wildlife sites and ancient woodlands, the Environment Agency uses less stringent criteria in its permitting decisions. A screening criterion of $\leq 100\%$ increase in the relevant long-term and short-term PC and PEC is used as the change below which effects are regarded as not significant.

Limitations and Assumptions

- 12.56 This chapter is based on a desktop assessment of the Site and surrounding area.
- 12.57 It is assumed that all third-party data sources used as part of this assessment have been produced by suitably qualified professionals and / or governing bodies, following recognised methodologies, and represent the most accurate and up to date information available at the time of writing.

BASELINE CONDITIONS

- 12.58 Baseline data was gathered from the following sources -
- The Council's 2023 Air Quality Annual Status Report,
 - DEFRA's UK AIR website, and
 - DEFRA's national air quality background maps 2021.

Air Quality Management Areas (AQMA)

- 12.59 As required by the Environment Act (2021), The Council has undertaken a review and assessment of air quality within its administrative area. This process determined that annual NO₂ concentrations exceed the AQO, leading to the declaration of three AQMAs. The Council has concluded that concentrations of all other pollutants are currently below their relevant AQOs and no further AQMAs have been designated.
- 12.60 The Proposed Development is not located within close proximity to an AQMA and therefore has not been considered further within this assessment.

Air Quality Monitoring Data

Automatic Monitoring Locations

- 12.61 The Council operated two continuous automatic monitoring stations throughout the administrative boundary in 2022. Table 12.11 shows monitoring results from CM2 in recent years. This station only monitors NO₂ concentrations. As indicated in Table 12.11, annual NO₂ concentrations monitored have not exceeded the annual AQO in recent years. The 1-hourly NO₂ AQO of 200 $\mu\text{g}/\text{m}^3$ was exceeded 15 times in 2018, however was below the threshold of 18 times per year and therefore did not breach the AQO. There have been no exceedances of the 1-hourly AQO since 2018.
- 12.62 CM2 is located within Wokingham town centre and therefore the monitor is not indicative of the Proposed Development Site location.

Non-Automatic Monitoring Locations

- 12.63 The Council operated 47 passive monitoring stations (diffusion tubes) within the area in 2022. Table 12.12 shows diffusion tube monitoring results within 3.75 km of the Site. There have been no exceedances of the annual mean NO₂ AQO at any monitoring station in recent years.
- 12.64 The diffusion tubes are located in urban areas and along the M4. These are not indicative of concentrations expected at the proposed development site where concentrations are likely to be lower.

Table 12.11: Automatic Monitoring Results

SITE ID	Site Name	NGR		Site Type	Measurement	Annual Mean NO ₂ Concentrations ($\mu\text{g}/\text{m}^3$)				
		X	Y			2018	2019	2020	2021	2022
CM2	Peach Street Wokingham	481348	168603	Roadside	Annual	33	33	22	24	27
					1-hourly exceedance	15	0	0	0	0

Table 12.12: Diffusion Tube Monitoring Results

Site ID	Site Name	NGR		Site Type	Annual Mean NO ₂ Concentrations (µg/m ³)				
		X	Y		2018	2019	2020	2021	2022
WOK 883	Evendons Pri Sch	480483	167011	Roadside	27.0	29.1	19.6	22.4	22.2
WOK 895	47 Barkham Road	480375	168399	Roadside	-	-	13.5	16.4	16.6
WOK 846	4 Hatch Cottages	Farm 477131	170019	Roadside	26.0	21.6	14.0	15.2	16.2

Air Quality Background Maps

- 12.65 Predictions of background pollutant concentrations on a 1km-by-1km grid basis have been produced by DEFRA for the entire of the UK to assist Local Authorities (LAs) in their Review and Assessment of air quality.
- 12.66 The Proposed Development Site is located in grid squares NGR: 477500, 166500. The predicted background concentrations for the baseline year (2022), for 2035 when the Proposed Development is expected to be fully completed and for 2040 to reflect the emerging Wokingham Local Plan growth scenario.

Table 12.13: DEFRA Predicted Background Concentrations

Pollutant	Predicted Background Concentration (µg/m ³)		
	2022	2035	2040
NO _x	12.96	6.76	6.32
NO ₂	9.87	5.38	5.04
PM ₁₀	13.11	10.27	10.01
PM _{2.5}	8.95	6.16	5.91

- 12.67 As shown in Table 12.13, background concentrations do not exceed the relevant AQOs and are predicted to reduce further in the completion year. The predicted concentrations are lower than the monitored data, reflecting the current farmland area.

Ecological Receptors

- 12.68 Ecological receptors were analysed using Magic Maps website which provides authoritative geographic information about the natural environment from across government. This application is managed by Natural England. The application showed that the Site boundary and track out route are within a SSSI Impact Risk Zone (IRZ) for Longmore Bog SSSI.
- 12.69 The Proposed Development is located approximately 237m north of Longmoor Bog SSSI. The relevant habitat features and associated critical load and level data for Longmoor Bog, obtained from the Air Pollution Information System (APIS), are summarised in Table 12.14.

Table 12.14: APIS Information for SSSI

Interested Feature Name	Feature Code	Min CL for N (kgN/ha/yr)	Max CL for N (kgN/ha/yr)	NH ₃ CL (µg/m ³)	NO _x CL (µg/m ³)	SO ₂ CL (µg/m ³)
Erica Tetralix - Sphagnum Compactum Wet Heath	SSSI0504	5	15	1	30	10
Betula pubescens - Molinia caerulea Woodland	SSSI0151	15	25	3	30	10
Molinia Caerulea - Potentilla Erecta Mire	SSSI0975	10	15	3	30	10

- 12.70 The assessment benchmarks for evaluating air pollutant impacts on ecological receptors are referred to as Critical Levels (CL_e) and Critical Loads (CL_o) -
- Critical Levels (CL_e) represent pollutant concentrations in air (µg/m³) below which no harmful effects on vegetation or ecosystems are expected,
 - Critical Loads (CL_o) represent the threshold deposition rates (kg N/ha/yr for nitrogen, or keq/ha/yr for acidity) below which no significant harmful effects occur on sensitive habitats.
- 12.71 Table 12.14 summarises the critical levels applicable to the qualifying habitats within Longmoor Bog SSSI. Among these, Erica tetralix – Sphagnum compactum Wet Heath is the most sensitive, with critical levels of 1 µg/m³ for ammonia, 30 µg/m³ for NO_x, and 10 µg/m³ for SO₂. The other habitats, Betula pubescens – Molinia caerulea Woodland and Molinia caerulea – Potentilla erecta Mire, have slightly higher ammonia thresholds (3 µg/m³) but the same limits for NO_x and SO₂.
- 12.72 As shown in Table 12.15, Nitrogen deposition for moorland (short vegetation) in Longmoor Bog is 9.3 kgN/ha/yr for the 2019 mid-year, which falls within the critical load range (CL_o) of 5–15 kgN/ha/yr for Erica Tetralix and below CL_o for the other habitat features. Table 12.15 also provides the acid deposition and related air pollutant concentrations for Longmoor Bog SSSI.

Table 12.15: Acid Deposition Information for Longmoor Bog

Total N deposition to Grid Average (kg/ha/yr)	Total N deposition to Moorland (short vegetation) (kg/ha/yr)	Acid deposition for Moorland (short vegetation) (keq/ha/yr)	Acid deposition for Grid Average (keq/ha/yr)	Ammonia Concentration (µg/m ³)	SO ₂ Concentration (µg/m ³)	NO _x Concentration (µg/m ³)
9.3	12.3	0.9	0.7	1.1	1.2	11.7

- 12.73 The data presented in Table 12.15 indicate that deposition levels at Longmoor Bog SSSI are mainly influenced by regional background sources. Ammonia (1.1 µg/m³) and SO₂ (1.2 µg/m³) are well below their relevant critical levels, while acid deposition values (0.9–1.8 keq/ha/yr) reflect typical background conditions for the area.

IMPACTS

Construction Impacts

- 12.74 The Proposed Development is expected to be phased. As such, the dust caused by construction activities will vary as the Site is developed. This will also determine the receptors sensitive to these phases.
- 12.75 It is therefore determined that the Dust Management Plan (DMP), secured by condition, will be regularly updated to reflect the changes in activities across the Site and the impact upon human and ecological receptors subject to dust caused by the Proposed Development.
- 12.76 The following construction phase assessment has been completed based on the whole Proposed Development.

Step 1: Screen the Need for a Detailed Assessment

- 12.77 Activities such as excavation, ground works, cutting, construction, concrete batching and storage of materials have the potential to result in fugitive dust emissions throughout the construction phase of the Proposed Development. Vehicle movements both on-site and on the local road network also have the potential to result in the re-suspension of dust from haul road and highway surfaces.
- 12.78 In accordance with screening criteria in the IAQM, an assessment is required as there are human receptors located within 250m and ecological receptors located within 50m of the Site boundary and track out route.
- 12.79 The exact construction vehicle access routes were not available for the purpose of this assessment as they will depend on the sourcing of materials. This is likely to be decided by the contractor. It is expected that vehicles will use east and west routes along Wolverton Road to access the Proposed Development. Track out buffers were mapped up to 500m from the Site boundary on major roads.

Step 2A: Define the Potential Dust Emission Magnitude

- 12.80 Dust emission magnitudes for the construction phase of the Proposed Development are shown in Table 12.16.

Table 12.16: Dust Emission Magnitudes

Activity	Dust Emission Magnitude
Earthworks	Large
Construction	Large
Track out	Large

Step 2B: Define the Sensitivity of the Area

- 12.81 The sensitivity of the surrounding area is defined using a number of factors, including receptor sensitivity, the number of receptors, the distance of receptors from the Site, and existing PM₁₀ concentrations. The sensitivity of the surrounding areas to potential impacts from the construction of the Proposed Development are shown in Table 12.17.

Table 12.17: Sensitivity of the Surrounding Area

Receptor	Potential Impact	Sensitivity of the Surrounding Area		
		Earthworks	Construction	Track out
High	Dust Soiling	High	High	High
	Human Health	Low	Low	Low
Medium	Dust Soiling	Medium	Medium	Medium
	Human Health	Low	Low	Low
Ecological		Medium	Medium	Medium

Step 2C: Define the Risks of Impacts

- 12.82 The risk of dust impacts from the relevant construction activities from the construction of the Proposed Development is summarised in Table 12.18. These results take into account both the potential dust emission magnitude and the sensitivity of the area. Results show that the risk from dust soiling is high. However, it is acknowledged these activities are temporary in nature (i.e. only during the construction phase).

Table 12.18: Summary of Risk from Dust

Receptor	Potential Impact	Sensitivity of the Surrounding Area		
		Earthworks	Construction	Track out
High	Dust Soiling	High	High	High
	Human Health	Low	Low	Low
Medium	Dust Soiling	Medium	Medium	Medium
	Human Health	Low	Low	Low
Ecological		Medium	Medium	Medium

- 12.83 As indicated in Table 12.18, the highest risk for dust generating activities during all activities is a high. The overall dust risk level is classed as a high risk for all non-specified activities.
- 12.84 The potential for significant effects depends significantly on the distance between the dust generating activity and receptor location. Low to high risks were predicted based on a realistic worst-case scenario of construction activities being undertaken at the Site boundary closest to each sensitive area and therefore the significance of effects is low to high risk. However, it would be noted that the actual risk is likely to be lower than that predicted during the majority of the construction phase.

Operational Impacts

- 12.85 A dispersion modelling assessment has been undertaken to determine annual concentrations of NO₂, PM₁₀ and PM_{2.5} at the operational Proposed Development for the expected operational year of 2035. These have been depicted as follows -
- S2 – Baseline scenario (2035),

- S3 – Completion year with the Proposed Development (2035),
- S4 – Wokingham Local Plan growth without the Proposed Development (2040), and
- S5 – Wokingham Local Plan growth with the Proposed Development (2040).

12.86 The analysis and results have been split into two sections to determine -

- All pollutant air quality impacts on human receptors, and
- All pollutant air quality impacts on ecological receptors.

Human Receptor Impacts

12.87 Human sensitive receptor locations were modelled at a height of 1.5 m to represent ground floor height.

Nitrogen Dioxide (S2 and S3 Scenarios)

12.88 In accordance with the assessment criteria the annual mean NO₂ concentrations were predicted for S2 and S3 scenarios and are summarised in Table 12.19.

Table 12.19: Predicted Annual Mean NO₂ Concentrations for S2 and S3

Sensitive Receptor	Predicted Annual Mean NO ₂ Concentration (µg/m ³)		
	S2	S3	Change
R1	11.75	11.75	0.0001
R2	11.78	11.78	0.0013
R3	11.78	11.78	0.0015
R4	11.79	11.80	0.0020
R5	11.79	11.79	0.0018
R6	11.82	11.83	0.0030
R7	11.80	11.80	0.0022
R8	11.84	11.84	0.0038
R9	11.85	11.86	0.0087
R10	11.88	11.89	0.0107
R11	11.80	11.80	0.0047
R12	11.79	11.79	0.0041
R13	11.76	11.76	0.0020
R14	11.88	11.89	0.0106
R15	11.85	11.86	0.0092
R16	11.87	11.88	0.0106
R17	11.89	11.90	0.0121
R18	11.87	11.88	0.0104
R19	11.85	11.86	0.0092
R20	11.86	11.87	0.0096
R21	11.85	11.86	0.0087
R22	11.92	11.93	0.0033
R23	11.87	11.88	0.0016

Sensitive Receptor	Predicted Annual Mean NO ₂ Concentration (µg/m ³)		
	S2	S3	Change
R24	11.82	11.82	0.0008
R25	11.79	11.79	0.0004
R26	11.77	11.77	0.0003
R27	11.77	11.77	0.0003
R28	11.77	11.77	0.0002
R29	11.77	11.77	0.0002
R30	11.77	11.77	0.0002
R31	11.78	11.78	0.0001
R32	11.79	11.79	0.0001
R33	11.80	11.80	0.0001
R34	11.79	11.79	0.0001
R35	11.79	11.79	0.0001
R36	11.79	11.79	0.0001
R37	11.79	11.79	0.0001
R38	11.75	11.75	0.0001
R38	11.75	11.75	0.0001
R39	11.76	11.76	0.0001
R40	11.75	11.75	0.0001
R41	11.75	11.75	0.0001
R42	11.97	11.98	0.0095
R43	11.84	11.84	0.0050
R44	11.88	11.89	0.0067
R45	11.80	11.81	0.0053
R46	11.83	11.84	0.0078
R47	11.79	11.80	0.0045
R48	11.76	11.76	0.0012
R49	11.74	11.74	0.0003
R50	11.75	11.75	0.0001
R51	11.75	11.76	0.0002
R52	11.75	11.75	0.0006
R53	11.75	11.75	0.0004
R54	11.74	11.74	0.0002

- 12.89 As indicated in Table 12.19, predicted annual mean NO₂ concentrations are below the AQO at all modelled sensitive receptor locations. There are small changes in concentrations with the Proposed Development in place.
- 12.90 Impacts on the Air Quality Assessment Level (AQAL) for the predicted annual mean NO₂ concentrations at the human sensitive receptor locations are summarised in Table 12.20.

Table 12.20: Predicted NO₂ Impacts As a Result of the Proposed Development

Sensitive Receptor	% Change in Concentration Relative to AQAL	Long Term Average Concentration	Impact
R1	0.0010	29.37	Negligible
R2	0.0110	29.45	Negligible
R3	0.0125	29.45	Negligible
R4	0.0172	29.49	Negligible
R5	0.0154	29.47	Negligible
R6	0.0251	29.57	Negligible
R7	0.0190	29.50	Negligible
R8	0.0324	29.60	Negligible
R9	0.0731	29.66	Negligible
R10	0.0900	29.72	Negligible
R11	0.0399	29.50	Negligible
R12	0.0352	29.48	Negligible
R13	0.0166	29.41	Negligible
R14	0.0892	29.72	Negligible
R15	0.0775	29.66	Negligible
R16	0.0890	29.71	Negligible
R17	0.1013	29.76	Negligible
R18	0.0879	29.70	Negligible
R19	0.0774	29.65	Negligible
R20	0.0806	29.67	Negligible
R21	0.0734	29.65	Negligible
R22	0.0274	29.82	Negligible
R23	0.0131	29.69	Negligible
R24	0.0070	29.55	Negligible
R25	0.0038	29.49	Negligible
R26	0.0026	29.42	Negligible
R27	0.0022	29.41	Negligible
R28	0.0020	29.42	Negligible
R29	0.0017	29.43	Negligible

Sensitive Receptor	% Change in Concentration Relative to AQAL	Long Term Average Concentration	Impact
R30	0.0015	29.43	Negligible
R31	0.0010	29.45	Negligible
R32	0.0011	29.47	Negligible
R33	0.0010	29.51	Negligible
R34	0.0010	29.49	Negligible
R35	0.0009	29.46	Negligible
R36	0.0008	29.48	Negligible
R37	0.0008	29.48	Negligible
R38	0.0006	29.38	Negligible
R39	0.0007	29.39	Negligible
R40	0.0007	29.39	Negligible
R41	0.0009	29.37	Negligible
R42	0.0789	29.96	Negligible
R43	0.0421	29.61	Negligible
R44	0.0567	29.71	Negligible
R45	0.0448	29.52	Negligible
R46	0.0656	29.60	Negligible
R47	0.0386	29.49	Negligible
R48	0.0102	29.39	Negligible
R49	0.0021	29.36	Negligible
R50	0.0012	29.38	Negligible
R51	0.0019	29.39	Negligible
R52	0.0050	29.37	Negligible
R53	0.0034	29.37	Negligible
R54	0.0013	29.36	Negligible

- 12.91 Overall, as indicated in Table 12.20, the significance of impacts of annual mean NO₂ concentrations as a result of the Proposed Development was predicted to be negligible at all receptor locations, in accordance with EPUK-IAQM guidance.
- 12.92 Predictions of 1-hour NO₂ concentrations were not produced as part of the dispersion modelling assessment. However, as stated in LAQM.TG22, if annual mean NO₂ concentrations are below 60 µg/m³ then it is unlikely that the 1-hour AQO will be exceeded. As such, it is not predicted that concentrations will exceed the 1-hour mean AQO for NO₂ across the modelled site for the Development's proposed operational year, 2035. The impact of operational traffic on 1-hour mean NO₂ concentrations at sensitive receptors is also considered **Negligible** at all receptors, and thus not significant.
- 12.93 It should also be noted that background NO₂ levels are likely to be lower at elevated heights due to increased distance from emission sources, such as the local road network. Therefore, predicted

concentrations at heights above ground floor level are considered to be acceptable in regard to pollutant exposure across all receptor locations and have not been assessed further.

- 12.94 The assessment shows a **Negligible** impact with the Proposed Development in place and predicted annual NO₂ concentrations below the AQO. Therefore, the Site is considered to be suitable for the proposed use without the implementation of mitigation techniques to protect existing receptors and future site users from elevated NO₂ concentrations.

NO₂ Impacts (S4 and S5 Scenarios)

- 12.95 In accordance with the assessment criteria the annual mean NO₂ concentrations were predicted for S4 and S5 scenarios and are summarised in Table 1.21.

Table 12.21: Predicted Annual Mean NO₂ Concentrations for S4 and S5

Sensitive Receptor	Predicted Annual Mean NO ₂ Concentration (µg/m ³)		
	S4	S5	Change
R1	9.88	9.88	0.0002
R2	9.90	9.90	0.0013
R3	9.90	9.90	0.0014
R4	9.91	9.91	0.0020
R5	9.90	9.91	0.0017
R6	9.93	9.93	0.0028
R7	9.91	9.91	0.0019
R8	9.93	9.94	0.0028
R9	9.94	9.94	0.0033
R10	9.96	9.96	0.0041
R11	9.91	9.91	0.0019
R12	9.91	9.91	0.0018
R13	9.89	9.89	0.0009
R14	9.96	9.96	0.0041
R15	9.94	9.95	0.0036
R16	9.96	9.96	0.0042
R17	9.97	9.98	0.0049
R18	9.96	9.96	0.0043
R19	9.95	9.95	0.0040
R20	9.96	9.96	0.0044
R21	9.95	9.96	0.0057
R22	10.01	10.02	0.0055
R23	9.99	9.99	0.0051
R24	9.95	9.95	0.0040
R25	9.93	9.93	0.0032
R26	9.91	9.91	0.0019
R27	9.90	9.90	0.0017

Sensitive Receptor	Predicted Annual Mean NO ₂ Concentration (µg/m ³)		
	S4	S5	Change
R28	9.90	9.91	0.0019
R29	9.90	9.91	0.0021
R30	9.90	9.90	0.0019
R31	9.90	9.91	0.0021
R32	9.91	9.91	0.0027
R33	9.92	9.93	0.0035
R34	9.92	9.92	0.0031
R35	9.91	9.91	0.0026
R36	9.92	9.92	0.0030
R37	9.91	9.92	0.0029
R38	9.88	9.88	0.0004
R38	9.88	9.88	0.0002
R39	9.88	9.88	0.0002
R40	9.88	9.88	0.0002
R41	10.01	10.01	0.0037
R42	9.94	9.95	0.0020
R43	9.98	9.98	0.0028
R44	10.00	10.01	0.0024
R45	10.16	10.16	0.0056
R46	9.94	9.94	0.0015
R47	9.93	9.93	0.0013
R48	9.92	9.92	0.0028
R49	9.94	9.94	0.0034
R50	9.91	9.91	0.0019
R51	9.89	9.89	0.0010
R52	9.88	9.88	0.0004
R53	9.88	9.88	0.0002
R54	9.88	9.88	0.0003

12.96 As shown in Table 12.21, the predicted annual mean NO₂ concentrations in 2040 for both scenarios are lower than those predicted for Scenarios S2 and S3 in 2035 and are below the AQO at all modelled sensitive receptor locations. Only small changes in concentrations are observed with the Proposed Development in place.

12.97 Impacts on the AQAL for the predicted annual mean NO₂ concentrations at the human sensitive receptor locations are summarised in Table 12.22.

Table 12.22: Predicted NO₂ Impacts as a Result of the Proposed Development

Sensitive Receptor	% Change in Concentration Relative to AQAL	Long Term Average Concentration	Impact
R1	0.0019	24.70	Negligible
R2	0.0130	24.75	Negligible
R3	0.0143	24.75	Negligible
R4	0.0197	24.78	Negligible
R5	0.0172	24.77	Negligible
R6	0.0283	24.83	Negligible
R7	0.0196	24.78	Negligible
R8	0.0278	24.84	Negligible
R9	0.0334	24.86	Negligible
R10	0.0407	24.90	Negligible
R11	0.0193	24.78	Negligible
R12	0.0177	24.77	Negligible
R13	0.0095	24.73	Negligible
R14	0.0414	24.90	Negligible
R15	0.0364	24.87	Negligible
R16	0.0421	24.90	Negligible
R17	0.0490	24.94	Negligible
R18	0.0436	24.91	Negligible
R19	0.0404	24.88	Negligible
R20	0.0445	24.90	Negligible
R21	0.0570	24.90	Negligible
R22	0.0547	25.04	Negligible
R23	0.0513	24.98	Negligible
R24	0.0405	24.89	Negligible
R25	0.0320	24.83	Negligible
R26	0.0188	24.77	Negligible
R27	0.0170	24.76	Negligible
R28	0.0190	24.76	Negligible
R29	0.0207	24.77	Negligible
R30	0.0189	24.76	Negligible
R31	0.0214	24.77	Negligible
R32	0.0269	24.79	Negligible

Sensitive Receptor	% Change in Concentration Relative to AQAL	Long Term Average Concentration	Impact
R33	0.0352	24.82	Negligible
R34	0.0309	24.80	Negligible
R35	0.0266	24.78	Negligible
R36	0.0303	24.80	Negligible
R37	0.0292	24.79	Negligible
R38	0.0037	24.71	Negligible
R39	0.0023	24.71	Negligible
R40	0.0025	24.71	Negligible
R41	0.0024	24.70	Negligible
R42	0.0365	25.03	Negligible
R43	0.0205	24.86	Negligible
R44	0.0277	24.96	Negligible
R45	0.0237	25.02	Negligible
R46	0.0550	25.40	Negligible
R47	0.0150	24.84	Negligible
R48	0.0133	24.82	Negligible
R49	0.0280	24.81	Negligible
R50	0.0343	24.85	Negligible
R51	0.0192	24.78	Negligible
R52	0.0097	24.73	Negligible
R53	0.0039	24.70	Negligible
R54	0.0021	24.70	Negligible

12.98 As shown in Table 12.22, the significance of impacts of annual mean NO₂ concentrations as a result of the Proposed Development was predicted to be negligible at all receptor locations, locations and, therefore, not significant, in accordance with EPUK-IAQM guidance.

12.99 The assessment shows a **Negligible** impact with the Proposed Development in place in 2040, taking into account the Local Plan infrastructure growth, with predicted annual mean NO₂ concentrations remaining below the relevant AQOO. Therefore, the Site is considered suitable for the proposed use without the need for mitigation measures to protect future site users from elevated NO₂ concentrations.

Particulate Matter (PM₁₀) Impacts (S2 and S3 Scenarios)

12.100 In accordance with the assessment criteria the annual mean PM₁₀ concentrations were predicted for S2 and S3 scenarios and are summarised in Table 12.23.

Table 12.23: Predicted Annual Mean PM₁₀ Concentrations for S2 and S3

Sensitive Receptor	Predicted Annual Mean PM ₁₀ Concentration (µg/m ³)		
	S2	S3	Change
R1	15.64	15.64	0.0005
R2	15.75	15.75	0.0051

Sensitive Receptor	Predicted Annual Mean PM ₁₀ Concentration (µg/m ³)		
	S2	S3	Change
R3	15.75	15.76	0.0058
R4	15.81	15.82	0.0079
R5	15.78	15.79	0.0071
R6	15.92	15.94	0.0116
R7	15.81	15.82	0.0088
R8	15.92	15.93	0.0148
R9	16.04	16.08	0.0380
R10	16.17	16.22	0.0482
R11	15.83	15.85	0.0208
R12	15.80	15.82	0.0180
R13	15.69	15.70	0.0084
R14	16.17	16.22	0.0472
R15	16.08	16.12	0.0406
R16	16.14	16.19	0.0457
R17	16.19	16.24	0.0475
R18	16.10	16.14	0.0407
R19	16.03	16.07	0.0358
R20	16.06	16.09	0.0373
R21	16.02	16.05	0.0342
R22	15.94	15.95	0.0110
R23	15.91	15.92	0.0056
R24	15.85	15.86	0.0031
R25	15.81	15.81	0.0017
R26	15.71	15.71	0.0012
R27	15.70	15.70	0.0010
R28	15.72	15.72	0.0009
R29	15.74	15.74	0.0008
R30	15.73	15.73	0.0007
R31	15.75	15.75	0.0005
R32	15.79	15.79	0.0005
R33	15.86	15.86	0.0005
R34	15.83	15.83	0.0005
R35	15.79	15.80	0.0004
R36	15.83	15.83	0.0004
R37	15.82	15.82	0.0004
R38	15.64	15.64	0.0003
R38	15.66	15.66	0.0003
R39	15.66	15.66	0.0004
R40	15.64	15.64	0.0004
R41	16.31	16.35	0.0396
R42	15.99	16.01	0.0219
R43	16.14	16.17	0.0296
R44	15.64	15.64	0.0005
R45	15.85	15.87	0.0207
R46	15.96	15.99	0.0303
R47	15.82	15.84	0.0200
R48	15.66	15.66	0.0048
R49	15.62	15.62	0.0010
R50	15.64	15.64	0.0006

Sensitive Receptor	Predicted Annual Mean PM ₁₀ Concentration (µg/m ³)		
	S2	S3	Change
R51	15.66	15.66	0.0009
R52	15.63	15.63	0.0025
R53	15.63	15.63	0.0016
R54	15.62	15.62	0.0006

- 12.101 As indicated in Table 12.23, predicted annual mean PM₁₀ concentrations are below the AQO at all modelled human sensitive receptor locations. There is a minimal change in concentrations with the Proposed Development in place.
- 12.102 Impacts on the AQAL for the predicted annual mean PM₁₀ concentrations at the human sensitive receptor locations are summarised in Table 12.24.

Table 12.24: Predicted PM₁₀ Impacts As a Result of the Proposed Development

Sensitive Receptor	% Change in Concentration Relative to AQAL	Long Term Average Concentration	Impact
R1	0.0031	78.21	Negligible
R2	0.0322	78.75	Negligible
R3	0.0366	78.79	Negligible
R4	0.0502	79.11	Negligible
R5	0.0450	78.96	Negligible
R6	0.0728	79.68	Negligible
R7	0.0558	79.11	Negligible
R8	0.0931	79.67	Negligible
R9	0.2366	80.38	Negligible
R10	0.2971	81.11	Negligible
R11	0.1315	79.26	Negligible
R12	0.1138	79.09	Negligible
R13	0.0535	78.49	Negligible
R14	0.2910	81.11	Negligible
R15	0.2521	80.58	Negligible
R16	0.2824	80.94	Negligible
R17	0.2922	81.19	Negligible
R18	0.2522	80.72	Negligible
R19	0.2226	80.35	Negligible
R20	0.2316	80.46	Negligible
R21	0.2128	80.27	Negligible
R22	0.0688	79.75	Negligible
R23	0.0355	79.59	Negligible
R24	0.0196	79.28	Negligible
R25	0.0111	79.07	Negligible
R26	0.0076	78.56	Negligible
R27	0.0066	78.52	Negligible
R28	0.0059	78.61	Negligible
R29	0.0050	78.69	Negligible
R30	0.0044	78.63	Negligible
R31	0.0031	78.73	Negligible
R32	0.0032	78.97	Negligible
R33	0.0030	79.32	Negligible
R34	0.0029	79.15	Negligible
R35	0.0028	78.98	Negligible

Sensitive Receptor	% Change in Concentration Relative to AQAL	Long Term Average Concentration	Impact
R36	0.0025	79.13	Negligible
R37	0.0024	79.08	Negligible
R38	0.0019	78.22	Negligible
R39	0.0021	78.32	Negligible
R40	0.0023	78.29	Negligible
R41	0.0026	78.21	Negligible
R42	0.2423	81.77	Negligible
R43	0.1368	80.05	Negligible
R44	0.1834	80.84	Negligible
R45	0.1306	79.33	Negligible
R46	0.1896	79.96	Negligible
R47	0.1259	79.21	Negligible
R48	0.0305	78.31	Negligible
R49	0.0066	78.10	Negligible
R50	0.0038	78.22	Negligible
R51	0.0058	78.31	Negligible
R52	0.0157	78.15	Negligible
R53	0.0105	78.14	Negligible
R54	0.0041	78.11	Negligible

12.103 As indicated in Table 12.24, impacts on annual mean PM₁₀ concentrations as a result of the Proposed Development were predicted to be **Negligible** at all receptor locations, in accordance with EPUK-IAQM guidance.

12.104 Similar to NO₂ concentrations, it should also be noted that background PM₁₀ levels are likely to be lower at elevated heights due to increased distance from emission sources, such as the local road network. Therefore, predicted concentrations at heights above ground floor level are considered to be acceptable in regard to pollutant exposure across all receptor locations and have not been assessed further.

12.105 The assessment shows a **Negligible** impact with the Proposed Development in place and predicted annual PM₁₀ concentrations below the AQO. Therefore, the Site is considered to be suitable for the proposed use without the implementation of mitigation techniques to protect existing receptors and future site users from elevated PM₁₀ concentrations.

PM₁₀ Impacts (S4 and S5 Scenarios)

12.106 In accordance with the assessment criteria the annual mean PM₁₀ concentrations were predicted for S4 and S5 scenarios and are summarised in Table 12.25.

Table 12.25: Predicted Annual Mean PM₁₀ Concentrations for S4 and S5

Sensitive Receptor	Predicted Annual Mean PM ₁₀ Concentration (µg/m ³)		
	S4	S5	Change
R1	13.17	13.17	0.0013
R2	13.27	13.28	0.0080
R3	13.28	13.29	0.0088
R4	13.34	13.35	0.0120
R5	13.31	13.32	0.0105
R6	13.45	13.47	0.0173
R7	13.35	13.36	0.0121
R8	13.45	13.47	0.0172

Sensitive Receptor	Predicted Annual Mean PM ₁₀ Concentration (µg/m ³)		
	S4	S5	Change
R9	13.55	13.58	0.0235
R10	13.68	13.71	0.0294
R11	13.36	13.37	0.0135
R12	13.33	13.34	0.0121
R13	13.23	13.23	0.0064
R14	13.68	13.71	0.0294
R15	13.59	13.61	0.0256
R16	13.65	13.68	0.0289
R17	13.70	13.73	0.0305
R18	13.63	13.65	0.0268
R19	13.57	13.59	0.0248
R20	13.60	13.62	0.0275
R21	13.58	13.62	0.0354
R22	13.70	13.74	0.0333
R23	13.67	13.70	0.0329
R24	13.56	13.59	0.0276
R25	13.46	13.49	0.0226
R26	13.33	13.34	0.0131
R27	13.30	13.31	0.0119
R28	13.31	13.33	0.0134
R29	13.32	13.34	0.0147
R30	13.30	13.32	0.0133
R31	13.32	13.33	0.0149
R32	13.38	13.39	0.0191
R33	13.46	13.49	0.0253
R34	13.42	13.44	0.0223
R35	13.37	13.39	0.0191
R36	13.41	13.43	0.0219
R37	13.40	13.42	0.0211
R38	13.17	13.18	0.0026
R38	13.19	13.19	0.0016
R39	13.18	13.19	0.0017
R40	13.17	13.17	0.0017
R41	13.86	13.89	0.0251

Sensitive Receptor	Predicted Annual Mean PM ₁₀ Concentration (µg/m ³)		
	S4	S5	Change
R42	13.57	13.58	0.0144
R43	13.79	13.81	0.0195
R44	14.00	14.02	0.0171
R45	14.73	14.77	0.0388
R46	13.52	13.53	0.0105
R47	13.42	13.42	0.0086
R48	13.40	13.42	0.0174
R49	13.50	13.52	0.0211
R50	13.35	13.36	0.0133
R51	13.21	13.22	0.0062
R52	13.16	13.16	0.0026
R53	13.17	13.17	0.0015
R54	13.19	13.19	0.0017

12.107 As shown in Table 12.25, predicted annual mean PM₁₀ concentrations in 2040 for both scenarios are lower than those predicted for Scenarios S2 and S3 in 2035, and are below the AQO at all modelled sensitive receptor locations. Only small changes in concentrations are observed with the Proposed Development in place.

12.108 Impacts on the AQAL for the predicted annual mean PM₁₀ concentrations at sensitive receptor locations are summarised in Table 12.26.

Table 12.26: Predicted Annual Mean PM₁₀ Concentrations for S4 and S5

Sensitive Receptor	% Change in Concentration Relative to AQAL	Long Term Average Concentration	Impact
R1	0.0096	32.92	Negligible
R2	0.0600	33.20	Negligible
R3	0.0661	33.22	Negligible
R4	0.0901	33.39	Negligible
R5	0.0792	33.31	Negligible
R6	0.1282	33.68	Negligible
R7	0.0902	33.39	Negligible
R8	0.1275	33.67	Negligible
R9	0.1734	33.94	Negligible
R10	0.2143	34.28	Negligible
R11	0.1010	33.43	Negligible
R12	0.0905	33.36	Negligible
R13	0.0485	33.08	Negligible

Sensitive Receptor	% Change in Concentration Relative to AQAL	Long Term Average Concentration	Impact
R14	0.2143	34.27	Negligible
R15	0.1881	34.03	Negligible
R16	0.2113	34.20	Negligible
R17	0.2218	34.33	Negligible
R18	0.1964	34.13	Negligible
R19	0.1825	33.98	Negligible
R20	0.2017	34.06	Negligible
R21	0.2603	34.04	Negligible
R22	0.2427	34.34	Negligible
R23	0.2398	34.25	Negligible
R24	0.2030	33.97	Negligible
R25	0.1675	33.72	Negligible
R26	0.0984	33.36	Negligible
R27	0.0893	33.29	Negligible
R28	0.1003	33.32	Negligible
R29	0.1099	33.35	Negligible
R30	0.0996	33.29	Negligible
R31	0.1119	33.33	Negligible
R32	0.1424	33.49	Negligible
R33	0.1877	33.72	Negligible
R34	0.1660	33.60	Negligible
R35	0.1430	33.48	Negligible
R36	0.1632	33.58	Negligible
R37	0.1573	33.55	Negligible
R38	0.0200	32.94	Negligible
R39	0.0123	32.98	Negligible
R40	0.0132	32.97	Negligible
R41	0.0128	32.93	Negligible
R42	0.1805	34.71	Negligible
R43	0.1060	33.96	Negligible
R44	0.1415	34.52	Negligible
R45	0.1221	35.05	Negligible
R46	0.2625	36.91	Negligible

Sensitive Receptor	% Change in Concentration Relative to AQAL	Long Term Average Concentration	Impact
R47	0.0773	33.83	Negligible
R48	0.0644	33.56	Negligible
R49	0.1297	33.54	Negligible
R50	0.1563	33.79	Negligible
R51	0.0993	33.41	Negligible
R52	0.0469	33.05	Negligible
R53	0.0197	32.89	Negligible
R54	0.0110	32.93	Negligible

12.109 As shown in Table 12.26, impacts on annual mean PM₁₀ concentrations as a result of the Proposed Development were predicted to be **Negligible** at all receptor locations, and, therefore, not significant, in accordance with EPUK-IAQM guidance.

12.110 Similar to NO₂ concentrations, it should also be noted that background PM₁₀ levels are likely to be lower at elevated heights due to increased distance from emission sources, such as the local road network. Therefore, predicted concentrations at heights above ground floor level are considered to be acceptable in regard to pollutant exposure across all receptor locations and have not been assessed further.

12.111 The assessment shows a **Negligible** impact with the development in place in 2040, taking into account the Local Plan infrastructure growth, with predicted annual mean PM₁₀ concentrations remaining below the relevant AQOO. Therefore, the Site is considered suitable for the proposed use without the need for mitigation measures to protect future site users from elevated PM₁₀ concentrations.

Particulate Matter (PM_{2.5}) Impacts (S2 and S3 Scenarios)

12.112 In accordance with the assessment criteria the annual mean PM_{2.5} concentrations were predicted for S2 and S3 scenarios and are summarised in Table 12.27.

Table 12.27: Predicted Annual Mean PM_{2.5} Concentrations for S2 and S3

Sensitive Receptor	Predicted Annual Mean PM _{2.5} Concentration (µg/m ³)		
	S2	S3	Change
R1	10.67	10.67	0.0003
R2	10.73	10.73	0.0027
R3	10.73	10.73	0.0031
R4	10.76	10.77	0.0043
R5	10.75	10.75	0.0038
R6	10.82	10.83	0.0062
R7	10.76	10.77	0.0047
R8	10.82	10.83	0.0079
R9	10.88	10.90	0.0199
R10	10.95	10.98	0.0252
R11	10.77	10.78	0.0109
R12	10.75	10.76	0.0095
R13	10.70	10.70	0.0044
R14	10.95	10.98	0.0248
R15	10.90	10.92	0.0213
R16	10.93	10.96	0.0241
R17	10.97	10.99	0.0254
R18	10.92	10.94	0.0218
R19	10.88	10.90	0.0192

Sensitive Receptor	Predicted Annual Mean PM _{2.5} Concentration (µg/m ³)		
	S2	S3	Change
R20	10.89	10.91	0.0200
R21	10.87	10.89	0.0183
R22	10.83	10.83	0.0057
R23	10.81	10.81	0.0030
R24	10.78	10.78	0.0016
R25	10.76	10.76	0.0009
R26	10.71	10.71	0.0006
R27	10.70	10.70	0.0005
R28	10.71	10.71	0.0005
R29	10.72	10.72	0.0004
R30	10.71	10.71	0.0004
R31	10.72	10.72	0.0003
R32	10.75	10.75	0.0003
R33	10.79	10.79	0.0003
R34	10.77	10.77	0.0002
R35	10.75	10.75	0.0002
R36	10.77	10.77	0.0002
R37	10.76	10.76	0.0002
R38	10.67	10.67	0.0002
R38	10.68	10.68	0.0002
R39	10.68	10.68	0.0002
R40	10.67	10.67	0.0002
R41	11.02	11.04	0.0207
R42	10.85	10.86	0.0115
R43	10.93	10.95	0.0155
R44	10.67	10.67	0.0003
R45	10.78	10.79	0.0111
R46	10.84	10.86	0.0163
R47	10.76	10.78	0.0105
R48	10.68	10.68	0.0025
R49	10.66	10.66	0.0005
R50	10.67	10.67	0.0003
R51	10.68	10.68	0.0005
R52	10.66	10.66	0.0013
R53	10.66	10.66	0.0009
R54	10.66	10.66	0.0003

- 12.113 As indicated in Table 12.27, predicted annual mean PM_{2.5} concentrations are below the interim target of 12 µg/m³, however slightly exceed the legally binding AQO of 10 µg/m³ at all modelled sensitive receptor locations. There are small changes in concentrations with the Proposed Development in place which are considered to be insignificant.
- 12.114 Impacts on the AQAL for the predicted annual mean PM_{2.5} concentrations at sensitive receptor locations are summarised in Table 12.28.

Table 12.28: Predicted PM_{2.5} Impacts As a Result of Proposed Development for 2040 Target (10ug/m³)

Sensitive Receptor	% Change in Concentration Relative to AQAL	Long Term Average Concentration	Impact
R1	0.0024	106.70	Negligible
R2	0.0253	107.29	Negligible
R3	0.0288	107.32	Negligible
R4	0.0395	107.67	Negligible
R5	0.0354	107.51	Negligible
R6	0.0574	108.29	Negligible
R7	0.0437	107.67	Negligible
R8	0.0726	108.27	Negligible
R9	0.1826	108.98	Negligible
R10	0.2300	109.75	Negligible
R11	0.1015	107.81	Negligible
R12	0.0880	107.63	Negligible
R13	0.0413	107.00	Negligible
R14	0.2257	109.75	Negligible
R15	0.1954	109.20	Negligible
R16	0.2198	109.58	Negligible
R17	0.2312	109.91	Negligible
R18	0.1996	109.41	Negligible
R19	0.1760	109.01	Negligible
R20	0.1831	109.13	Negligible
R21	0.1679	108.92	Negligible
R22	0.0528	108.31	Negligible
R23	0.0273	108.14	Negligible
R24	0.0151	107.82	Negligible
R25	0.0085	107.61	Negligible
R26	0.0059	107.07	Negligible
R27	0.0051	107.02	Negligible
R28	0.0045	107.12	Negligible
R29	0.0038	107.21	Negligible
R30	0.0034	107.14	Negligible
R31	0.0024	107.25	Negligible
R32	0.0025	107.50	Negligible

Sensitive Receptor	% Change in Concentration Relative to AQAL	Long Term Average Concentration	Impact
R33	0.0023	107.87	Negligible
R34	0.0023	107.69	Negligible
R35	0.0022	107.50	Negligible
R36	0.0019	107.67	Negligible
R37	0.0019	107.62	Negligible
R38	0.0015	106.71	Negligible
R39	0.0016	106.82	Negligible
R40	0.0018	106.79	Negligible
R41	0.0020	106.70	Negligible
R42	0.1874	110.43	Negligible
R43	0.1056	108.63	Negligible
R44	0.1417	109.47	Negligible
R45	0.1029	107.91	Negligible
R46	0.1497	108.59	Negligible
R47	0.0973	107.75	Negligible
R48	0.0238	106.81	Negligible
R49	0.0051	106.58	Negligible
R50	0.0029	106.72	Negligible
R51	0.0045	106.82	Negligible
R52	0.0121	106.64	Negligible
R53	0.0081	106.62	Negligible
R54	0.0032	106.60	Negligible

12.115 As indicated in Table 12.28, impacts on annual mean PM_{2.5} concentrations as a result of the Proposed Development were predicted to be **Negligible** at all receptor locations, and, therefore, not significant, in accordance with EPUK-IAQM guidance.

12.116 Similar to NO₂ and PM₁₀ concentrations, it should also be noted that background PM_{2.5} levels are likely to be lower at elevated heights due to increased distance from emission sources, such as the local road network. Therefore, predicted concentrations at heights above ground floor level are considered to be lower than those modelled within the assessment.

12.117 Although predicted annual PM_{2.5} concentrations are above the legally binding AQO, it should be noted that pollutant concentrations have been decreasing year on year due to changes in traffic movements after the COVID pandemic and improvements in vehicle technologies. This is also supported by the monitored data where pollutants have reduced in annual concentrations from pre-pandemic (2018 and 2019) to post pandemic (2022) years. Therefore, concentrations are expected to reduce further in 2040, with a lower impact on existing receptor locations.

PM_{2.5} Impacts (S4 and S5 Scenarios)

12.118 In accordance with the assessment criteria the annual mean PM_{2.5} concentrations were predicted for S4 and S5 scenarios and are summarised in Table 12.29.

Table 12.29: Predicted Annual Mean PM_{2.5} Concentrations for S4 and S5

Sensitive Receptor	Predicted Annual Mean PM _{2.5} Concentration (µg/m ³)		
	S4	S5	Change
R1	8.95	8.98	0.0315
R2	8.95	9.04	0.0934
R3	8.95	9.05	0.0980
R4	8.95	9.08	0.1341
R5	8.95	9.07	0.1174
R6	8.95	9.15	0.1977
R7	8.95	9.09	0.1351
R8	8.95	9.15	0.1957
R9	8.95	9.20	0.2507
R10	8.95	9.27	0.3236
R11	8.95	9.09	0.1418
R12	8.95	9.08	0.1262
R13	8.95	9.02	0.0666
R14	8.95	9.27	0.3208
R15	8.95	9.22	0.2703
R16	8.95	9.26	0.3072
R17	8.95	9.29	0.3412
R18	8.95	9.25	0.2975
R19	8.95	9.21	0.2647
R20	8.95	9.23	0.2818
R21	8.95	9.23	0.2774
R22	8.95	9.29	0.3354
R23	8.95	9.27	0.3163
R24	8.95	9.21	0.2554
R25	8.95	9.15	0.2022
R26	8.95	9.08	0.1256
R27	8.95	9.06	0.1101
R28	8.95	9.07	0.1168
R29	8.95	9.07	0.1226
R30	8.95	9.06	0.1100
R31	8.95	9.07	0.1192
R32	8.95	9.10	0.1525
R33	8.95	9.15	0.2022

Sensitive Receptor	Predicted Annual Mean PM _{2.5} Concentration (µg/m ³)		
	S4	S5	Change
R34	8.95	9.13	0.1774
R35	8.95	9.10	0.1519
R36	8.95	9.12	0.1737
R37	8.95	9.12	0.1665
R38	8.95	8.99	0.0356
R38	8.95	8.99	0.0440
R39	8.95	8.99	0.0416
R40	8.95	8.98	0.0330
R41	8.95	9.37	0.4155
R42	8.95	9.20	0.2542
R43	8.95	9.32	0.3735
R44	8.95	9.44	0.4871
R45	8.95	9.84	0.8859
R46	8.95	9.18	0.2270
R47	8.95	9.12	0.1701
R48	8.95	9.12	0.1673
R49	8.95	9.17	0.2232
R50	8.95	9.09	0.1370
R51	8.95	9.01	0.0601
R52	8.95	8.98	0.0257
R53	8.95	8.98	0.0337
R54	8.95	8.99	0.0431

12.119 As shown in Table 12.29, predicted annual mean PM_{2.5} concentrations are below the legally binding AQO of 10 µg/m³ at all modelled sensitive receptor locations. There are small changes in concentrations with the Proposed Development in place.

12.120 Impacts on the AQAL for the predicted annual mean PM_{2.5} concentrations at sensitive receptor locations are summarised in Table 12.30.

Table 12.30: Predicted PM_{2.5} Impacts As a Result of Proposed Development for 2040 Target (10ug/m³)

Sensitive Receptor	% Change in Concentration Relative to AQAL	Long Term Average Concentration	Impact
R1	0.3502	89.81	Negligible
R2	1.0326	90.43	Negligible

Sensitive Receptor	% Change in Concentration Relative to AQAL	Long Term Average Concentration	Impact
R3	1.0832	90.48	Negligible
R4	1.4761	90.84	Negligible
R5	1.2951	90.67	Negligible
R6	2.1609	91.48	Slight
R7	1.4867	90.85	Negligible
R8	2.1400	91.46	Slight
R9	2.7244	92.01	Slight
R10	3.4895	92.74	Slight
R11	1.5597	90.92	Negligible
R12	1.3907	90.76	Negligible
R13	0.7390	90.17	Negligible
R14	3.4598	92.71	Slight
R15	2.9320	92.20	Slight
R16	3.3183	92.57	Slight
R17	3.6720	92.91	Slight
R18	3.2170	92.47	Slight
R19	2.8724	92.15	Slight
R20	3.0524	92.32	Slight
R21	3.0063	92.27	Slight
R22	3.6126	92.85	Slight
R23	3.4134	92.66	Slight
R24	2.7748	92.05	Slight
R25	2.2098	91.52	Slight
R26	1.3844	90.76	Negligible
R27	1.2156	90.60	Negligible
R28	1.2881	90.67	Negligible
R29	1.3510	90.73	Negligible
R30	1.2146	90.60	Negligible
R31	1.3139	90.69	Negligible
R32	1.6758	91.03	Negligible
R33	2.2091	91.52	Slight
R34	1.9434	91.27	Slight
R35	1.6690	91.02	Negligible

Sensitive Receptor	% Change in Concentration Relative to AQAL	Long Term Average Concentration	Impact
R36	1.9041	91.24	Slight
R37	1.8262	91.16	Negligible
R38	0.3964	89.86	Negligible
R39	0.4893	89.94	Negligible
R40	0.4627	89.92	Negligible
R41	0.3673	89.83	Negligible
R42	4.4368	93.66	Slight
R43	2.7622	92.04	Slight
R44	4.0063	93.24	Slight
R45	5.1612	94.37	Slight
R46	9.0073	98.36	Moderate
R47	2.4739	91.77	Slight
R48	1.8647	91.20	Negligible
R49	1.8345	91.17	Negligible
R50	2.4334	91.73	Slight
R51	1.5079	90.87	Negligible
R52	0.6666	90.10	Negligible
R53	0.2862	89.76	Negligible
R54	0.3756	89.84	Negligible

12.121 As shown in Table 12.30, the predicted impacts on annual mean PM_{2.5} concentrations as a result of the Proposed Development range from Negligible to Moderate, in accordance with EPUK-IAQM guidance. A Moderate impact was predicted only at receptor R46.

12.122 Although the predicted annual mean PM_{2.5} concentrations are below the legally binding AQO at all receptor locations in both the S4 and S5 scenarios, the Proposed Development, together with the Local Plan infrastructure growth in 2040, is predicted to result in **Slight** effects at some receptors and a **Moderate** impact at one receptor, as shown in Table 12.26. Mitigation measures should therefore be implemented to minimise residual impacts.

Ecological Receptor Impacts

12.123 Ecological receptor locations were modelled at 0m to represent ground level and 1m to account for bat activity.

Significance Criteria

12.124 The designated habitats may contain species, habitats, or other receptors that are potentially sensitive to environmental pollution and for which indicative exposure thresholds have been determined by UK government to ensure their protection. These thresholds are known as Critical Levels (CL_e - for airborne concentrations) and Critical Loads (CL_o - for deposition rates). Critical Levels represent the pollutant concentrations below which no known adverse effects occur on ecosystems or vegetation. These have been defined for internationally designated sites (e.g., SACs, SPAs), nationally designated sites (e.g., SSSIs), and locally designated sites (e.g., Ancient Woodland).

12.125 The relevant critical levels are summarised in Table 12.31.

Table 12.31: Ecological Critical Levels

Pollutant	Air Quality Objective	
	Concentration ($\mu\text{g}/\text{m}^3$)	Measured as
NO _x	30	Annual mean

Nitrogen Oxide (NO_x) Impacts

12.126 Annual mean NO_x concentrations are predicted at nine ecological receptor locations for all of the modelling scenarios. The calculation of the process contribution (PC) to the critical level (CLE) has been conducted for operational Proposed Development in 2035. The results are presented in Table 12.33.

Table 12.33: Predicted Annual Mean NO_x Concentrations and PC

Sensitive Receptor	Predicted Annual Mean NO _x Concentration ($\mu\text{g}/\text{m}^3$)		NO _x PC ($\mu\text{g}/\text{m}^3$)	Predicted Annual Mean NO _x Concentration ($\mu\text{g}/\text{m}^3$)		NO _x PC ($\mu\text{g}/\text{m}^3$)
	S2	S3		S4	S5	
Eco1	13.98	13.99	0.002	11.77	11.78	0.003
Eco2	14.24	14.27	0.027	12.85	12.90	0.047
Eco3	13.99	14.01	0.014	12.19	12.22	0.027
Eco4	13.83	13.83	0.000	11.69	11.70	0.001
Eco5	15.48	15.51	0.029	12.77	12.78	0.016
Eco6	14.69	14.69	0.002	12.60	12.61	0.012
Eco7	14.10	14.10	0.006	12.07	12.09	0.018
Eco8	14.50	14.50	0.000	12.46	12.50	0.035

12.127 As shown in Table 12.33, predicted annual mean NO_x concentrations are well below the NO_x critical levels (30 $\mu\text{g}/\text{m}^3$) at all modelled receptor locations for both 2035 and 2040 scenarios. The calculated PCs are below 0.3 $\mu\text{g}/\text{m}^3$ at all ecological receptors. Therefore, the Proposed Development is considered to have insignificant impacts on the sensitive ecological receptors with respect to NO_x.

Nitrogen Deposition Impacts

12.128 Of the modelled ecological receptors, only E4 lies within the boundary of the Longmoor Bog SSSI and represents the qualifying bog habitat. Therefore, nitrogen and acid deposition calculations have been undertaken for E4 only. The remaining receptors (E1–E3 and E5–E9) are located outside designated ecological sites and have been assessed for NO_x concentrations only.

12.129 Annual mean NO_x concentrations, nutrient nitrogen deposition, and acid deposition were predicted at identified ecological receptors for S2 to S5 scenarios.

12.130 Nitrogen deposition was derived from the modelled annual mean NO₂ concentrations by applying a dry deposition velocity of 0.0015 m/s, representative of short vegetation typical of bog habitats, and a unit conversion factor of 0.315 to express the result in kg N/ha/yr.

12.131 The PC was calculated as the difference between the predicted nitrogen deposition under the *with development* and *without development* scenarios.

12.132 The PEC was obtained by adding the background nitrogen deposition of 15.4 kg N/ha/yr (2019 mid-year average from APIS) to the calculated PC. The results for receptor E4 are presented in Tables 12.34. and 12.34 for both 2035 and 2040 scenarios.

12.133 For both 2035 and 2040 operational years, the PC and PEC were compared against the relevant critical loads to determine significance.

12.134 The APIS identifies three qualifying habitats within Longmoor Bog SSSI -

- Betula pubescens–Molinia caerulea Woodland
- Erica tetralix–Sphagnum compactum Wet Heath

- *Molinia caerulea*–*Potentilla erecta* Mire

12.135 All three are characterised by wet, acidic vegetation communities that are sensitive to atmospheric nitrogen and acid deposition. The corresponding critical loads for acid deposition range from 0.142 to 1.058 keq N/ha/yr and 0.1865 to 1.200 keq S/ha/yr, as summarised in Tables 12.34 and 12.35 Nitrogen and acid deposition calculations were undertaken for E4, representing the most sensitive of these habitats.

Table 12.34: Predicted Annual Mean NO₂ Concentrations, PC, PEC, Dry Nitrogen and Acid Deposition For S2 and S3 Scenarios

Sensitive Receptor	Predicted Annual Mean NO ₂ Concentration (µg/m ³)		Dry Nitrogen Deposition (KgN/ha/yr)		N Dep PC (KgN/ha/yr)	Ndep Background (KgN/ha/yr)	PEC	1% CL of 5 (KgN/ha/yr)
	S2	S3	S2	S3				
Eco4	11.74	11.74	0.0055	0.0055	3.5x10 ⁻⁰⁸	12.3	12.3	0.05

Table 12.35: Predicted Annual Mean NO₂ Concentrations, PC, PEC, Dry Nitrogen and Acid Deposition For S4 and S5 Scenarios

Sensitive Receptor	Predicted Annual Mean NO ₂ Concentration (µg/m ³)		Dry Nitrogen Deposition (KgN/ha/yr)		N Dep PC (KgN/ha/yr)	Ndep Background (KgN/ha/yr)	PEC	1% CL of 5 (KgN/ha/yr)
	S4	S5	S4	S5				
Eco4	9.883	9.883	0.00467	0.00467	1.0x10 ⁻⁰⁷	12.3	12.3	0.05

12.136 As shown in Tables 12.34 and 12.35, the PC from the Proposed Development, 1.0×10^{-8} kg N/ha/yr in 2035 and 1.0×10^{-7} kg N/ha/yr in 2040 are substantially below 1 % of the critical load (0.05 kg N/ha/yr). The total nitrogen deposition (PEC = 12.3 kg N/ha/yr) remains unchanged from the background value, indicating that the Proposed Development makes no measurable addition to existing nitrogen deposition levels. The impact of the Proposed Development on nitrogen and acid deposition at Longmoor Bog SSSI is therefore considered **insignificant**.

MITIGATION

Construction Mitigation

- 12.137 Dust caused by construction activities will vary as the site moves and changes. This will also determine the receptors sensitive to these phases.
- 12.138 It is therefore determined that the DMP, secured by condition, will be regularly updated to reflect the changes in activities across the site and the impact upon human and ecological receptors subject to dust caused by the Proposed Development.
- 12.139 The following construction phase assessment has been completed based on the whole Proposed Development. This will be updated to reflect the phased Development plans.
- 12.140 The IAQM guidance provides a number of potential mitigation measures to reduce effects during the construction phase. These measures have been adapted for the Site as summarised in Table 12.36. The mitigation measures will be set out in a CEMP to be secured by a planning condition to the planning permission to ensure any likely significant effects are appropriately mitigated.

Table 12.36: Fugitive Dust Mitigation Measures

Guidance	Comment
Communications	• Develop and implement a stakeholder communications plan that includes community engagement before work commences on site. • Display the name and contact details of person(s) accountable for air quality and dust

Guidance	Comment
Site Management	issues on the site boundary. This may be the environment manager/engineer or the site manager. • Display the head or regional office contact information. • Develop and implement a Dust Management Plan.
	• Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken. • Make the complaints log available to the local authority when asked. • Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the logbook. • Hold regular liaison meetings with other high risk construction sites within 500 m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes.
Monitoring	• Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of site boundary, with cleaning to be provided if necessary. • Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked. • Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions. • Agree dust deposition, dust flux, or real-time PM10 continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site or, if it a large site, before work on a phase commences.
Preparing and Maintaining the Site	• Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible. • Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site. • Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period. • Avoid site runoff of water or mud. • Keep site fencing, barriers and scaffolding clean using wet methods. • Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below. • Cover, seed or fence stockpiles to prevent wind whipping.
Operating Vehicle/Machinery and Sustainable Travel	• Ensure all vehicles switch off engines when stationary - no idling vehicles. • Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable. • Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate). • Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials. • Implement a Travel Plan that supports and encourages sustainable travel.
Operations	• Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems. • Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate. • Use enclosed chutes and conveyors and covered skips. • Minimise drop heights from conveyors, loading shovels, hoppers and other loading or

Guidance	Comment
	handling equipment and use fine water sprays on such equipment wherever appropriate.
	• Ensure equipment is readily available on site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.
Waste Management	• Avoid bonfires and burning of waste materials.
Earthworks	• Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable. • Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable. • Only remove the cover in small areas during work and not all at once.
Construction	• Avoid scabbling (roughening of concrete surfaces) if possible. • Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place. • Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery. • For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.
Track out	• Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site, This may require the sweeper being continuously in use. • Avoid dry sweeping of large areas. • Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport. • Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable. • Record all inspections of haul routes and any subsequent action in a site logbook. • Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned. • Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable). • Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits. • Access gates to be located at least 10 m from receptors where possible.

Operational Mitigation

- 12.141 The modelled results show predicted annual mean NO₂, PM₁₀, and PM_{2.5} concentrations at all human receptor locations were below the relevant AQO in the proposed operational year, 2035. Additionally, the Proposed Development will have a Negligible impact at all receptor locations, in line with EPUK-IAQM guidance. However, in 2040, the Proposed Development is predicted to result in Slight effects at some receptors and a Moderate effect at one receptor.
- 12.142 It should be noted that PM_{2.5} concentrations are predicted to slightly exceed the legally binding target in 2035. However, pollutant concentrations have been decreasing year on year due to changes in traffic patterns following the COVID-19 pandemic and ongoing improvements in vehicle technologies. This trend is supported by the monitored data presented, which show a reduction in annual pollutant concentrations between the pre-pandemic years (2018 and 2019) and post-pandemic years (2022). By 2040, concentrations are predicted to remain below the legally binding target for PM_{2.5}, providing further evidence of a continuing improvement in local air quality and a reduced impact at existing receptor locations.
- 12.143 Additionally, the Proposed Development will have an insignificant impact on ecological receptor locations in relation to NO₂, PM₁₀, and PM_{2.5} emissions.
- 12.144 The slight and moderate effects predicted in 2040 represent a conservative, worst-case assessment, as the modelled receptor locations are positioned immediately adjacent to the road network and

therefore do not reflect actual exposure conditions. Furthermore, each of the committed developments included in the 2040 scenario is likely to incorporate its own mitigation measures, while the local authority continues to implement air quality action plans aimed at improving overall air quality across the area. Nevertheless, the best practice measures outlined below will help to further minimise any residual effects associated with the Proposed Development.

12.145 Potential best practice mitigation options are listed below. It is acknowledged that this is not an exhaustive list but sets out a range of mitigation measures which could be implemented at the reserved matters stage of the Proposed Development -

- At least 1 Electric Vehicle point per ten residential dwellings - This shall be based on the best technology available at the time of planning approval,
- Travel Plan (where required) including mechanisms for discouraging high emission vehicle use and encouraging the uptake of low emission fuels and technologies,
- A Welcome Pack available to all new residents online and as a booklet, containing information and incentives to encourage the use of sustainable transport modes from new occupiers, and
- Car club provision within the Proposed Development or support given to local car club/Electric vehicle car clubs.

12.146 If the above measures are implemented, this will further reduce the potential impacts associated with the Proposed Development. Therefore, the development is considered suitable for the proposed use without the need for additional air quality mitigation techniques.

RESIDUAL IMPACTS

12.147 Residual effects are defined as those that remain following the implementation of mitigation. Residual effects on air quality for the Proposed Development are outlined below.

Construction Phase

12.148 Assuming the relevant mitigation measures outlined in Table 12.36 are implemented, the residual effect from all dust generation activities and other activities associated with the construction phase of the Proposed Development is predicted to be **Negligible** and therefore not significant.

Operational Phase

12.149 For S2 and S3, predicted annual mean NO₂, PM₁₀ and PM_{2.5} concentrations at all human receptor locations are below the relevant AQOs, and the Proposed Development is predicted to have a **Negligible** impact in line with EPUK-IAQM guidance. In 2040 (S4 and S5), **Slight** effects are predicted at some receptors and a **Moderate** effect at one receptor (R46); however, these represent a conservative worst-case as receptors were modelled immediately adjacent to the road, overstating actual exposure. Committed developments are expected to incorporate their own mitigation, and ongoing local air quality actions will further improve conditions. Overall, residual effects from the Proposed Development are predicted to be **Negligible**.

12.150 Predicted annual mean NO_x concentrations are below the critical level of 30 µg/m³ at all modelled ecological receptor locations for all modelling scenarios. In addition, long-term PC, alongside the derived PEC values, do not exceed the relevant AQAL at any of the ecological receptor locations.

12.151 Of the ecological receptors assessed, only E4 lies within Longmoor Bog SSSI and was therefore evaluated for nitrogen and acid deposition; all other receptors were assessed for NO_x only. Predicted NO_x, nitrogen deposition and acid deposition were calculated for Scenarios S2-S5 using standard deposition velocities and APIS background values. The resulting Process Contributions for E4 in both 2035 and 2040 are extremely small ($\leq 1.0 \times 10^{-7}$ kg N/ha/yr) and far below 1% of the lowest critical load. The Predicted Environmental Concentration remains identical to the background level (12.3 kg N/ha/yr), demonstrating no measurable increase from the Proposed Development. Overall, the Proposed Development is predicted to have an **insignificant** effect on nitrogen and acid deposition at Longmoor Bog SSSI.

CUMULATIVE IMPACTS

12.152 Cumulative effects are defined as those that occur as a result of combined baseline and future activities that may impact in combination over time. The assessment incorporated traffic generated by all committed developments, including approved schemes within the wider area that could affect road traffic near the Proposed Development. On this basis, the cumulative impact of the Proposed Development is predicted to be **not significant** during both the construction and operational phases.

SUMMARY

- 12.153 During the construction phase of the Proposed Development, there is the potential for air quality impacts as a result of fugitive dust emissions from the Site. These were assessed in accordance with the IAQM methodology. Assuming good practice dust control measures are implemented, as detailed in the report, the residual significance of potential air quality impacts from dust generated by demolition, earthworks, construction and track out activities was predicted to be **Negligible**. The residual effects of dust and PM₁₀ generated by construction activities are therefore not significant.
- 12.154 The dispersion modelling results indicated that predicted NO₂, PM₁₀ and PM_{2.5} concentrations at all sensitive human receptor locations across the modelling extent were below the relevant AQOs. For S2 and S3, operational phase impacts are predicted to be **Negligible** at all receptors in accordance with EPUK-IAQM guidance. For S4 and S5, the Proposed Development is predicted to result in **Slight** effects at some receptors and a **Moderate** effect at one receptor, reflecting a conservative worst-case assessment. Overall, the operational impacts of the Proposed Development are not considered significant.
- 12.155 Predicted annual mean NO_x concentrations are below the critical level of 30 µg/m³ at all modelled ecological receptor locations for all modelling scenarios. In addition, long-term PC, alongside the derived PEC values, do not exceed the relevant AQAL at any of the ecological receptor locations.
- 12.156 Across all assessment scenarios, nitrogen and acid deposition at the only relevant ecological receptor within Longmoor Bog SSSI (E4) remain effectively unchanged from background levels. The predicted Process Contributions are extremely small and consistently well below 1% of the lowest critical load, indicating no measurable increase attributable to the Proposed Development. Consequently, the Proposed Development is not expected to give rise to significant effects on designated habitats, and ecological impacts are considered insignificant.
- 12.157 The Site is therefore considered suitable for residential use without the need for mitigation methods to protect existing human receptors, future users and ecological receptors from poor air quality. However, to further reduce air quality impacts, good practice measures have been recommended.
- 12.158 Table 12.37 summarises the effects of the Proposed Development in respect of air quality.

Table 12.37: Summary Table

Description of Likely Significant Effects	Significance	Description of Mitigation	Description of Residual Effects	Significance
Demolition/Construction Phase				
Earthworks	High	Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable. Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable. Only remove the cover in small areas during work and not all at once.	Assuming the relevant mitigation measures are implemented, the residual effect from all dust generation activities and other activities associated with the construction phase of the Proposed Development is predicted to be negligible and therefore not significant. Insignificant	Negligible
Construction	High	Avoid scabbling (roughening of concrete surfaces) if possible. Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place. Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.	As above	Negligible

		For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.		
Track out	High	Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site, This may require the sweeper being continuously in use. Avoid dry sweeping of large areas. Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport. Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable. Record all inspections of haul routes and any subsequent action in a site logbook. Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowzers and regularly cleaned. Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable). Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits. Access gates to be located at least 10 m from receptors where possible.	As above	Negligible
Operational Phase				
In 2035 with/without Proposed Development - NO ₂ , PM ₁₀ , PM _{2.5}	Negligible	No mitigation measures are required, however best practice mitigation options to further reduce operational effects are recommended: At least 1 Electric Vehicle point per ten dwellings – This shall be based on the best technology available at the time of planning approval. Travel Plan (where required) including mechanisms for discouraging high emission vehicle use and encouraging the uptake of low emission fuels and technologies. A Welcome Pack available to all residents online and as a booklet, containing information and incentives to encourage the use of sustainable transport modes; and Car club provision within the Proposed Development or support given to local car club/Electric vehicle car clubs.	Predicted impacts on NO₂, PM₁₀ and PM_{2.5} concentrations as a result of the operational phase of the Proposed Development were predicted to be negligible and therefore not significant at all human sensitive receptor locations within the vicinity of the Site. As such, no further mitigation measures are required. The Proposed Development can further reduce impacts by adopting IAQM Planning Guidance minimum best practice techniques.	Negligible
In 2040 with/without Proposed Development – NO ₂ /PM ₁₀	Negligible	As above	As above	Negligible

In 2040 with/without Proposed Development – PM _{2.5}	Negligible for some, Slight Adverse for some and Moderate Adverse at the R46 receptor	As above	As above	Negligible for some, Slight Adverse for some and Moderate Adverse at the R46 receptor
In both 2035 and 2040 scenarios, NO _x , PM _{2.5} , PM ₁₀ , NO ₂ on ecological receptors, including Longmoor Bog SSSI	Negligible	As above	As above	Negligible
Cumulative - Construction				
NO ₂ , PM ₁₀ , PM _{2.5}	Negligible	As above	As above – assumed for all sites	Negligible
Cumulative - Operation				
NO ₂ , PM ₁₀ , PM _{2.5}	Negligible	As above, and note that Transport modelling includes the 4 large cumulative sites	As above – assumed for all sites	Negligible

13 CLIMATE CHANGE

INTRODUCTION

- 13.1 This chapter of the ES assesses the likely significant effects of the Proposed Development on climate change ('Greenhouse Gas (GHG) Emissions Assessment'), and the likely significant effects of climate change on the Proposed Development ('Climate Change Resilience and Adaptation Assessment'). It has been produced by Aether Ltd.
- 13.2 As each assessment has different methodologies, baseline conditions, potential impacts and mitigation measures, this chapter will present the GHG Emissions Assessment and Climate Change Resilience and Adaptation assessments separately. This chapter is structured as follows:
- **Introduction and Context** – introduces the chapter, presents the policy and legislation relevant to the assessments;
 - **Part 1: GHG Emissions Assessment** – sets out the methodology, baseline and considers the activities associated with the Proposed Development with the potential to emit GHG emissions and the mitigation measures implemented to reduce these emissions;
 - **Part 2: Climate Change Resilience and Adaptation** – sets out the methodology, baseline and reviews the outcomes of a high-level climate risk and resilience assessment undertaken for the Proposed Development and the mitigation measures implemented to increase climate resilience.

POLICY CONTEXT

Legislation

Climate Change Act 2008

- 13.3 The Climate Change Act (CCA) 2008 established the context for government action, providing a legally binding framework for the UK to reduce GHG emissions and build the UK's ability to adapt to climate change. The CCA 2008 requires the Government to compile a Climate Change Risk Assessment every 5 years and develop a National Adaptation Programme to address risks and opportunities from climate change.
- 13.4 In July 2019, an amendment was made to change the target of net UK carbon emissions for the year 2050 from 80% to 100% lower than the 1990 baseline.
- 13.5 To reduce carbon emissions, the UK Government has set legally binding carbon budgets, capping the amount of GHGs emitted in the UK over 5-year periods.
- 13.6 The Committee on Climate Change (CCC) published its recommendation on the level of the 6th carbon budget for the period 2033-37, in December 2020. The Carbon Budget Order 2021 sets the legally binding limit at 965 million tonnes CO₂e, aligned with achieving net-zero by 2050, with a trajectory that is consistent with the Paris Agreement.

Planning Policy

National Planning Policy Framework 2024

- 13.7 Climate change is one of the core planning principles which the NPPF expects plan-making and decision-taking to underpin. The NPPF recognises that planning plays a key role in minimising vulnerability, providing resilience and managing risks associated with climate change.
- 13.8 Paragraph 161 now explicitly recognises the UK's legally-binding target of achieving net-zero greenhouse-gas emissions by 2050. Paragraph 163 requires that the *"need to mitigate and adapt to climate change should also be considered in preparing and assessing planning applications, taking into account the full range of potential climate-change impacts."*
- 13.9 Paragraph 164 continues to underline that new development should be planned to:
- "avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green and blue infrastructure",* and

“help to reduce greenhouse-gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government’s policy for national technical standards.”

Planning Practice Guidance

13.10 The PPG is intended to be read alongside the NPPF and provides guidance on a range of planning issues. The PPG, in relation to climate change, advises how to identify suitable mitigation and adaptation measures in the planning process to address the impacts of climate change.

13.11 Paragraph 004 Reference ID: 6-004-20140612 provides guidance on how adaptation and mitigation approaches should be integrated as follows:

“When preparing Local Plans and taking planning decisions local planning authorities should pay particular attention to integrating adaptation and mitigation approaches and looking for ‘win-win’ solutions that will support sustainable development. This could be achieved in a variety of ways, for example:

- *by maximising summer cooling through natural ventilation in buildings and avoiding solar gain;*
- *through district heating networks that include tri-generation (combined cooling, heat and power); or*
- *through the provision of multi-functional green infrastructure, which can reduce urban heat islands, manage flooding and help species adapt to climate change – as well as contributing to a pleasant environment which encourages people to walk and cycle.*

Local planning authorities should be aware of and avoid the risk of maladaptation (adaptation that could become more harmful than helpful). For example, designing buildings to maximise solar gain in winter without thinking through the implications for overheating in summer.”

13.12 Paragraph 005 Reference ID: 6-005-20140306 provides guidance on dealing with the uncertainty of climate risks when promoting adaptation in particular developments:

“The impact of climate change needs to be taken into account in a realistic way. In doing so, local planning authorities will want to consider:

- *identifying no or low cost responses to climate risks that also deliver other benefits, such as green infrastructure that improves adaptation, biodiversity and amenity*
- *building in flexibility to allow future adaptation if it is needed, such as setting back new development from rivers so that it does not make it harder to improve flood defences in future*
- *the potential vulnerability of a development to climate change risk over its whole lifetime”*

13.13 Paragraph 007 Reference ID: 6-007-20140306 discusses how local planning authorities can identify appropriate mitigation measures in plan making:

“Every area will have different challenges and opportunities for reducing carbon emissions from new development such as homes, businesses, energy, transport and agricultural related development.”

- *“... The distribution and design of new development and the potential for servicing sites through sustainable transport solutions, are particularly important considerations that affect transport emissions. Sustainability appraisal should be used to test different spatial options in plans on emissions.*
- *Different sectors may have different options for mitigation. For example, measures for reducing emissions in agricultural related development include anaerobic digestion, improved slurry and manure storage and improvements to buildings. In more energy intensive sectors, energy efficiency and generation of renewable energy can make a significant contribution to emissions reduction.”*

13.14 Local development plans identify the need for housing over the plan period, including the amount and location for sites for new development. In accordance with the NPPF, local development plans need to consider carbon emissions throughout the process of selecting suitable sites for development and the number of houses that will be built in each location. A Sustainability Appraisal (SA) is required to assess the impact of building new houses on climate change and through adopting the local plan, the Local Planning Authority (LPA) has accepted the impact of new housing developments on climate change through their potential to release GHGs.

Building Regulations (England) and the Future Homes Standard

- 13.15 The Building Regulations 2010 (as amended) set the statutory framework for building works in England, including key provisions for energy performance and resilience to climate change. The associated technical guidance includes Approved Document L (2021 edition, effective June 2022) for the conservation of fuel and power and Approved Document O (2021 edition, effective June 2022) for preventing overheating, both of which are directly relevant to assessing a project's operational carbon performance and climate-resilience design.
- 13.16 The Government is also progressing the Future Homes Standard, which will significantly raise standards for new homes to support low-carbon development and align with national climate targets.

Wokingham Borough Local Development Framework – Adopted Core Strategy Development Plan Document (January 2010)

- 13.17 Policy CP1 (Sustainable Development) requires development to minimise the emissions of pollutants into the wider environment; minimise the consumption of resources; and *“contribute to the goal of reaching zero-carbon developments as soon as possible by: a) including appropriate on-site renewable energy features; and b) minimising energy and water consumption by measures including the use of appropriate layout and orientation, building form, design and construction, and take account of microclimate so as to minimise carbon dioxide emissions through giving careful consideration to how all aspects of development form.”*

Wokingham Borough Development Plan – Adopted Managing Development Delivery Local Plan (February 2014)

- 13.18 Policy CC04 (Sustainable Design and Construction) requires proposals to deliver high quality sustainably designed and constructed developments and references the now withdrawn Code for Sustainable Homes. The Climate Change Interim Policy Statement (December 2022) clarifies Policy's CC04 requirements, encouraging new buildings to aim towards the Future Homes/Buildings Standards and also applying the Part G 'optional standard' of 110 litres/person/day water consumption for new homes.
- 13.19 Policy CC05 (Renewable Energy and Decentralised Energy Networks) states the requirement that *“Planning permission will only be granted to proposals that deliver a minimum 10% reduction in carbon emissions through renewable energy or low carbon technology where development is for schemes of more than 10 dwellings or non-residential development of more than 1,000 sq. m gross floor space.”* The Interim Policy Statement clarifies that this 10% uplift is expected to be achieved in addition to the emissions improvements through the Building Regulations (as updated in June 2022).

Wokingham Borough Local Development Framework – Sustainable Design and Construction Supplementary Planning Document (May 2010)

- 13.20 The SPD outlines the Borough's approach to sustainable design and construction for new developments. It emphasises the integration of renewable and low-carbon technologies, water and resource efficiency, sustainable site design (including orientation and passive measures), biodiversity enhancement, and waste reduction. It provides guidance for implementing the minimum 10% on-site renewable or low-carbon energy requirement set out in Policy CC05. The document also highlights the need to both mitigate the causes of climate change and adapt to its consequences via construction methods, site layout, drainage strategies, biodiversity considerations and materials choices.

Emerging Local Plan Update

- 13.21 The emerging Local Plan Update (LPU) will replace the Core Strategy and MDD, setting policies on housing, infrastructure, climate, and biodiversity to 2040. According to the Local Development Scheme 2024–2027, adoption is anticipated in May 2026.

Wokingham Borough Council's Climate Change Emergency Declaration (July 2019)

- 13.22 The Council declared a climate emergency in July 2019, committing to do as much as possible to achieve carbon neutrality by 2030. The council published its first Climate Emergency Action Plan (CEAP), which sets out planned steps to achieving the goal. Key priority 7 of the CEAP is to utilise planning policies to minimise emissions from new developments.

PART 1: GHG EMISSIONS ASSESSMENT METHODOLOGY

- 13.23 This section presents the assessment of the impact the Proposed Development will have upon climate change.
- 13.24 There is no nationally prescribed method for assessing GHG emissions within Environmental Impact Assessment (EIA); therefore, the approach draws upon IEMA's 2022 guidance *Assessing Greenhouse Gas Emissions and Evaluating their Significance*.
- 13.25 The guidance establishes a proportionate, transparent and iterative framework for the consideration of GHGs through the EIA process. It emphasises the integration of mitigation at the earliest design stages following the IEMA GHG Management Hierarchy of eliminate, reduce, substitute and compensate, ensuring measures are embedded rather than retrofitted. Screening and scoping determine whether GHGs are likely to give rise to significant effects, and establish the scope, boundaries and proportionality of assessment in line with the project's scale and context.
- 13.26 The guidance sets out a structured approach encompassing mitigation, screening, scoping, assessment, significance and reporting. The assessment methodology follows key steps: defining scope and baselines, collecting activity data, applying suitable emissions factors and evaluating the significance of residual impacts. Significance is judged not by fixed thresholds but by reference to the project's contribution to national and sectoral net zero pathways and its alignment with a 1.5°C trajectory.
- 13.27 Qualitative assessment is acceptable where data are limited or mitigation has been embedded early in design. The guidance also stresses clear communication of assumptions, limitations, and mitigation commitments within the ES to ensure a consistent, proportionate and credible assessment of GHG emissions.

Consultation

- 13.28 The Council issued their EIA Scoping Opinion on 28 January 2025 (**Technical Appendix 1.2**). The Sustainability Officer provided several comments relevant to the assessment of greenhouse gas emissions within the EIA, which are outlined below -
- The use of Representative Concentration Pathway (RCP) 8.5 as the emissions scenario for assessing climate change impacts and significance is supported.
 - The Whole Life Carbon Assessment (WLCA) approach is strongly supported – further detail should be provided on items such as scope and modules, benchmarks and targets, and the monitoring framework.
 - The ES should demonstrate how GHG emission reductions are being achieved in line with the energy hierarchy (be lean, be clean, be green, be seen).
 - The 10% carbon reduction requirement (beyond Building Regulations Part L at the time of submission) should be stated and accounted for.
 - The GHG assessment should quantify both the operational and embodied emissions, and present results as total CO₂e over the project lifecycle to enable evaluation of the schemes overall carbon performance.

Study Area

- 13.29 The GHG Emissions Assessment study area includes the Site and extends to include activities that occur beyond the Site boundary, such as the generation of electricity off site. As GHG impacts are global and cumulative with all other sources of emissions, no specific geographical study area is defined for this assessment as the system is global.

Assessment

- 13.30 The goal of this assessment is to identify the GHG emissions generated during the construction and operation of the Proposed Development and the mitigation measures that will seek to reduce these emissions.
- 13.31 The scope of emissions within the assessment align with the World Business Council for Sustainable Development (WBCSD) / World Resources Institute (WRI) Greenhouse Gas Protocol, and British Standard Institution (BSI) PAS 2070 methodology and considers the construction and operation stages of the Development. The WRI GHG Protocol categorises direct and indirect emissions into three broad scopes -
- Scope 1: all direct GHG emissions,

- Scope 2: indirect GHG emissions from consumption of purchased energy, such as electricity, heat or steam, and
- Scope 3: all other indirect emissions not covered in Scope 2 that occur in the value chain of the Development, such as the extraction and production of purchased materials and fuel, waste disposal, etc.

13.32 The GHG emissions assessment has been based on the assumption that construction works will commence in 2027, with completion in 2035.

13.33 IEMA guidance emphasises that a proportionate and appropriate assessment should be undertaken to inform decision making. The sources of emissions that are considered within the assessment, in line with IEMA guidance, are discussed below.

Emissions Scoped into the Assessment

13.34 The GHG Emissions Assessment evaluates the following potential sources of GHG emissions from the construction and operation of the Development. The following emission sources and scope of GHG emission assessment is based on information provided in the Barkham Square EIA Scoping Opinion Report (December 2024) (**Technical Appendix 1.1**) and WBC's Scoping Opinion Response (28th January 2025) (**Technical Appendix 1.2**). These are outlined in Table 13.1 below.

Table 13.1: GHG Emissions Sources and Scope of GHG Emission Assessment

Development Stage	GHG Protocol	Activity Assessed
Baseline	Scope 1	A qualitative review of the current land use of the Site. It is difficult to calculate GHG emissions in a way that is proportionate as detailed information would be required to assess these emissions qualitatively, such as specific information on farming activities, use of fertilisers and soil moisture content. Therefore, a qualitative review has been undertaken.
	Scope 2	There are no existing buildings on Site therefore there are no Scope 2 emissions for the baseline scenario.
Construction	Scope 1	Direct emissions were considered non-significant due to the temporary nature of transport and construction activities and therefore scoped out. A qualitative appraisal has been provided. Emission during construction are considered within both the transport and air quality assessments.
	Scope 2	Indirect energy related emissions are considered temporary in nature. A qualitative appraisal of electricity use during construction has been considered proportionate at this stage of development.
	Scope 3	A quantitative estimate of the embodied carbon of the development, based on previous Crest Nicholson project data. Potential indirect emissions associated with waste has been addressed qualitatively as the exact materials and quantities used during construction of the proposed buildings is not known at this stage and will be managed within the waste infrastructure available in the Wokingham region.
Operation	Scope 1	A quantitative estimate of emissions associated with directly burning fossil fuel on site, such as heating in proposed buildings, and vehicle trips generated by the Site. A qualitative description of the carbon sequestration associated with landscaping and green infrastructure. As carbon sequestration is dependent on several factors including rate of tree growth and management regime, it is considered proportionate to undertake a qualitative evaluation.
	Scope 2	A quantitative estimate of emissions associated with purchased electricity from the national grid during operation of the Development.
	Scope 3	A qualitative assessment of water use and waste disposal has been provided and is considered proportionate in the context of the scale of the development and the embedded mitigation designed into the scheme to reduce water use and to meeting WBC's waste requirements.

13.35 Due to the nature of the Proposed Development (residential-led), it has not been designed with a fixed lifetime and therefore the end-of-life emissions have not been assessed at this stage.

Data Sources

- 13.36 The following technical reports have been utilised within this assessment -
- Transport ES Chapter 7 – vehicle emissions,
 - Energy & Sustainability Statement – operational carbon (PED),
 - Crest Nicholson WLCA data for existing projects, aligning with BS EN 15978:2011.

Determining Significance

Identification and Sensitivity of Receptors

- 13.37 The IEMA guidance 2022 states that GHG emissions are not geographically limited. They have a global effect rather than directly affecting any specific local receptor to which a level of sensitivity can be assigned. The receptor for GHG emissions is the global atmosphere. The receptor has **a high sensitivity**, given the severe consequences of global climate change and the cumulative contributions of all GHG emission sources.

Determining Magnitude of Change

- 13.38 The magnitude of change has been considered as the change experienced from the baseline conditions at the sensitive receptor and has been considered on a scale of high, medium, low and negligible. Table 13.2 provides definitions for each scale of magnitude used within this assessment. The definitions are based on IEMA guidance and will be determined by professional judgement.

Table 13.2: Definition of Magnitude of Change

Magnitude of Impact	Description
High	A large or very large change considered to be on a national scale.
Medium	An intermediate change considered to be on a regional scale
Low	A small change considered to be on a local scale.
Negligible	No discernible change from baseline conditions and considered to be beneath level of perception.

Determining Level of Significance

- 13.39 The IEMA guidance 2022 illustrates how to determine significance depending on the project's whole life GHG emissions and how these align with the UK's net zero by 2050 compatible trajectory.
- 13.40 The guidance provides practitioners with examples of how to distinguish different levels of significance, which are presented in Table 13.3. Major or moderate adverse effects or beneficial effects are considered to be significant. Minor adverse and negligible effects are not considered to be significant.

Cumulative Effects

- 13.41 In line with IEMA guidance 2022, GHG emissions are global in nature and have no locally defined receptor. Therefore, unlike other EIA topics, it is neither appropriate nor meaningful to assess cumulative GHG impacts from nearby projects individually.
- 13.42 All GHG emissions contribute cumulatively to global climate change, and this cumulative effect is inherently considered through contextualisation against the UK's carbon budgets and the national trajectory toward net zero.
- 13.43 Accordingly, this assessment focuses on the project's total emissions and its alignment with relevant carbon reduction pathways, rather than duplicating cumulative assessments of individual developments.

Limitations and Assumptions

- 13.44 The assessment has been based on parameters for the Proposed Development, therefore the project information that has informed the GHG assessment is broad and, where referenced, based on assumptions.
- 13.45 This qualitative assessment provides a high level overview of the likely significant effects of GHG emissions on the Proposed Development. Given the outline nature of the application, specific GHG emissions data is not available within this ES. Quantitative estimations of emissions have been made as

defined in Table 13.1, where data is available from technical assessment made as identified in paragraph 13.37.

BASELINE CONDITIONS

The Site

- 13.46 The existing Site conditions are outlined in Chapter 3 of the ES. It is presently principally comprised of poor-quality agricultural grassland (DEFRA classification Grade 4). The agricultural use of the Site is likely to produce GHG emissions associated with livestock, crop fertilisation, soil-based emissions from disturbing soils, waste produced as a result of farming practices, and other activities.
- 13.47 Within the Site there is linear boundary vegetation (including native hedgerows) and sporadic mature tree coverage (including veteran trees and parcels of ancient woodland). These features are likely to sequester small amounts of carbon.

The Surrounding Area

- 13.48 The total emissions for the UK over the last three carbon budgets are shown in Table 13.3 below. The average annual net UK carbon account across the third carbon budget period represents a 37% reduction from base year emissions (1990).

Table 13.3: 2008 – 2022 UK Carbon Budgets

UK Budget	Carbon budget level	Reduction below 1990 levels	UK emissions
1 st carbon budget (2008 – 2012)	3,018 MtCO ₂ e	26%	2,982 MtCO ₂ e
2 nd carbon budget (2013 – 2017)	2,782 MtCO ₂ e	31%	2,398 MtCO ₂ e
3 rd carbon budget (2018 – 2022)	2,544 MtCO ₂ e	37%	2,513 MtCO ₂ e

- 13.49 The GHG emissions for the Council area in 2023 are presented in Table 13.4 below. Transport was the greatest source of emissions. 'Land Use, Land Use Change and Forestry' (LULUCF) sequestered 10.9 ktCO₂e, which is reflected in the total emissions for The Council area.

Table 13.4: Wokingham GHG estimates for 2023

Wokingham GHG estimates (ktCO ₂ e)								
Industry	Commercial	Public sector	Domestic	Transport	LULUCF (net)	Agriculture	Waste	Grand total
26.9	62.7	16.7	213.0	311.3	-10.9	23.2	12.1	655

Future Baseline

- 13.50 If the Site is not developed, the amount of GHG emissions emitted will remain at the current levels. As the linear boundary vegetation and patches of woodland continue to mature, their ability to sequester carbon may marginally increase. However, due to the limited size of these areas, this is likely to be a negligible change.

UK Carbon Budgets

- 13.51 The UK Carbon Budgets for the next 16 years are set out below in Table 13.5. The carbon budgets are legally binding and UK GHG emissions will need to be reduced to meet them. The CCC provided their recommendation for the 7th carbon budget, for the period 2038 – 2042, in February 2025, however, the Government has not yet imposed this budget into law.

Table 13.5: UK Carbon Budgets for 2023 – 2042

Budget	Carbon budget level	Reduction below 1990 levels
4 th carbon budget (2023 – 2027)	1,950 MtCO ₂ e	52%
5 th carbon budget (2028 – 2032)	1,725 MtCO ₂ e	58%
6 th carbon budget (2033 – 2037)	965 MtCO ₂ e	78%
7 th carbon budget (2038 – 2042)	535 MtCO ₂ e	87%

Decarbonisation of Grid

- 13.52 The rapid decarbonisation of the national electricity grid is directly contributing to a steady reduction in GHG emissions from new developments over the next decade. This shift is being driven by the continued expansion of renewable energy generation and the decline of coal-fired power stations. The growing share of low-carbon and renewable energy sources, coupled with the corresponding reduction in fossil fuel use, is referred to as decarbonisation. As a result, the emissions intensity of electricity generation—measured in grams of carbon dioxide per kilowatt hour—is steadily decreasing. This represents a vital step toward meeting the emissions reduction targets set under the Climate Change Act (CCA) 2008.
- 13.53 In December 2024, the Department for Energy Security and Net Zero (DESNZ) published its Clean Power 2030 Action Plan, outlining the Government's strategy to achieve a clean power system by 2030. The plan focuses on strengthening energy security and affordability while driving down emissions. It envisions that, in a typical weather year, the 2030 power system will see clean sources produce at least as much power as Great Britain consumes in total over the whole year, and at least 95% of Great Britain's generation. This would reduce grid carbon intensity from 171 gCO₂e/kWh in 2023 to below 50 gCO₂e/kWh in 2030.
- 13.54 For new developments, the energy supply from the Grid is that is used to power homes and businesses is increasingly becoming cleaner and greener, thereby reducing the GHG emissions associated with energy use at the Proposed Development.

Electric Vehicles

- 13.55 Vehicle electrification remains a key component of the UK Government's approach to achieve net zero GHG emissions by 2050. Policy continues to evolve to accelerate the transition towards zero-emission transport, supported by national strategies such as the Road to Zero Strategy, the Electric Vehicle Infrastructure Strategy, and the Smart Charging Action Plan.
- 13.56 The Zero Emission Vehicle (ZEV) Mandate now requires manufacturers to meet progressively increasing sales targets for zero-emission vehicles, leading to the phase-out of new petrol and diesel cars and vans by 2035. Complementary measures, including planning reforms and targeted funding, are designed to expand and streamline the deployment of public and private charging infrastructure, particularly in areas with limited access to off-street parking.
- 13.57 Financial and regulatory incentives remain in place to encourage uptake of electric vehicles, with a gradual transition towards long-term mechanisms that integrate vehicle ownership, taxation, and energy system planning. Collectively, these initiatives form a central part of the UK's wider strategy to decarbonise the transport sector and reduce GHG emissions from road traffic.

IMPACTS

Construction Impacts

- 13.58 The main sources of direct GHG emissions during construction relate to the burning of fossil fuels during the transportation of building materials and waste by HGV to and from the Site. Further sources of GHG emissions include the burning of fossil fuels on Site to power the plant engines and equipment.
- 13.59 Construction of the Proposed Development would result in a land use change of the Site from predominantly agricultural to a built urban development, which will comprise of sealed surfaces and open space. Following completion of the Proposed Development, all land will be removed from agricultural use. Therefore, GHG emissions associated with the agricultural use of the Site will no longer be generated and will be replaced by the operational GHG emissions of the Proposed Development, as discussed below.

Scope 1 Emissions

- 13.60 The direct Scope 1 GHG emissions from construction activities, without mitigation, is considered to be a temporary **Minor Adverse** impact and therefore **Not Significant**.

Scope 2 Emissions

- 13.61 The temporary construction office, welfare facilities and lighting on the Site will require electricity purchased from the National Grid. This will result in indirect GHG emissions generated from the burning of fossil fuels to deliver electricity to the Site.

- 13.62 The indirect GHG emissions from construction activities, without mitigation, is considered to be a temporary **Minor Adverse** impact and therefore **Not Significant**.

Scope 3 Emissions

- 13.63 Construction of the Proposed Development will cause an increase in indirect GHG emissions including from, for example, embodied carbon and emissions from processing waste.
- 13.64 Embodied carbon emissions are a result of extracting raw materials, processing them, assembling them into usable products and transporting them to Site for use in the construction of the Proposed Development. It is noted that a large proportion of GHG emissions from a development may be accounted for within Scope 3 embodied carbon.
- 13.65 The embodied carbon associated with the Proposed Development will be heavily influenced by the type and amount of material required to construct the Proposed Development. Extraction and production processes can be carbon intensive, particularly for materials such as concrete. It is noted that the embodied carbon associated with the Proposed Development is also heavily influenced by available materials and supply chains in the local and wider areas.
- 13.66 A preliminary assessment of embodied (Scope 3) greenhouse gas emissions has been undertaken using whole life cycle carbon analysis (WLCA) data provided by the Applicant from a comparable previous residential development. The WLCA was prepared in accordance with BS EN 15978:2011. The reported kgCO₂e/m² values have been proportionally scaled to reflect the approximate gross internal floor area (GIA) of the Proposed Development.
- 13.67 The assessment considers lifecycle stages A1-A5 (product and construction), B1-B5 (use stage embodied impacts) and C1-C4 (end of life). Operational energy use (Stage B6) is addressed separately within the Scope 2 operational assessment. Where stage-specific data were unavailable from the reference project, those elements have been excluded from this preliminary review. The findings are summarised in Table 13.6 below.

Table 13.6: WLCA Analysis for Scope 3 Emissions

WLCA Stage	Stage Description	Emissions (kgCO ₂ e/m ²)	Tonnes CO ₂ e (for approximate Development floor area)	Comment
A1 – A3	Product Stage	304.00	23,909.60	N/A
A4	Transportation to Site	5.00	393.25	N/A
A5	Construction Installation Process	16.00	1,258.40	N/A
B1 – B5	Use, Maintenance, Repair, Refurbishment/Replacement	142.00	11,168.30	Only data for Replacement (B5) available.
B6	Operational Energy Use	-	-	Addressed in Scope 2 operational analysis.
C1 – C4	End of Life	125.00	9,831.25	N/A
N/A	Biogenic Carbon	-107.00	-8,415.55	Carbon sequestered by materials of biological origin; not specific to a stage.
D	Benefits and Loads Beyond the System Boundary	-	-	No data – excluded from assessment.
	TOTAL	485	38,145.25	

- 13.68 The total embodied carbon intensity (associated with lifecycle stages A1-A5, B1-B5 and C1-C4) is estimated to be approximately 592 kgCO₂e/m² prior to accounting for biogenic carbon storage, or 485 <500kgCO₂e/m² when including biogenic carbon associated with materials of biological origin.
- 13.69 The London Energy Transformation Initiative (LETI) Climate Emergency Design Guide identifies a benchmark target for residential development of reducing embodied carbon by 40% or achieving <500

kgCO₂e/m² across stages A1–A5, B1–B5 and C1–C4. On a whole life basis including biogenic carbon storage, the Development is estimated to fall within this benchmark. Excluding biogenic carbon, the embodied carbon intensity would exceed the LETI target.

- 13.70 Given the preliminary nature of this proportional scaling exercise, these findings should be validated through a project-specific WLCA prepared at detailed design stage in accordance with BS EN 15978:2011.
- 13.71 Construction waste will need to be transported and treated, through the existing waste management infrastructure and through the waste hierarchy as delivered through site waste management plans. This will result in GHG emissions, although these will inevitably be in the control of the organisation that manages these processes.
- 13.72 With consideration of the above, scope 3 emissions from the construction are considered to be noticeable on a local scale due to the several activities associated with purchased materials and their embodied carbon. Therefore, there is likely to be an indirect, **Minor Adverse** effect. Recommended mitigation measures are outlined below.

Operational Impacts

Scope 1 Emissions

- 13.73 The use of electric-led heating, as defined within the energy statement for the project, means there will be no direct emissions for heating.
- 13.74 The completed Proposed Development will generate an increase in traffic volumes through the Site and along the local transport network thereby generating GHG emissions from burning fossil fuels through road transport. As the Proposed Development is residential, it would generate a limited number of HGV movements. The Proposed Development is located in proximity to existing sustainable transport facilities that are within walking distance of proposed residents, with pedestrian and cycling routes that connect to local facilities. The provision of pedestrian and cycle routes reduces the need to rely on cars and therefore reduces GHG emissions associated from transport during operation.
- 13.75 There is potential for carbon sequestration associated with the Proposed Development and the green infrastructure strategy during operation, as shown on Figure 5.4. This relates to the land use changes from agricultural land to the creation of new habitats, and the retention and enhancement of existing habitats.
- 13.76 Based on estimates presented in the Transport Assessment, the Proposed Development is forecast to generate 2,806 two-way daily vehicle trips. Using the data from the Department for Transport, which indicates that the average car journey length in the South East is 8.3 miles, this equates to an estimated 23,290 total vehicle miles per day (8,500,850 miles per annum). Given the residential nature of the Site, the majority of trips are anticipated to comprise private car movements, with limited LGV or HGV activity.
- 13.77 Applying the Government's 2025 greenhouse gas conversion factor for an average car (unknown fuel) of 0.26915kgCO₂ e per mile, this equates to estimated direct operational transport emissions of approximately 2,289 tCO₂e per annum.
- 13.78 For contextualisation, the estimated annual operational transport emissions can be compared against Wokingham Borough's transport emission, which total 311.3 ktCO₂e (2023). The Proposed Development's transport-related Scope 1 emissions (noting this comparison is indicative and intended to provide context only).
- 13.79 In the absence of mitigation, these direct operational transport emissions are considered to give rise to **Minor Adverse** effect and are therefore assessed as **Not Significant**. As with the example above, GHG effects are experienced at a global scale, with the atmosphere acting as the receptor.

Scope 2 Emissions

- 13.80 Scope 2 emissions will arise from purchased electricity from the National Grid to meet the building energy demand of the Proposed Development, which will predominantly comprise new residential dwellings. This includes electric heating systems, hot water provision and the operation of appliances and internal lighting. The estimated emissions associated with electricity consumption over the first 10 years of operation are presented in Table 13.7.

Table 13.7: Emissions associated with electricity use within buildings

Year	Annual Emissions (tCO ₂ /year)
2027	666
2030	455
2035	122

- 13.81 For contextualisation, Wokingham Borough's domestic emissions totalled 213.0 ktCO₂e in 2023 with total Borough-wide emissions of 655 ktCO₂e. The Proposed Development's estimated Scope 2 emissions would therefore represent approximately 0.3% of Wokingham's domestic emissions in 2027, reducing to approximately 0.2% in 2030 and 0.06% by 2035. When compared against total Borough emissions, the Proposed Development would represent approximately 0.01% in 2027, reducing further over time (noting these comparisons are indicative and intended to provide scale and context only).

Scope 3 Emissions

- 13.82 During operation, indirect Scope 3 emissions will result from, for example, the disposal of waste and the provision and treatment of water supplies. Emissions resulting from the treatment of both waste and water will be managed by the relevant companies (such as Thames Water). It is anticipated that emissions will reduce over time as these companies are legally required to align with the CCA.
- 13.83 The Proposed Development will incorporate water efficiency measures and target the higher water efficiency standard outlined in Building Regulations Part G, which is 110 litres/person/day.
- 13.84 The Proposed Development will provide recycling facilities in accordance with the Council's policy, enabling users to recycle. In turn this will reduce the amount of GHG emissions associated with waste.
- 13.85 The indirect Scope 3 GHG emissions during operation of the Proposed Development, without mitigation, are considered to be a **Minor Adverse** effect and therefore **Not Significant**.

MITIGATION

Construction Mitigation

- 13.86 A CEMP will be secured through a suitably worded planning condition. The CEMP should include several mitigation measures covering transport, materials, waste and air quality during construction. Measures that will reduce GHG emissions during construction include, for example, no unnecessary idling of engines, maintenance of plant equipment to check they are operating optimally and efficient use of materials to reduce waste.
- 13.87 Other recommended measures include procuring locally sourced materials and requiring suppliers to report on annual Scope 1 and 2 GHG emissions. The CEMP should also outline the management arrangements to reduce road vehicle trips, seek to reduce the number and length of construction related transport movements, and seek to reduce GHG emissions from vehicle movements through training and best construction and logistics practice.
- 13.88 It is recommended that a SWMP is prepared prior to the commencement of construction, although this is no longer a legal requirement. The SWMP will be secured through a suitably worded planning condition. The SWMP will aid the management, procurement and delivery of materials to support material usage optimisation and minimisation of waste quantities. This will reduce the need for offsite waste management, limit the number of vehicle movements required during site preparation and will result in a reduction of GHG emissions associated with transport, waste and material used during construction.

Operational Mitigation

Transport

- 13.89 Chapter 7 of the ES presents the assessment for Transportation. No significant adverse highways and transport related effects have been identified, and therefore no specific mitigation or monitoring is required. Nevertheless, a number of measures will be implemented to promote the use of sustainable modes of travel and thus minimise the impacts on the transport network. This includes improvements to location pedestrian and cycle connectivity to be delivered as part of the development. The new Site access junction also incorporates improved, widened shared-use footways as well as crossing points at appropriate locations.

- 13.90 The uptake of sustainable modes of travel will also be promoted through sustainable travel initiatives delivered through The Council's MyJourney, which the Proposed Development is supportive of. This follows the same approach to implementation as Arborfield Green, enabling a collaborative, holistic approach to wider travel initiatives.
- 13.91 The operational mitigation is summarised as follows -
- Sustainable travel initiatives to encourage future occupants of the Development to travel sustainably.
 - Appropriate vehicle access strategy, providing connections to influence traffic distribution.
 - Comprehensive sustainable travel strategy to encourage sustainable modes of travel and reduce car use.

Energy Efficiency

- 13.92 The mitigation of operational GHG emissions is informed by the energy efficiency measures set out in the accompanying Energy & Sustainability Statement, which should be referred to for further detail.
- 13.93 The Proposed Development will reduce emissions through a fabric-first, energy-efficient design. High levels of insulation, enhanced airtightness, reduced thermal bridging and optimised building orientation will minimise heat loss and support passive solar gains. Glazing, shading and daylighting strategies will further reduce heating and cooling demand, lowering regulated carbon emissions at source.
- 13.94 Beyond demand reduction, all dwellings will incorporate low-carbon, all electric building services. Air source heat pumps (ASHP) are anticipated to provide space heating and hot water, avoiding the use of fossil fuels and supporting compliance with the Future Homes Standard trajectory. Energy-efficient lighting, smart controls and appropriately designed ventilation systems (prioritising natural ventilation where possible) will further reduce operational energy use, ensuring homes perform efficiently in practice.
- 13.95 To meet The Council's Policy CC05, at least 10% of regulated energy demand will be met through on-site renewable or low-carbon technologies. Roof-mounted solar photovoltaic (PV) systems are considered the most suitable solution and will be integrated into building designs to optimise output and carbon savings. Final system sizing and placement will be confirmed at the Reserved Matters stage to secure a robust and policy-compliant GHG mitigation package.

RESIDUAL IMPACTS

Construction Phase

- 13.96 The Proposed Development will still emit GHG emissions despite mitigation so the residual effect of the Proposed Development on climate change during construction is considered to be temporary **Minor Adverse and Not Significant**. However, as stated in the methodology, GHG impacts are cumulative. It should be noted that the SA/SEA of the Local Plan gives consideration to GHG emissions and accepts the impact of GHGs from the Proposed Development.

Operational Phase

- 13.97 The assessment identified negligible to minor adverse effects resulting from operational GHG emissions. Several mitigation measures are embedded into the design of the Proposed Development including zero carbon ready building design, along with further measures that will be brought forward at detailed design. GHG emissions are also expected to reduce over time with the increased use of EVs over petrol or diesel vehicles. It is therefore considered that the Proposed Development addresses operational GHG emissions. The residual effect of the Proposed Development on climate change during operation is considered to be permanent **Minor Adverse and Not Significant**. It should be noted that the SA/SEA of the Local Plan gives consideration to GHG emissions and accepts the impact of GHGs from the Proposed Development.

CUMULATIVE IMPACTS

- 13.98 As noted above, and in line with IEMA guidance 2022, GHG emissions are global in nature and have no locally defined receptor. Therefore, unlike other EIA topics, it is neither appropriate nor meaningful to assess cumulative GHG impacts from nearby projects individually. Therefore, a cumulative impacts assessment has not been undertaken.

PART 2: CLIMATE CHANGE RESILIENCE AND ADAPTION METHODOLOGY

- 13.99 This section presents the outcome of the assessment on the impact of climate change upon the Proposed Development.

- 13.100 There is no single nationally prescribed method for assessing climate change resilience and adaptation within an EIA; therefore, the approach considers IEMA's 2020 *Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation*.
- 13.101 This guidance provides a proportionate and transparent framework for integrating climate resilience into the EIA process. It promotes early consideration of future climate risks, embedding adaptation measures from the outset rather than retrofitting them later. Screening and scoping identify whether the project's vulnerability to climate change, or the potential for climate to exacerbate other environmental effects, could give risk to significant effects. The scope and proportionality of assessment are defined according to project scale, location, and design life.
- 13.102 Key steps include identifying relevant climate projections, defining receptor sensitivity and vulnerability, assessing the magnitude and likelihood of climate-induced effects, and determining overall significance. Significance is judged in terms of the project's robustness to project future climates and the effectiveness of embedded adaptation measures, rather than fixed quantitative thresholds.
- 13.103 Qualitative or risk-based assessment is appropriate where data are limited or where resilience has been designed in from early stages.

Consultation

- 13.104 The Sustainability Officer provided several comments relevant to the assessment of climate change resilience and adaptation within the EIA in the Scoping Opinion. These are outlined below -
- The use of Representative Concentration Pathway (RCP) 8.5 as the high-emissions scenario for assessing climate impacts is supported.
 - Local climate projections (rather than UK-wide averages) should be used wherever possible, recognising that Wokingham is projected to experience higher summer temperatures (above the UK average) and significant seasonal rainfall variation. Recommended sources for local projections are provided.
 - The assessment of summer overheating – particularly in dwellings and for vulnerable residents – is appropriately recognised as a potentially significant effect and is supported.
 - The cooling hierarchy and passive design measures should be embedded within the development.
 - The ES should treat reduced winter heating demand and increased summer cooling need as separate effects, if scoped into the assessment.
 - The assessment should also consider reduced summer rainfall as a water-supply vulnerability issue, drawing on local projections.
 - Planning applications should demonstrate that both climate mitigation and adaptation have been integrated into design, responding to local climate hazards, vulnerabilities and resilience opportunities.

Study Area

- 13.105 The climate change resilience and adaptation assessment utilises UK Climate Change Projections 2018 (UKCP18) for a high emissions scenario (RCP 8.5), produced by the Met Office, for Wokingham, although the area of influence for potential vulnerability impacts is expected to be limited to the Site and the immediate area around this. The district-level probabilistic projections have been used to show a broad range of outcomes for the study area.

Data Sources

- 13.106 IEMA's 2020 guidance recommends that the climatic baseline should consider extremes in short-term weather events, such as heatwaves; long-term climatic variability, such as seasonal changes in precipitation; and average climatic norms, such as ambient temperature.
- 13.107 The current climatic baseline has been defined by historic climate conditions and the prevailing conditions at the time of the assessment using UK and regional observations, supplemented by Wokingham specific data.

- 13.108 The future climatic conditions have been informed by the Met Office's Local Authority Climate Explorer (BETA, V1.0) online tool. This provides location-specific climate projection data and indicators at local authority scale to support adaptation planning and risk assessment.
- 13.109 The projections in the Explorer are based on datasets from UKCP18, which use global and regional climate models to simulate potential future climate conditions across the UK. The projections employ RCPs reflecting differing global trajectories in terms of economic activity, land use, and population growth, which collectively influence the degree of future climate change.
- 13.110 For the purposes of this assessment, projections associated with RCP8.5 (the most conservative, high-impact emission scenario) have been considered, representing a potential average increase in global mean surface temperature of approximately 4.3°C by 2081-2100 compared to pre-industrial conditions. This scenario is considered appropriate for assessing potential long-term effects of climate change on the Development given the inherent uncertainties associated with global emissions trends.
- 13.111 The Explorer provides a range of climate change indicators derived from the UKCP18 model outputs, including projected changes in average annual and seasonal temperature, frequency of extreme heat events, average and extreme precipitation, and changes in the intensity of heavy rainfall. Projections are presented as percentage of temperature changes relative to the 1981-2000 baseline period and are available for standard future time horizons (2040s and 2080s). This data enables an understanding of both the magnitude and direction of projected climatic trends at a spatial scale relevant to the local authority within which the Site is located.
- 13.112 It should be noted that the Site is in-land and is not affected by coastal influences; therefore, parameters relating to sea level rise and coastal flood have not been included within this assessment.
- 13.113 To assess the impacts of climate change on the Development within the context of specific disciplines, a review of Chapter 7 Transportation, Chapter 12 Air Quality, Chapter 10 Landscape and Visual, Chapter 8 Ecology/Conservation, and Chapter 11 Drainage/Flood Risk of the ES and the associated supporting technical appendices has been undertaken.

Assessment Approach

- 13.114 In accordance with IEMA guidance, the vulnerability and resilience of the Proposed Development to climate change has been identified by undertaking a risk assessment that includes -
- Identifying potential climate change risks to a scheme or project,
 - Assessing these risks (potentially prioritising to identify the most severe), and
 - Formulating mitigation actions to reduce the impact of the identified risks.
- 13.115 The risk assessment considers the likelihood of a hazard occurring that could result in an impact on sensitive receptors. In addition, the magnitude of effects on the Proposed Development will depend on the severity of the consequences of the impact, and the vulnerability of the receptor itself. The definitions of these terms can therefore be summarised as follows -
- **Hazard** is an effect of climate change which has the potential to cause an impact on sensitive receptors associated with the Proposed Development,
 - **Magnitude** is the likelihood of an impact occurring and the consequence of the impact of a hazard, and
 - **Vulnerability** is the degree to which receptors are susceptible to adverse impacts and is influenced by sensitivity, adaptive capacity, and exposure to climate hazards.
- 13.116 IEMA guidance recommends that the climatic baseline should consider extremes in short-term weather events, such as heatwaves; long-term climatic variability, such as seasonal changes in precipitation; and average climate norms, such as ambient temperatures.
- 13.117 The temporal scope of the assessment has been based on the assumption that construction works are anticipated to commence on Site in 2027, and last for approximately eight years with completion in 2035, as outlined in Chapter 5. The post-construction stage will run up to 2100, as this is the last date available in the UKCP18 data.

Determining Significance

Identification of Receptors

13.118 Receptors that may be affected by climate change have been identified with consideration of both extreme weather events and gradual climatic changes in the study area for the Proposed Development. In accordance with IEMA guidance, receptors have been assessed against their vulnerability which is defined as follows -

- **High vulnerability:** directly dependent on existing/prevaling climatic factors and reliant on these specific existing climate conditions in continuing in future, or only able to tolerate a very limited variation in climate conditions,
- **Medium vulnerability:** receptor is dependent on some climatic factors but able to tolerate a range of conditions, and
- **Low vulnerability:** climate factors have little influence on receptors.

Receptors Scoped into the Assessment

13.119 The GHG Emissions Assessment evaluates the following potential sources of GHG emissions from the construction and operation of the Proposed Development. The following emission sources and scope of GHG emission assessment is based on information provided in **Technical Appendices 1.1 and 1.2**. These include -

- Increase in summer temperatures during construction affecting workers,
- Decrease in summer rainfall and reduced water supplies impacting construction,
- Changing temperatures and rainfall levels and impact to existing ground conditions,
- Enjoyment of social infrastructure in a changing climate.

13.120 Table 13.8 outlines the moderate and high vulnerability receptors included in this assessment and their vulnerability to climate change.

Table 13.8: Receptor vulnerability

Receptor	Vulnerability	Reasoning
Future users of the site (residents including those in elderly care, employees, students)	Medium to High	Some future users of the Site will be more vulnerable to climate change than others, depending on a range of factors such as age (children, young people and the elderly) and existing poor health. A key emerging climate risk for new residential development is overheating, particularly as average summer temperatures rise and heatwaves become more frequent and intense. Without appropriate design, dwellings can experience internal conditions that compromise comfort and health, especially for vulnerable occupants.
Infrastructure including buildings and roads	Medium	Infrastructure across the Development ranges in value. Critical infrastructure, such as energy and water pipes/cables are considered to be of moderate vulnerability given they can tolerate some changes in climate but are critical for the operation of the Development.
Ecology, landscaping and planting	Medium	Species identified within and surrounding the Site (see Chapter 8 for details) have widespread geographical ranges and the Site is not within the edge of their ranges.

Magnitude of Change

13.121 The magnitude of change depends on a combination of the probability of an effect occurring over the time period of the Proposed Development and the consequence of the receptors affected, as set out in the IEMA guidance.

13.122 The climate resilience assessment provides a high level summary of the magnitude of hazards that have been identified through defining the current and emerging climatic baseline. As per IEMA guidance, the magnitude assigned to the effect also considers embedded mitigation measures which will reduce the probability or the consequence of the effect and therefore the overall magnitude.

Defining Significance

- 13.123 There is an absence of significance criteria for determining the significance of effects resulting from climate change. IEMA guidance states that receptor vulnerability and uncertainties must be considered. Significance has therefore been determined by IEMA guidance and professional judgement. Effects determined to be moderate or greater are considered significant in EIA terms.

Limitations and Assumptions

- 13.124 Scientific evidence shows that our climate is changing. However, there are significant uncertainties in the magnitude, frequency and spatial occurrence within the climate projections utilised in this assessment. The projections are dependent on future global GHG emissions and, while several different scenarios are provided, it cannot be reliably predicted which (if any) emission scenario will occur over the next 80 years. As a result, RCP8.5, the highest emission scenario, is considered most appropriate for this assessment to provide a conservative projection.
- 13.125 Additionally, projections after the 2040s increasingly diverge between scenarios and provide greater confidence for long-term climate averages than extreme events. For example, there is greater confidence around changes in temperature than there is in relation to wind. Levels of confidence and certainty are considered when assessing the likelihood and consequence of climate hazards.
- 13.126 The projections provided by the Met Office's Explorer tool represent plausible climate futures rather than forecasts and are subject to inherent model, scenario and downscaling uncertainties. Aggregation to local authority boundaries generalises finer-scale climatic variation, and local micro-climates or exposure factors (e.g. urban heat effects, orography) may not be fully captured. Accordingly, results should be interpreted as indicative trends to inform adaptation planning rather than deterministic predictions.

BASELINE CONDITIONS

UK Observations

- 13.127 Observed climate changes over the UK include -
- The most recent full decade (2009–2018) has been on average 0.3°C warmer than the 1981–2010 average and 0.9°C warmer than 1961–1990. All of the top ten warmest years have occurred since 2002, whilst 2024 was provisionally the fourth warmest year on record for the UK,
 - In the past few decades there has been an increase in annual average rainfall over the UK. However, natural variations are also seen in the longer observational record,
 - The period since 2000 accounts for two-thirds of hot-day records, and close to half of wet-day records, in monthly, seasonal and annual observations since 1910,
 - The frequency of severe autumn and winter wind storms increased between 1950 and 2003, although storminess in recent decades is not unusual in the context of longer European records dating back to the early 20th century, and
 - Widespread and substantial snow events have occurred in 2018, 2013, 2010 and 2009, but their number and severity have generally declined since the 1960s.

Regional Observations

- 13.128 Historic climate averages during the period 1991–2020 for the closest climate station to the Site (Reading University, Whiteknights), obtained from the Met office website, indicates the following -
- Average annual maximum temperature was 14.9°C,
 - Warmest month on average was July (mean maximum temperatures of 22.7°C),
 - Coldest month on average was January (mean minimum temperatures of 2.13°C),
 - Average total annual rainfall was 658.24 mm,
 - Wettest month on average was October (average monthly rainfall of 73.75), and

- Driest month on average was March (average monthly rainfall of 40.27).

Future Baseline

- 13.129 Table 13.9 below shows projected changes in climate for a number of Global Warming Levels (GWLs) – 0.6°C GWL (baseline 1981-2000); 1.0°C GWL (recent past 2001-2020), 1.5°C GWL (Paris Agreement), 2°C GWL and 4°C GWL. Independent guidance, adopted by the UK Government for the Climate Change Risk Assessment (CCRA) and 3rd National Adaptation Plan (NAP3), is to prepare for a 2°C rise in global temperature, whilst assessing the risks for 4°C.
- 13.130 Each GWP represents a stage of global temperature rise rather than a specific year. The 1.5°C and 2°C are expected to occur around the 2030s and 2050s respectively, while the 4°C GWP corresponds to a high-emissions pathway (RCP8.5) projected towards the end of the century (circa 2080-2100).
- 13.131 In each case there is a central projection (the Median) and an uncertainty range (the Lower and Upper values are the 10th and 90th percentiles). Changes are relative to 1981-2000. Data is taken from the Met Office's Local Authority Climate Explorer tool's Climate Report for Wokingham.

Table 13.9: Projected changes in climate for Wokingham for various GWLs

	GWL scenarios				
	0.6°C GWL (Baseline 1981-2000)	1.0°C GWL (Recent Past 2001-2020)	1.5°C GWL (Paris Agreement)	2°C GWL (Guidance: Prepare)	4°C GWL (Guidance: Assess risks)
Temperature	°C	°C	°C change	°C change	°C change
Summer Maximum Temperature	30.2 (29.7 to 30.4)	32.1 (31.1 – 33.3)	+2.7 (+1.2 to +3.5)	+3.5 (+2.4 to +5.2)	+7.4 (+6.6 to +8.8)
Summer Average Temperature	16.2 (16.2 to 16.3)	17.5 (17.0 to 17.9)	+1.5 (+1.1 to +2.2)	+2.2 (+1.6 to +2.9)	+4.6 (+4.0 to +5.5)
Winter Average Temperature	4.6 (4.6 to 4.6)	5.3 (4.9 to 5.6)	+1.0 (+0.6 to +1.3)	+1.3 (+0.8 to +1.6)	+2.8 (+1.9 to +3.3)
Winter Minimum Temperature	-8.0 (-8.4 to -7.5)	-6.9 (-7.1 to -4.7)	+2.0 (+1.0 to +3.4)	+2.6 (+1.1 to +3.7)	+4.4 (+3.7 to +5.4)
Annual Average Temperature	10.1 (10.1 to 10.2)	11.0 (10.9 to 11.2)	+1.1 (+1.0 to +1.4)	+1.7 (+1.3 to +1.9)	+3.5 (+3.1 to +4.0)
Precipitation	mm/day	mm/day	% change	% change	% change
Summer Precipitation Rate	1.54 (1.53 to 1.54)	1.55 (1.25 to 1.69)	-2 (-17 to +7)	-13 (-27 to -5)	-31 (-48 to -25)
Winter Precipitation Rate	1.90 (1.88 to 1.90)	1.98 (1.91 to 2.27)	+6 (-6 to +18)	+9 (-2 to +14)	+18 (+10 to +29)

- 13.132 The projections for Wokingham indicate an almost continuous increase in annual average temperature throughout the remainder of the century, with a rise of approximately 3.5°C above the 1981-2000 baseline under a 4°C GWL (equivalent to RCP8.5 scenario). Annual precipitation is project to continue to vary year-on-year, with some years being dryer or wetter than previous years.
- 13.133 Summers are expected to become warmer and drier, with average summer temperatures increasing by around 4.6°C and maximum summer temperatures by up to 7.4°C compared with the late 20th century baseline. Summer rainfall is projected to decrease by around 30%, although natural variability means that occasional cooler or wetter summers will still occur.
- 13.134 Winters are projected to become milder and wetter, with average winter temperatures increasing by about 2.8°C and minimum winter temperatures by over 4°C. Winter precipitation is expected to rise by around 18%. Despite these overall increases, occasional cold or dry winters may still occur due to natural climatic variability.
- 13.135 In the UK, the heaviest snowfalls tend to occur when air temperature is between zero and 2°C. Although there is some uncertainty regarding the extent of change, climate models consistently indicate a decline in both falling and lying snow over time as winters become warmer.

Extreme Weather Events

Heatwaves

- 13.136 A heatwave is an extended period of hot weather relative to the expected conditions of the area at that time of year, which may be accompanied by high humidity. For the UK, the Met Office defines a heatwave as *“when a location records a period of at least three consecutive days with daily maximum temperatures meeting or exceeding the heatwave temperature threshold”*. The threshold varies by county and have been calculated using the 1981-2010 climatology of daily maximum temperature at the mid-point of the meteorological summer (15 July), which for the Site (Wokingham, Berkshire) is 28°C.
- 13.137 Under the 4°C scenario, the frequency and intensity of heatwaves are expected to increase, with the number of summer days exceeding 25°C rising from 18 to around 77 days per year, and extreme summer days (>35°C) increasing from virtually none to between 3 and 8 days per year, when compared to the late 20th century baseline. These conditions are likely to result in greater heat-related illnesses, pressure on healthcare services, and transport network disruption.

Low Rainfall and Drought

- 13.138 Droughts are natural events that occur when a period of low rainfall creates a shortage of water. There is no single definition of drought, although the Environment Agency (EA) identifies three main types that may occur together or separately -
- Agricultural drought – *“when there isn't enough rainfall and moisture in soils to support crop production or farming practices such as spray irrigation”*,
 - Environmental drought – *“when lack of rainfall has a detrimental impact on the environment and ecology”*, and
 - Water supply drought – *“when a lack of rainfall leads to concerns from water companies about supplies for their customers”*.
- 13.139 Summers are projected to become notably drier with a decline in precipitation of around 30%. This may raise the likelihood of agricultural and environmental droughts, affecting crop production, water quality and eco-system health. Water supply droughts may also become more frequent during prolonged dry periods. However, natural variability will continue to play a major role in the occurrence and duration of drought events.

Heavier Rainfall

- 13.140 While summers are expected to become drier overall, individual rainfall events are likely to become more intense when they do occur. Conversely, winter rainfall totals are expected to increase by around 18%, and the frequency of heavy rainfall events may also rise.

Storms and High Winds

- 13.141 Projections of future wind and storm occurrences and intensity in the UK remain uncertain, with low confidence in specific changes in extreme gusts or storm frequency. Observational analysis shows no compelling long-term trend in maximum gust speeds or storm numbers over the past four decades in the UK, and there is currently no clear attribution of changes in UK storminess to anthropogenic climate change.
- 13.142 UKCP18 projections suggest a small increase in near-surface winter wind speeds and a potential rise in the frequency and intensity of winter windstorms by the late 21st century. However, these projected changes are modest relative to natural year-to-year variability and are subject to substantial inter-model spread.
- 13.143 Given the limited evidence of past changes and the modest magnitude and uncertainty of future projection, likely significant effects resulting from storms and high winds are scoped out of further assessment. Nonetheless, further research – particularly into compound hazards such as wind-driven rain – may influence this position.

IMPACTS

Construction Impacts

- 13.144 The construction period (2027-2035) aligns most closely with the 1.5°C GWL, representing the near-term stage of global temperature rise expected to occur around the 2030s. Under the 1.5°C GWL,

average annual temperatures are projected to increase by approximately +1.1°C (range +1.0°C to 1.4°C) relative to the baseline, with summer maximum temperatures rising by around +2.7°C and winter minima by +2.0°C. Average summer precipitation is projected to decrease by around 2%, whilst winter precipitation may increase by about 6%, indicating minor seasonal variation in the near term.

- 13.145 The moderate climate changes projected for this timeframe suggest that average temperature increases and precipitation shifts will remain within manageable limits, with limited implications for worker safety, materials, or equipment performance, and are unlikely to cause significant adverse effects.
- 13.146 Climate hazards have the potential to disrupt or delay the construction programme due to unsafe conditions for works and potential damage to equipment or works. The risk of climate hazards, for example from heatwaves or periods of heavy precipitation, may increase during the construction period. However, it is expected that these will be managed through standard construction and health & safety practices, such as securing material/equipment and not undertaking works during periods of extreme rainfall.
- 13.147 The effect of climate change on the Proposed Development during the construction phase (2027 – 2035) is therefore likely to be **Negligible**. The impact of climate change on the Proposed Development during construction is therefore considered to be **Not Significant** as defined at the Scoping Opinion stage.

Operational Impacts

- 13.148 Table 13.10 outlines the potential significant effects from climate on the identified receptors within the Proposed Development. **Minor Adverse** effects are anticipated on future users of the Site as a result of increased frequency and intensity of heatwaves. **Minor Adverse** effects are also expected on ecology, landscaping, and planting due to both increased heatwave intensity and the occurrence of low rainfall and drought conditions. These effects are **Not Significant**.

Table 13.10: Likely Significant Effects of Climate Change

Climate Condition	Receptor	Receptor Vulnerability	Potential Impact (embedded)	Significance
Long term changes To climate norms	Future site users	Medium/High	Increased average temperatures and more frequent heatwaves may increase the risk of overheating within new homes. To ensure internal comfort and protect occupant health, detailed design of homes will include overheating risk assessment in accordance with Building Regulations Part O (Overheating 2021). Furthermore, dynamic assessment will be provided, e.g. using CIBSE's TM59 or TM52 for domestic and non-domestic properties, respectively, where necessary. Mitigation will follow the cooling hierarchy, giving priority to passive measures such as natural ventilation, and only considering active cooling where absolutely necessary.	Negligible
	Infrastructure	Medium	Increased temperatures and drier summers may also affect human haviour with an increase in outdoor activity. The Development includes a network of open spaces, including footpaths, recreational cycle routes and areas for informal recreation. The design of the Development and open spaces considers creating shade and allowing throughflow of air to allow for cooling and reduced risk of overheating.	Negligible
	Ecology/landscaping	Medium	Warmer, drier summers and milder wetter winters are likely to have a long-term impact	Negligible

Climate Condition	Receptor	Receptor Vulnerability	Potential Impact (embedded)	Significance
			on species' ranges, potentially causing flora and fauna to relocate to more tolerable climatic conditions. The changes in annual and seasonal averages may also impact the timing of seasonal biological activities, such as migrating birds. Chapter 8 identifies that important habitats and species present are generally considered to be widespread and the Site is not near the edge of their ranges.	
Heatwaves	Future site users	Medium/High	Increased frequency and intensity of heatwaves may adversely impact human health by increasing the risk of mortality and morbidity due to heat. Embedded mitigation will be addressed through compliance with Part O, supported by dynamic thermal modelling (e.g. TM59) to ensure homes remain within acceptable comfort limits. Mitigation will follow the cooling hierarchy, giving priority to passive measures such as natural ventilation, and only considering active cooling where absolutely necessary. In parallel, the provision of well-shaded open spaces and green infrastructure promoting evaporative cooling, will support healthy outdoor activity, maintaining thermal comfort during periods of extreme heat.	Minor Adverse
	Infrastructure	Medium	Extremes in temperature have the potential to damage infrastructure, for example causing tarmac to soften, melt and be more susceptible to damage. As a result, additional maintenance and emergency repairs may be required. This will be managed at the detailed design stage, where risk assessments will be undertaken to manage risks from future climate changes in accordance with nationally accepted standards and guidance.	Negligible
	Ecology, landscaping	Medium	Increased frequency of extreme weather events such as heatwaves could change the type and structure of existing and proposed vegetation.	Minor Adverse
Low rainfall/drought	Future site users	Medium/high	Periods of low rainfall and drought have the potential to adversely affect public water supplies. Water companies have a statutory duty to maintain a secure water supply during a drought and to produce Water Resources Management Plans, which consider climate change and drought. Potable water consumption on the site will be managed through an internal potable water consumption limit of 110 litres/person/day for dwellings (in accordance with Part G), use of drought-resistant vegetation (reducing water consumption for irrigation) and potentially rainwater harvest / greywater recycling schemes. These measures will be defined at detailed design.	Negligible
	Infrastructure	Medium	Reduction in rainfall could cause soil moisture deficits, which may affect soil stability. This may increase risk of damage to infrastructure. This will be managed at the detailed design stage, where risk assessments will be undertaken to manage risks from future climate change in accordance with nationally accepted standards and guidance.	Negligible

Climate Condition	Receptor	Receptor Vulnerability	Potential Impact (embedded)	Significance
	Ecology, landscaping	Medium	Increased frequency of low rainfall and droughts combined with higher average temperatures may adversely impact the productivity, function and structure of ecosystem services by, for example, causing an increase in erosion as soils and substrates dry out.	Minor Adverse
Heavy rainfall/flooding	Future Site users	Medium/High	Flooding has the potential to isolate future users of the Site, disrupt service provision, damage homes and potentially increase risk to human health and life. Chapter 11 Drainage/Flood Risk assesses the likely significant effects of flood risk and states that the Proposed Development has been designed to include attenuation basins and SuDS features which will clean/filter the surface water runoff, store it onsite and release it at a controlled rate into the system. The resulting impact to flood risk and pollution of water courses on the Site is therefore minor adverse (not significant).	Minor Adverse
	Infrastructure	Medium	Increased precipitation during the winter and more intense rainfall events are likely to increase flood risk and surface water run-off. This could prevent the use of and/or damage infrastructure and also adversely affect water quality. Chapter 11 Drainage/Flood Risk assesses the likely significant effects of flood risk and states that attenuation basins and SuDS features will mean the impact to flood risk and pollution of water courses on the Site is minor adverse (not significant).	Minor Adverse
	Ecology/landscaping	Medium	Flooding has the potential to damage planting and habitats on Site. As stated in Chapter 11 (Drainage/Flood Risk) the Development has been designed to include attenuation basins and SuDS features which will filter/clean the surface water runoff, store it onsite and release it at a controlled rate back into the system. The resulting impact to flood risk and pollution of water courses on the Site is therefore Minor Adverse (not significant).	Minor Adverse

MITIGATION

Construction Mitigation

- 13.149 Mitigation measures during the construction stage should be secured through a CEMP via a suitably worded planning condition. The CEMP will include several measures covering, for example, transport, waste, air quality, materials, water quality and health & safety for workers.

Operational Mitigation

Landscape and Planting

- 13.150 The landscaping and planting strategy, which will be developed at the detailed design stage, should seek to improve the climate resilience of the Proposed Development through the following measures -
- Planting should aim to be structurally diverse and include a range of pollen and nectar rich species that flower throughout the year and aim to maximise species diversity to strengthen the ecological network,
 - Provision of woodland planting that will provide nighttime evaporative cooling, helping to reduce the heat island effect, and provide passive shading,

- The planting strategy should consider the selection of native plant and tree species that are deemed suitable for future climate conditions, including being tolerant to higher temperatures and drought, and
- The planting scheme should consider reducing the risk of soil erosion and help retain topsoil by providing a protective barrier from direct rainfall (plant roots help stabilise the soil).

13.151 Mitigation considered as part of the Proposed Development design includes the provision of a CEMP to control potential effects during construction (such as pollution, dust generation, etc.) and an EMP to detail all ecology measures required to be undertaken prior to, during construction and after construction. This should be secured through an appropriately worded planning condition. The EMP should set out measures for ongoing management, maintenance and monitoring of habitats of the Site. This would increase the long-term resilience of habitats and species within the Site and help manage areas that may be affected by droughts.

Flood Risk and Surface Water Drainage

13.152 The Proposed Development has been designed to include attenuation basins and SuDS features which will filter/clean the surface water runoff, store it onsite and release it at a controlled rate back into the system. The layout of the Site has been designed to minimise surface water flood risk, i.e. the 1-in-100-year flood event plus 40% allowance for climate change, in line with planning policy and LLFA requirements. Further information is provided in Chapter 11 of the ES.

Water Use

13.153 At the detailed design stage, measures to reduce water demand and improve water efficiency in line with Building Regulations Part G will be incorporated to enhance the Proposed Development's resilience to drought and reduce pressure on water supply services. The Proposed Development aims to achieve a design standard that limits home water consumption to 110 litres/person/day.

13.154 These measures will be secured through planning conditions and developed further at the Reserved Matters stage. Potential measures include -

- Dual-flush toilets – to reduce water consumption,
- Leak detection systems – to identify and address leaks promptly,
- Flow control devices – to reduce the flow rate of kitchen sink and bathroom basin taps,
- Pulsed water meters and sub-meters – to enable monitoring and reduce the energy demand associated with water heating,
- Water-efficient appliances – such as those rated 'A' or above under the European Water Label scheme.

Mitigating Overheating in Homes

13.155 At the outline stage, only parameter plans are being fixed. As such, the following measures are incorporated -

- The masterplan layout and orientation principles do not create undue risk of excessive solar exposure to habitable rooms, particularly those facing west,
- Flexibility within building heights and spacing to enable cross-ventilation potential to be considered at detailed design.,
- Potential opportunities for landscape-based shading, such as deciduous street trees, which can be incorporated at Reserved Matters to provide seasonal shading benefits.

13.156 At the Reserved Matters stage, a full overheating assessment for dwellings will be undertaken in accordance with Part O. This will confirm compliance using either the simplified method (glazing and ventilation standards) or dynamic thermal modelling (CIBSE TM59). At that stage, the following will be done -

- Specify glazing performance and shading measures appropriate to each dwelling type,
- Demonstrate ventilation strategies, including purge ventilation, with alternatives where noise, air quality and security are constraints,
- Consider the role of thermal mass and internal layout in moderating internal temperatures,

- Follow the cooling hierarchy, prioritising passive and low-carbon design measures over energy-intensive active cooling,
- Identify any specific risks and mitigation measures for vulnerable groups, including the elderly.

13.157 This staged approach ensures that overheating mitigation is addressed consistently from the outline master planning principles through to detailed dwelling design, providing compliance with Part O and resilience to future climate change.

13.158 The overheating assessment is a mandatory requirement of the Building Regulations (Part O) but could also be secured via planning condition.

RESIDUAL IMPACTS

Construction Phase

13.159 As noted in the Scoping Opinion the construction residual effects of climate change on the Proposed Development are judged to be **Negligible** and **Not Significant**.

Operational Phase

13.160 The minor adverse effect on human health as a result of the increased likelihood and frequency of heatwaves has been mitigated as far as possible with embedded mitigation.

13.161 Among other considerations, overheating risk will be addressed through compliance with Building Regulations Part O, supported by detailed assessments (including dynamic thermal modelling in accordance with CIBSE TM59 where required) and application of the cooling hierarchy. Water efficiency measures limiting potable consumption to 110 litres per person per day may help reduce pressure on water resources and improve resilience to drought and high temperatures.

13.162 Mitigating these effects further is reliant on aspects outside the scope of the Proposed Development, such as the resilience of water supplies to climate change (under the statutory duty of water companies), increasing the resilience of health services and availability of emergency services. Therefore, these effects remain as **Minor Adverse**, which is considered to be **Not Significant**.

13.163 Potential slight adverse effects to ecology, landscaping and planting resulting from heatwaves, droughts and storms could be managed through the implementation of the LEMP and planting strategy. The likely effect is therefore considered to be **Negligible** and **Not Significant**.

CUMULATIVE IMPACTS

13.164 No cumulative effects are anticipated on the basis that climate change resilience and adaptation effects and impacts are specific to the Proposed Development and will not result in impacts to neighbouring development or sensitive receptors. Cumulative effects are therefore **Negligible** and **Not Significant**.

13.165 There is, however, potential for in-combination climate change effects to exacerbate other environmental effects identified in other topic chapters without mitigation. There is a need to deliver a coordinated approach to the climate change mitigation measures to provide climate resilience within the Proposed Development.

13.166 It is considered that, with the implementation of embedded mitigation measures outlined within the impacts section of this chapter, and careful conditions of further climate change resilience and adaptation measures at the detailed design stages, the effects identified within the topic chapters will not be exacerbated as a result of climate change. In combination effects are therefore **Negligible** and **Not Significant**.

SUMMARY

GHG Emission Assessment

13.167 This Climate Change chapter assesses the Proposed Development's greenhouse gas (GHG) emissions during construction and operation in line with relevant policy and guidance.

13.168 The construction phase will produce direct and indirect GHG emissions (e.g. from construction vehicles, machinery, and embodied carbon in materials), but these are predicted to result in only a **Minor Adverse** impact on climate change that is **Not Significant** in EIA terms.

13.169 During operation, the Proposed Development incorporates extensive embedded mitigation – including an all-electric, energy-efficient design (with heat pumps and high fabric performance), on-site renewable energy (solar PV to meet at least 10% of energy demand), and sustainable transport measures (such as enhanced pedestrian/cycle connectivity and travel plan participation) – to minimise GHG emissions. As a result, operational GHG emissions are low. Any effects are assessed as negligible to

minor adverse and Not Significant, with the residual effect of the Proposed Development on climate change during operation considered **Minor Adverse** and **Not Significant**.

- 13.170 While all GHG emissions contribute cumulatively to global climate change, the scale of the Proposed Development's emissions is small relative to local and national carbon baselines. The project is therefore in broad alignment with the UK's net zero trajectory and local climate objectives, **and No significant** climate effects from GHG emissions are anticipated after mitigation.

Climate Change Resilience and Adaptation

- 13.171 This chapter also evaluates the effects of climate change on the Proposed Development, using UKCP18 projections for a high-emissions scenario (RCP 8.5) to 2100. The future baseline climate for the Site is expected to feature warmer, drier summers and milder, wetter winters, with increased frequency of extreme events such as heatwaves, droughts, and intense rainfall.
- 13.172 During the construction phase, these climatic changes are moderate and can be managed with standard construction planning and health and safety measures (e.g. scheduling to avoid extreme weather, securing materials during storms). Accordingly, the effect of climate change on construction is assessed as **Negligible and Not Significant**. Potential climate hazards (like heavy rainfall or heat during works) are not expected to significantly disrupt construction given such adaptive management.
- 13.173 For the operational phase, the assessment considered key receptors: future residents/users, infrastructure, and ecology/landscaping. Heatwaves pose a potential risk to human health and comfort, and low rainfall/drought could affect water resources and landscaping. However, the Proposed Development has been designed and will be detailed to be climate-resilient.
- 13.174 Measures include compliance with Building Regulations Part O and the cooling hierarchy to mitigate overheating in homes (through passive design, ventilation, and, if needed, active cooling). The Site layout provides green infrastructure and shaded open spaces to reduce urban heat effects. Water efficiency measures (e.g. 110 litres/person/day consumption target, drought-tolerant planting, and potential rainwater harvesting) will enhance resilience to dry weather. In terms of flood risk, the Proposed Development's drainage strategy embeds sustainable drainage systems (SuDS) and attenuation basins, designed for a 1-in-100 year storm plus climate change, to manage increased rainfall and runoff. The resulting impact to flood risk and pollution of water courses on the Site is designated **Minor Adverse (not significant)** (as detailed in Chapter 11).
- 13.175 With these adaptation measures in place, the Proposed Development is not overly vulnerable to projected climate changes. Any residual impacts during operation are limited to **Minor Adverse** effects – for instance, occasional heat stress for vulnerable individuals – which are considered **Not Significant** in EIA terms. Potential effects on habitats and planting from increased heat or drought are similarly reduced to **Negligible** with the implementation of a LEMP, meaning no significant ecological resilience effects.
- 13.176 Overall, the Climate Change Resilience and Adaptation assessment concludes that, with the embedded design features and proposed mitigation, the Proposed Development will withstand future climate conditions without significant adverse effects. There are no anticipated significant cumulative or in-combination climate change effects – the climate risks are site-specific and managed on-site, and they are not expected to exacerbate impacts in other environmental topics when adaptive measures are integrated. All residual climate change effects of the Proposed Development are therefore assessed as **Not Significant**, reflecting the robust climate mitigation and adaptation strategies adopted.
- 13.177 Table 13.11 provides a final summary of effects relating to Climate Change.

Table 13.11: Summary Table for Climate Change

Description of Likely Significant Effects	Significance	Description of Mitigation	Description of Residual Effects	Significance
Demolition/Construction Phase				
Climate hazards such as high temperatures, increased rainfall could create unsafe working conditions	Negligible	CEMP, EMP, Best Practice	N/A	Negligible,
Operational Phase				
Increased frequency of heatwaves affecting site users, infrastructure & ecology/landscaping	Minor Adverse to Negligible	Compliance with Part O, use of cooling hierarchy; use of more resilient plants; improvements house	N/A	Minor Adverse - Negligible

		building/infrastructure materials; risk management		
Low rainfall & drought affecting site users, infrastructure, ecology/landscaping	Negligible to Minor Adverse	Water Resource Management Plans; compliance with Part G; sensitive planting regimes and use of drought-resilient planting; risk management.	N/A	Negligible - Minor Adverse
Heavy rainfall & flooding affecting site users, infrastructure, ecology/landscaping	Minor Adverse	Use of SuDs, attenuation basins	N/A	Minor Adverse
Cumulative - Construction				
N/A				
Cumulative - Operation				
N/A				

14 NOISE/VIBRATION

INTRODUCTION

- 14.1 This chapter of the ES assesses the likely significant environmental effects of the Proposed Development with respect to noise and vibration. This chapter also describes the methods used to assess the effects, the baseline conditions currently existing at the Site and the surrounding area; the mitigation measures required to prevent, reduce or offset any significant adverse effects, and the likely significant residual effects of the Proposed Development after these measures have been implemented.
- 14.2 This chapter has also assessed the impact of the Proposed Development on the existing surrounding properties and has assessed it on a cumulative basis.
- 14.3 **Technical Appendix 14.1** is the supporting Acoustic Assessment.

POLICY CONTEXT

Legislation

Control of Pollution Act 1974

- 14.4 Part III of the Control of Pollution Act 1974 (CoPA) is specifically concerned with the control of pollution. With regard to noise, the CoPA covers construction sites; noise in the street; noise abatement zones; codes of practice; and Best Practicable Means (BPM).
- 14.5 Under Part III Section 60 'Control of Noise on Construction Sites' and Section 61 'Prior Consent for Works on Construction Sites' discusses the requirements on how works should be undertaken and in particular about the method by which they will be carried out, including the steps proposed to be taken to minimise noise resulting from the works.

British Standards

- 14.6 The following is a list of the most relevant British Standards that have been used to inform this assessment:
- BS 7445-1:2003 Description and measurement of environmental noise,
 - BS 4142:2014 Method for Rating and Assessing Industrial and Commercial Sound,
 - BS 4866:2010 Mechanical vibration and shock – Vibration of Fixed Structures – Guidelines for the Measurement of Vibrations and Evaluation of their Effects on Structures,
 - BS 6472-1:2008 Guide to Evaluation of Human Exposure to Vibration in Buildings. Vibration sources other than blasting,
 - BS 5228-1:2009(+A1:2014) Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise,
 - BS 5228-2:2009(+A1:2014) Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 2: Vibration,
 - BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings.

BS 4142:2014+A1:2019

- 14.7 The British Standard 4142:2014 (BS 4142) describes methods for rating the sound of an industrial and/or commercial nature to assess its likely effects on people who might be inside or outside a dwelling or premises used for residential purposes upon which the sound is incident.
- 14.8 BS 4142 specifies that an initial estimate of the impact of the specific sound can be obtained by subtracting the measured background sound level from the rating level and then considering the following;
- Typically, the greater this difference, the greater the magnitude of the impact,
 - A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context,
 - A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context,
 - The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact, and

- 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.

14.9 The rating level is defined in BS4142 as the sound level of the source plus any penalties for the characteristic features of the sound, such as tonality and impulsivity, intermittency and any other acoustical features which make the sound distinguishable.

BS 6472-1:2008

14.10 In terms of vibration levels, Table 14.1 shows the criteria followed in terms of vibration dose values. These values represent the best judgement currently available and may be used for both vertical and horizontal vibration, provided that they are correctly weighted. This table has been obtained from the standard BS 6472-1:2008.

Table 14.1: Vibration Dose Value Ranges Which Might Result in Probability of Adverse Comment Within Residential Buildings

Place and Period	Low Probability of Adverse Comment (m/s ^{1.75})	Adverse Comment (m/s ^{1.75})	Possible Adverse Comment (m/s ^{1.75})	Probable
Residential Building 16h Day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6	
Residential Building 8h Night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8	

BS 5228-1:2009 (+A1:2014)

14.11 Guidance relating to the prediction and assessment of the demolition and construction phase noise effects has been taken from BS 5228-1: 2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites' Part 1: 'Noise' which provides recommendations for basic methods of noise control relating to construction and open sites where work activities/operations generate significant noise levels. Amongst other things, the annexes to BS 5228 provide information on the following;

- Relevant legislation (Annex A),
- Typical noise sources and advice on mitigating them (Annex B),
- Sound level data for use in the prediction methods described in the standard (Annexes C and D),
- Assessing the significance of noise effects (Annex E),
- Estimating noise levels (Annex F), and
- Implementing noise monitoring (Annex G).

BS 5228-2:2009 (+A1:2014)

14.12 Guidance relating to the prediction and assessment of the construction phase vibration effects has been taken from BS 5228-2: 2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites' (BS 5228) Part 2: 'Vibration' which provides recommendations for basic methods of vibration control relating to construction and open sites where work activities/operations generate significant vibration levels.

BS 8233:2014

14.13 BS 8233:2014 Guidance on sound insulation and noise reduction for buildings provides criteria for the assessment of noise affecting various uses, including residential dwellings.

14.14 BS 8233:1987^{iv} has been withdrawn and replaced firstly by 8233:1999, and more recently BS 8233:2014 Sound insulation and noise reduction for buildings. The current BS 8233:2014 standard has revised the 'good' and 'reasonable' noise level criterion that were set out in BS 8233:1999, and replaces it with a recommendation of a single standard as detailed in Table 14.2 below:

Table 14.2: BS 8233:2014 Indoor Ambient Noise Levels for Dwellings

Activity	Location	07:00 to 23:00 L _{Aeq,16h}	23:00 to 07:00 L _{Aeq,8h}
Resting	Living Room	35 dB	
Dining	Dining Room / Area	40 dB	

Sleeping (Daytime Resting)	Bedroom	35 dB	30 dB
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Note: – Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

14.15 It also suggests that:

‘for traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it also recognized that these guideline values are not achievable in all circumstances where development might be desirable.’

14.16 Part III of the Control of Pollution Act 1974 (CoPA) is specifically concerned with the control of pollution. With regard to noise, the CoPA covers construction sites; noise in the street; noise abatement zones; codes of practice; and Best Practicable Means (BPM).

Other Relevant Guidance

- Department of Transport – Calculation of Road Traffic noise (CRTN),
- The Highways Agency – Design Manual for Roads and Bridges (DRMB) LA111 Noise & Vibration Revision 2,
- World Health Organisation – Guidelines for Community Noise

Calculation of Road Traffic Noise

14.17 The Calculation of Road Traffic Noise (CRTN) describes the procedure for predicting and measuring the noise from road traffic in terms of L_{A10} and is suitable for environmental assessments of proposed developments where road traffic noise may have an effect on proposed or existing sensitive receptors.

Design Manual for Roads and Bridges

14.18 The Calculation of Road Traffic Noise (CRTN) describes the procedure for predicting and measuring the noise from road traffic in terms of L_{A10} and is suitable for environmental assessments of proposed developments where road traffic noise may have an effect on proposed or existing sensitive receptors.

14.19 The LA111 Rev 2 ‘Noise and Vibration’ provides the guidance for the environmental assessment of construction noise and operational noise levels. The Lowest Observed Adverse Effect Level (LOAEL), the Significant Observed Adverse Effect Level (SOAEL) and the magnitude of impact are clearly defined. Tables 3.54a and 3.54b of the LA111 document detail the various magnitudes of change for both short and long-term periods respectively, as shown in the Table below.

Table 14.6: Magnitude of Change As Defined in Tables 3.54a and 3.54b

Magnitude	Short Term Noise Change	Long Term Noise Change
	(dB $L_{A10,18h}$ Or L_{Night})	(dB $L_{A10,18h}$ Or L_{Night})
Major	Greater than or equal to 5.0	Greater than or equal to 10.0
Moderate	3.0 to 4.9	5.0 to 9.9
Minor	1.0 to 2.9	3.0 to 4.9
Negligible	Less than 1.0	Less than 3.0

14.20 The DMRB LA111 document also considers the effect of vibration from construction activities. The document assumes that new roads being constructed would be clear of defects and well maintained and therefore the operational vibration from road traffic would not have the potential to lead to likely significant adverse effects.

14.21 The following table shows how the average human perceives the change in vibration levels from construction related activities.

Table 14.4: Magnitude of Change As Defined in Table 3.33 of DMRB LA111

Data Source	Reference
Major	Above or equal to 10mm/s PPV
Moderate	Above or equal to SOAEL (1.0 mm/s PPV) and Below 10mm/s
Minor	Above or Equal to LOAEL (0.3 mm/s PPV) and Below SOAEL (1.0 mm/s PPV)
Negligible	Below LOAEL (0.3 mm/s PPV)

WHO Guidelines for Community Noise

- 14.22 World Health Organisation (WHO) 'Guidelines for Community Noise' provides criteria for the assessment of internal and external noise levels affecting various used including residential dwellings. The WHO Guidelines for Community Noise include guideline values for community noise in specific environments, as specified in Table 14.5 below.

Table 14.5: WHO Guideline Values for Community Noise

Specific Environment	Critical Health Effects	L _{Aeq,T}	L _{Amax,fast}
Dwelling, Indoors	Speech intelligibility and moderate annoyance	35 dB	-
Inside Bedrooms	Sleep disturbance, night-time	30 dB	45 dB
Outdoor Living Area	Serious annoyance, daytime and evening	55 dB	-
	Moderate annoyance, daytime and evening	50 dB	-

- 14.23 The WHO Guidelines for Community Noise document refers to research conducted by Vallet & Varnet which states:

'For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10-15 times per night, (Vallet & Varnet 1991 v).'

- 14.24 On the basis of the above, it has been assumed that the following internal noise levels would be adopted as a minimum design target for the Proposed Development's residential dwellings at the detailed design stage.

Table 14.6: Proposed Indoor Acoustic Criteria

Period	Duration	"Good" Noise Target	"Reasonable" Noise Target
Day	07:00 to 23:00	35 dB L _{Aeq,16h}	40 dB L _{Aeq,16h}
Night	23:00 to 07:00	30 dB L _{Aeq,8h}	35 dB L _{Aeq,8h}
		45 dB L _{Amax,fast}	50 dB L _{Amax,fast}

Notes: From Consultation Response, BS 8233:2014 and WHO Guidelines

The design targets relate to internal noise levels. With respect to outdoor living areas, a design target of 50 dB L_{Aeq,T} and an upper target of 55 dB L_{Aeq,T} should avoid serious annoyance during the day and evening.

Planning Policy

National Planning Policy Framework (December 2024)

- 14.25 The NPPF replaces the previous version of the NPPF and the Planning Policy Statements (PPS) and PPG, including the Department of the Environment's PPG 24 Planning and Noise, which was published in 1994. The main reference to noise within the latest version of the NPPF is at Paragraphs 187 (e) and 198:
- 'Para.187 (e). "Planning policies and decisions should contribute to and enhance the natural and local environment by:*
- (e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and."*
- 'Para.198. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*
- (a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life⁷²;*
- (b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.; and*
- (c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.'*

- 14.26 The reference number 72 cross references the National Policy Statement for England (2010) Explanatory Note.
- 14.27 Although some qualitative guidance on noise has been provided in the web-based Planning Practice Guidance document, there has been no alternative quantitative guidance proposed by the Government as a direct replacement for PPG24. This was due to the recognition that every site is different and that there is no single acceptable noise level, suitable for all applications.

National Planning Policy Guidance (2019)

- 14.28 The NPPG-Noise provides guidance on the assessment of noise, the needs to be considered when new developments may create additional noise and when developments would be sensitive to the prevailing acoustic environment.
- 14.29 The acoustic environment should be taken into account in the planning of new development and decision making should take the following into consideration -
- 'whether or not significant adverse effect is occurring or likely to occur,
 - whether or not an adverse effect is occurring or likely to occur, and
 - whether or not a good standard of amenity can be achieved.'
- 14.30 It then cross-references the Noise Policy Statement for England (2010) for further clarification on how to assess the overall effect of noise exposure.

The Noise Policy Statement for England (2010)

- 14.31 The Noise Policy Statement for England (NPSE) was published in March 2010 and is the overarching statement of noise policy for England and applies to all forms of noise other than occupational noise, setting out the long-term vision of Government noise policy which is to -
- 'Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.'*
- 14.32 The vision is supported by the following aims which are reflected in paragraph 1.7 of the Noise Policy Statement for England -
- 'Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*

- *Avoid significant adverse impacts on health and quality of life,*
- *Mitigate and minimise adverse impacts on health and quality of life, and*
- *Where possible, contribute to the improvement of health and quality of life.'*

14.33 The Explanatory Note to the NPSE introduces three concepts to the assessment of the potential effects of noise -

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

14.34 Unlike the now redundant PPG24, the three levels are not defined numerically in the NPSE, and for the SOAEL the NPSE makes it clear that the noise level is likely to vary depending upon the noise source, the receptor and the time of day/day of the week, etc. The need for more research to investigate what may represent a SOAEL for noise is acknowledged and the NPSE asserts that not stating specific SOAEL levels provides policy flexibility in the period until there is further evidence and guidance.

Adopted Core Strategy Development Plan Document (January 2010)

14.35 The Core Strategy is a high-level document setting out the strategy for managing the development until 2026. This includes policies and strategies to provide new housing, schools, roads, places to work and other services.

14.36 Policy CP1 relates to sustainable developments and in particular to noise, it states the following;

8) Avoid areas where pollution (including noise) may impact upon the amenity of future occupiers;

14.37 The supporting text under this section then goes on to say that -

The community, Government and regional policy (PPG24 & SEP Policy NRM10 respectively) recognise the need for proposals to avoid areas of noise. Within the borough, noise issues arise in a variety of locations including alongside the major roads (M4 & A329(M)/A3290) and the railway lines within the Strategic Transport Network (see paragraph 4.56). Proposals should have regard to the advice in PPG24 concerning the suitability of different locations (based on noise exposure levels) for a variety of activities and the Air Quality Management Areas of the borough. The LAA includes targets for dealing with local concerns about anti-social behaviours and crime. Initiatives such as 'Secured by Design' can make a contribution to this.

Wokingham Borough Development Plan (February 2014) – Policy CC06: Noise

14.38 This policy should be read alongside Policy CP1 of the Core Strategy.

Wokingham Borough Local Plan Update 2023 – 2040 Proposed Submission Plan

14.39 Within this future plan, noise and vibration have been referred to through several policies, but only in a very broad manner. Policy HC8 however relates solely to Noise Pollution.

14.40 Policy HC8 will require the following points to be satisfied, for upcoming proposed development sites -

- 1) Development proposals must demonstrate how noise impacts have been addressed, to protect sensitive receptors, including existing and proposed dwellings.*
- 2) The noise impact of the proposed development must be assessed. Where there is no adverse impact (no observed effect level), noise pollution will not be a material consideration.*
- 3) Where there is an adverse effect (ranging from the lowest observed effect level to a significant observed effect level), then the following approaches must be taken in the order listed;*
 - a. The development must be reviewed. Where this results in there no longer being an adverse impact then design and mitigation measures should be incorporated accordingly;*
 - b. Where there is still an adverse impact, the internal review must be reviewed. Where this results in there no longer being an adverse impact, then design and mitigation measures should be incorporated accordingly;*

- c. Where there is still an adverse impact, physical mitigation measures such as barriers/mechanical ventilation must be considered. Where this results in there no longer being an adverse impact, these measures should be incorporated accordingly;
- d. Where there is still an adverse impact and the development falls within the significant observed adverse effect level, then planning will normally be refused.
- 4) Adverse impacts on sensitive environmental receptors, such as wildlife corridors, should be avoided or comprehensively mitigated where avoidance is not possible.

ASSESSMENT METHODOLOGY

Geographical Scope

14.41 The proposal is for a residential-led development on between Langley Common Road to the north-west, Commonfield Lane to the south-east and Arborfield Studios to the south-west. Land to the north-east of the Site is largely agricultural in nature.

The Study Area

14.42 The Study Area assessed includes the Site and surrounding noise and vibration sensitive properties as shown in Figure 14.1 . The main noise and vibration sensitive receptors assessed within this assessment have been included within Table 14.7.

Table 14.7: Noise and Vibration Sensitive Receptors

Figure 14.1 Reference	Name of Sensitive Receptor (NSR)	Location of NSR from The Site	Distance to NSR From Boundary of The Site
NSR 1	Oak Drive Residences	South	100m
NSR 2	Field House	North	13m
NSR 3	1-27 (Odds) Langley Common Rd	North West	45m
NSR 4	Isaac Newton Road Residences	South West	45m
NSR 5	Stable House	East	200m
NSR 6	Archer Grove Residences	South	40m
NSR 7	Princess Marina Drive Residences	South West	130m

14.43 The noise sensitive properties set out in Table 14.7 above were identified through the use of aerial photography, as well as a detailed site reconnaissance visit in person prior to undertaking any baseline noise measurements. Vibration impacts were also considered for these same receptors. However, the impact of vibration from the Proposed Development over these distances would typically be negligible due to standard distance attenuation.

Baseline Survey Data

- 14.44 Environmental noise monitoring was completed for both unmanned (automatic) and manned surveys. Automatic monitoring was undertaken from Tuesday 23rd July 2024 through to Thursday 1st August 2024. Manned monitoring was undertaken during the same period.
- 14.45 The monitoring locations across the Site were selected to represent the baseline noise conditions for the proposed residential properties that would comprise the Proposed Development from all existing noise sources, including the high altitude aircraft serving Heathrow Airport and the local road network including Langley Common Road as well as for the existing noise sensitive receptors.
- 14.46 The baseline survey data was compared to additional sources of sound levels for the area, including noise contour maps provided by London Heathrow as part of their Noise Management Plan. These additional measures were taken to reduce the level of uncertainty as far as reasonably practicable.
- 14.47 There were no existing vibrational sources noted either at the Site, or the immediate surrounding area to the Site. From researching available data, there were no signs of rail services running below ground

at this site. Vibration levels were therefore deemed to be at acceptable levels across the Site for the existing residents and future residents from the Proposed Development.

Scope of Assessment

14.48 In line with the assessment methodology set out in the EIA Scoping Report submitted the scope of this assessment includes an assessment of:

- Construction plant noise and vibration effects from the Proposed Development,
- Construction road traffic noise and vibration effects from the Proposed Development,
- Site suitability,
- Operational noise due to changes in road traffic with and without the Proposed Development, and
- Operational noise egress from the Proposed Development's building services plant.

Construction Noise

14.49 The assessment of the effects of noise generated by the construction activities for the Proposed Development have considered a range of recognised calculations and modelling methodologies which have been detailed in the previous Guidance Documents section. The main reference document used was BS 5228:2009+A1:2014 Part 1. Through the use of Annexes C and D of BS 5228, typical sound levels for assumed construction plant and activities have been considered in the assessment.

14.50 Using the calculation method in Annex F of BS 5228-1, assumptions for typical on-time and corrected for distance to establish the predicted sound levels at the relevant NSRs have been incorporated into the assessment. Predictions of the construction plant noise levels at the NSRs have been made in terms of $L_{Aeq,10h}$ measured over the working day during the key phases of works, comprising:

- Demolition,
- Site clearance,
- Road construction, and
- Construction of buildings and structures.

Construction Vibration

14.51 The effects of the vibration impacts from the construction activities have been assessed using the recognised calculations and modelling methodologies within BS 5228:2009+A1:2014 Part 2. Through the use of the Annexes C and D of BS 5228-2:2009+A1:2014, typical vibration levels for assumed construction plant and activities have been considered in the assessment.

14.52 Using the calculation method in Annex E of BS 5228-2 and information provided by Hiller and Crabb, the predicted vibration levels at the relevant vibration sensitive receptors have been calculated.

14.53 Annex B of BS5228-2 relates to the significance of vibration effects. Table B.1 of BS 5228-2 provides data on the response to vibration for the average human. Table B.2 assesses the likelihood of cosmetic damage to a range of buildings resulting from temporary construction activities.

14.54 Vibrational excitement is categorised and quantified by peak particle velocity or 'PPV' and the typical display units are millimetres-per-second.

Operational Phase

14.55 The operational levels have been assessed for the following scenarios:

- Baseline year (2022),
- Future Year (2035) Without the Development (Do Nothing), and
- Future Year (2035) With the Development (Do Something).

Operational Noise

14.56 In order to predict the future noise levels within the occupied Development, a 3D noise propagation model has been constructed. The noise model considered all potential noise sources and methods of acoustic attenuation and was subsequently used to predict the noise levels both resulting from and impacting upon the existing residents in the vicinity of the Site and the future residents of the Proposed Development. The primary source of noise generated by the operational Proposed Development has

been identified as road traffic and high-altitude aircraft noise, which has been assessed at the completion of the Proposed Development in order to assess the worst case scenario.

- 14.57 As such, this assessment has considered the existing levels of road traffic and predicted road traffic levels as provided by the project transport consultant, including traffic to be generated by the Proposed Development as well as the cumulative effects with other local, committed developments. The methodologies within the CRTN and DMRB documents have been utilised along with predicted traffic flows for the Proposed Development and the other local, committed developments.
- 14.58 The effect prediction has been assessed using three-dimensional acoustic modelling software, CadnaA v4.1.155. Modelling images have been included within the detailed Noise And Vibration Impact Assessment (but have also been included in **Technical Appendix 14.1**).

Site Suitability

- 14.59 The nature of the Proposed Development has been noted to be predominantly residential. Therefore, an assessment has been undertaken of the suitability of the Site for the Proposed Development and whether any mitigation measures are required in order to provide an adequate environment for future occupants.

Operational Vibration

- 14.60 As set out in the Scoping Report of December 2024, operational vibration has been scoped out of the assessment.

Significance Criteria

- 14.61 The sensitivity of a receptor has been based on the relative importance of the receptor using a mixture of professional experience and industry standards, which have been detailed in Table 14.8 below. This refers to the sensitivity for both noise and vibration.

Table 14.8: Receptor Sensitivity Descriptors

Value (Sensitivity)	Descriptor
High	The receptor has little ability to absorb change without fundamentally altering its present character or is of national or international importance. These could include residential dwellings, hospitals, care homes, hotels, schools, universities, research facilities and national parks.
Moderate	The receptor has a moderate capacity to absorb change without significantly altering its present character or is of high importance. Examples comprising offices, shops, outdoor amenity spaces, footpaths, doctor's surgeries, sports facilities and places of worship.
Low	The receptor is tolerant of change without detriment to its character, is of low or local importance. For example: warehouses, light industry, car parks, agricultural land.
Negligible	The receptor will be tolerant and generally emit high sound and / or vibration levels themselves. For example: Heavy industry, motorways, railway lines, airports.

Construction Noise

- 14.62 In accordance with the DMRB LA111 document, the magnitude of impact for construction noise is defined by the matrix shown in Table 14.9 below. The level referred to as the 'LOAEL' is the baseline noise levels and the 'SOAEL' is the threshold level as determined by the BS 5228 document.

Table 14.9: Magnitude of Impact From Construction Noise

Magnitude of Impact	Construction Noise Level
Major	Above or equal to SOAEL + 5 dB
Moderate	Above or equal to SOAEL and below SOAEL + 5 dB
Minor	Above or equal to LOAEL and below SOAEL

Negligible

Below LOAEL

Construction Vibration

- 14.63 In accordance with the DMRB LA111 document, the magnitude of impact for construction vibration is defined by the matrix shown in Table 14.10 below. The level referred to as the 'LOAEL' is the vibration level of 0.3 mm/s PPV during all time periods and the 'SOAEL' is the vibration level of 1.0 mm/s PPV during all time periods.

Table 14.10: Magnitude of Impact From Construction Vibration

Magnitude of Impact	Construction Vibration Level
Major	Above or equal to 10 mm/s PPV
Moderate	Above or equal to SOAEL and below 10 mm/s PPV
Minor	Above or equal to LOAEL and below SOAEL
Negligible	Below LOAEL

Operational Road Traffic Noise

- 14.64 The magnitude of impact for changes to the operational noise levels relate to short-term and long-term increases. The short term is generally considered to be the first year after opening and the long term is typically 15 years after opening. Table 14.11 shows the magnitude of impact for the various increases on road traffic noise levels as set out in the DMRB.

Table 14.11: Magnitude of Impact From Operational Phase Road Traffic Noise

Magnitude of Impact	Noise Change in Short Term (LA10,18h)	Noise Change in Long Term (LA10,18h)
No Change	0.0 dB	0.0 dB
Negligible	0.1 dB – 0.9 dB	0.1 dB – 2.9 dB
Minor	1.0 dB – 2.9 dB	3.0 dB – 4.9 dB
Moderate	3.0 dB – 4.9 dB	5.0 dB – 9.9 dB
Major	5.0 dB and above	10.0 dB and above

Operational Plant Noise

- 14.65 In this assessment, the impact of plant noise has been considered in accordance with the BS 4142. Unlike the other best practice guidance considered in this assessment, BS 4142 does not use the terminology for defining magnitude as either 'negligible', 'minor', 'moderate' or 'major'. Instead, a difference between the 'rated' sound pressure level and the existing background sound level of around +10 dB is considered to be an indication of a significant adverse impact, depending on the context of the sound. A difference of around +5 dB is likely to be an indication of an adverse impact, depending on context. The lower the rating level is relative to the background sound level, the less likely it is to be an adverse impact, depending on the context. If the rated level is below the background sound level, this is an indication of a minor/negligible impact, again, depending on context.
- 14.66 The rated sound level is defined as being the specific sound level for the item of plant, inclusive of any penalties for acoustical characteristics, such as tonality, impulsivity, intermittency or any other distinguishable feature.
- 14.67 Table 14.12 below defines the magnitude of impact from operational plant noise but uses the terminology consistent with the rest of the assessment.

Table 14.12: Magnitude of Impact From Operational Plant Noise

Magnitude of Impact	'Rated' Plant Sound Level
Major	More than 10 dB above background sound level
Moderate	Between 5 dB and 9.9 dB above background sound level
Minor	Between 0 dB and 4.9 dB above background sound level
Negligible	Below background sound level

- 14.68 The significance of an environmental effect is determined by the interaction of magnitude and sensitivity, whereby the impacts can be beneficial or adverse. The 'Effect Significance' matrix is set out in Table 14.13 below and is relevant to both noise and vibration for the construction and operational phases of the Proposed Development.

Table 14.13: Matrix for Determining the Effect Significance

Sensitivity of Receptor	Magnitude of Impact			
	High	Moderate	Low	Negligible
High	Major	Moderate	Minor	Negligible
Moderate	Moderate	Minor	Negligible	Negligible
Low	Minor	Negligible	Negligible	Negligible
Very Low	Negligible	Negligible	Negligible	Negligible

- 14.69 Table 14.14 below provides definitions of the significance of effects set out in Table 14.13 above which has been based on the Institute of Acoustics and the Institute of Environmental Management and Assessment Guidelines and the ProPG: Planning and noise document. Reference has been made to the magnitude of adverse impact with the 'LOAEL' and 'SOAEL' as detailed within the NPSE.
- 14.70 The ProPG: Planning and Noise document continues to state that it is not possible to have a single objective noise-based measure that defines SOAEL for all circumstances, therefore the LOAEL and SOAEL levels are considered to be different for different receptors at varying times. Essentially, noise levels which exceed the SOAEL would require mitigation and levels which exceed the LOAEL may require mitigation, depending on the context. For the purposes of the assessment, identified effects with a magnitude of LOAEL + 5 dB or greater are considered to be significant, in line with this practice.

Table 14.14: Classification of Noise and Vibration Effects

Level of significance	Description of Effect	Exceeds SOAEL?	Exceeds LOAEL?	Acceptance
Major	The noise or vibration is distinguishable which can cause a material change in behaviour and/or attitude. There is the potential for sleep disturbance with the quality of life diminished due to changes in the area.	✓	✓	✗
Moderate	Intrusive noises which can be heard or vibration levels which can be readily determined. These levels can cause small changes in behaviour and/or attitude such as increasing the level of the TV. There is the potential for non-awakening sleep disturbance and	✗	✓	Temporary Works (construction) ✓

	can affect the overall character of the area due to the perceived change in the quality of life			Permanent Noise Sources (building services plant)
				✗
Minor	Non-intrusive noise or vibration levels which can be heard or felt but would not cause any change in behaviour or attitude. This could lead to changes in the character of the area, but not where there would be a perceived change in the quality of life.	✗	✗	✓
Negligible	No discernible effect on the receptor	✗	✗	✓

Limitations and Assumptions

- 14.71 The long-term noise monitoring locations (MP1 and MP2) have been included in Figure 14.2 and have been deemed to be representative of noise levels in the area as far as reasonably practicable.
- 14.72 The monitoring duration of nine days provided a thorough review of the existing sound levels, with a view to minimising the uncertainties associated with environmental noise monitoring. These measurements were bolstered by several short term, time-aligned noise measurements, to gather an understanding of the sound levels across the wider parcel of the Site.
- 14.73 The monitoring equipment, when calibrated before and after the measurements, showed a low degree of drift in calibration; consequently, any uncertainty due to measurement calibration is considered to be low.
- 14.74 Calculations using the computer software were carried out in accordance with ISO 9613-2. The standard states that there is a +/- 3 dB error associated with the calculation method. In practice the assumptions used in the calculation method tend to the worst-case assumption for propagation, and uncertainty associated with the calculation method is not considered to alter the outcome of the assessment. It should be noted that a new version of the above standard has been released in 2024. This standard addresses reduced performances of grazing instance predictions of barriers that may occur over large distances. Again, a significant degree of uncertainty is not expected to be associated with the changes to the standard in regard to this assessment.
- 14.75 The weather for the manned noise monitoring was measured continuously on a PCE-FWS-20N weather station, with data logger and was considered to be suitable for the purposes of environmental noise monitoring.

BASELINE CONDITIONS

Long Term Monitoring Locations

- 14.76 MP1 – North-west of the Site – This location was selected as it was adjacent to the residential dwellings close to NSR3.
- 14.77 MP2 – South-west of the Site – This location was selected as it was adjacent to the industrial units closest to the Site.

Short Term Time-Aligned Monitoring Locations

- 14.78 SP1 –West of the Site – This location was selected as it was close to some industrial units to the West of the Site. This has also been deemed to be a potentially sensitive location and has been referred to as NSR4.
- 14.79 SP2 – South-South-West of the Site – This location was selected as it was adjacent to existing residential dwellings close to NSR6.
- 14.80 SP3 – North-east of the Site – This location was selected as it was close to NSR5
- 14.81 SP4 – South-east of the Site – This location was selected as it was close to a single residential dwelling.

Unmanned Monitoring Survey Results – MP1 and MP2

14.82 The average $L_{Aeq,T}$ values, most commonly occurring background $L_{A90,T}$ values, and the 10th highest maximum event level L_{AFMax} have been shown below in Table 14.15 for both daytime and night-time periods.

Table 14.15: Long Term Baseline Survey Results

Day-Time Survey Data (23 rd to 31 st July 2024)			
Location Ref	dB $L_{Aeq,T}$ (T=16h)	dB $L_{A90,T}$ (T=1h)	dB L_{AFMax}
MP1	60	46	-
MP2	45	40	-

Day-Time Survey Data (23 rd to 31 st July 2024)			
Location Ref	dB $L_{Aeq,T}$ (T=8h)	dB $L_{A90,T}$ (T=15min)	dB $L_{AFMax,T}$ (T=1 min)
MP1	51	28	73
MP2	39	28	58

Unmanned Short Term Baseline Survey Results

14.83 The overall sound levels measured during the short-term surveying attributable to the local road traffic levels and any other noise sources in the area have been shown in Table 14.16.

Table 14.16: Short Term Baseline Survey Results

Location	Date	Time (hh:mm)	dB $L_{Aeq,1h}$	dB $L_{AFMax,1h}$	dB $L_{A10,1h}$	dB $L_{A90,1h}$
SP1	1st August 2024	09:44 - 10:44	46.5	74.3	49.3	39
SP2	1st August 2024	09:23 - 10:23	48.2	78.9	49.7	34.1
SP3	1st August 2024	10:59 - 11:59	46.9	63.9	50.9	34.7
SP4	1st August 2024	10:31 - 11:31	48.4	76.5	52.4	36.6

IMPACTS

Construction Noise Impacts

14.84 Detailed information regarding the likely construction plant was not available at the time of the preparation of this assessment. As such, the information relating to construction plant has been prepared, using past experience of similar projects. The assumed plant has been included in Table 14.17 below.

Table 14.17: Assumed Plant for Each Phase of the Development's Construction

Plant & Equipment	Site Establishment	Excavation Substructure	& Superstructure Envelope	& Fit-Out
Long Reach Excavator	✓	×	×	×
Tower Crane	×	×	✓	×

Breaker Mounted on Excavator		x	✓	x	x
Tracked/Wheeled Excavators	360	✓	✓	x	x
Drills/Cutters		x	✓	✓	✓
Hand Power Tools		✓	✓	✓	✓
Generators		✓	✓	x	x
Piling Rig		x	✓	x	x
Concrete Pump		x	✓	✓	x
Mobile Access Platforms		x	x	✓	x
Scaffolding		✓	x	✓	x
Goods / Passenger Hoists		x	x	✓	✓
Skips & Trucks		✓	✓	✓	✓

14.85 The quantity of construction equipment predicted for use during the Proposed Development's construction phase and the percentage on-time (%OT) that each item of plant would be in use for have been detailed in Table 14.18.

14.86 The quantity of construction equipment predicted for use during the Proposed Development's construction phase and the percentage on-time (%OT) that each item of plant would be in use for have been detailed in Table 14.18.

Table 14.18: Assumed Construction Plant Quantity and % On-Time for Each Phase of the Development's Construction

Plant	Site Establishment		Excavation & Substructure		Superstructure & Envelope		Fit-Out	
	Qty	%OT	Qty	%OT	Qty	%OT	Qty	%OT
Long Reach Excavator	1	50	0	0	0	0	0	0
Tower Crane	0	0	0	0	1	50	0	0
Breaker Mounted on Excavator	0	0	1	20	0	0	0	0
Tracked/Wheeled 360 Excavators	1	30	1	30	0	0	0	0
Drills/Cutters	0	0	1	10	1	10	1	10
Hand Power Tools	1	10	1	10	1	10	1	10
Generators	1	100	1	100	0	0	0	0
Piling Rig	0	0	1	20	0	0	0	0

Concrete Pump	0	0	1	50	1	50	0	0
Mobile Access Platforms	0	0	0	0	1	40	0	0
Scaffolding	1	5	0	0	1	5	0	0
Goods / Passenger Hoists	0	0	0	0	1	10	1	10
Skips & Trucks	1	40	1	30	1	30	1	30

- 14.87 The sound levels for each item of construction related plant has been taken from various reference tables in Annex C of BS 5228-1:2009+A1:2014 and shown in Table 14.19.

Table 14.19: Construction Plant Sound Levels and Reference

Plant	Sound Pressure Level Lp (dBA at 10m)	BS 5228-1:2009+A1:2014 Reference
Long Reach Excavator	79	C.2-14
Tower Crane	76	C.4-48
Breaker Mounted on Excavator	90	C.1-9
Tracked/Wheeled 360 Excavators	86	C.1-13
Drills / Cutters	77 / 65	C.4-96 / C.3-35
Hand/Power Tools	73 / 81	C.4-95 / C.1-20
Generators	65	C.4-83
Crawler Mounted Piling Rig	80	C.3-22
Concrete Pump	75	C.3-26
Mobile Access Platforms	67	C.4-57
Scaffolding	80	D.7-1
Goods/Passenger Hoists	76	D.7-98
Skips and Trucks	82	C.4-6

- 14.88 Following the construction noise level calculations referred to in BS 5228, the results of the predicted sound level for the construction phase have been tabulated by the site clearance, road construction and construction of buildings and structures of the Proposed Development and the predicted unmitigated sound levels outside the various NSRs. Only daytime noise levels have been assessed as construction works would be limited to daytime hours only.
- 14.89 The effect was calculated by defining the magnitude of impact by comparing the predicted sound level to the baseline (LOAEL) and the BS 5228 Threshold levels (SOAEL) and then multiplying by the sensitivity of the receptors as defined in Table 14.8.

Table 14.20: Predicted Sound Pressure Level (SPL) at NSRs for Site Establishment Phase

NSR ID	Receiver	Baseline dB $L_{Aeq,T}$	BS5228-1 ABC Category	Site Establishment Predicted dB $L_{Aeq,T}$	Effect
NSR1	Oak Drive Residences	45	Category A 65 dB	57	Minor
NSR2	Field House	60	Category A 65 dB	80	Major
NSR3	1-27 (Odds) Langley Common Rd	60	Category A 65 dB	80	Major
NSR4	Isaac Newton Road Residences	45	Category A 65 dB	76	Major
NSR5	Stable House	45	Category A 65 dB	52	Minor
NSR6	Archer Grove Residences	45	Category A 65 dB	58	Minor
NSR7	Princess Marina Drive Residences	45	Category A 65 dB	58	Minor

Table 14.21: Predicted Sound Pressure Level (SPL) at NSRs for Excavation & Substructure Phase

NSR ID	Receiver	Baseline dB $L_{Aeq,T}$	BS5228-1 ABC Category	Excavation & Substructure Predicted dB $L_{Aeq,T}$	Effect
NSR1	Oak Drive Residences	45	Category A 65 dB	58	Minor
NSR2	Field House	60	Category A 65 dB	81	Major
NSR3	1-27 (Odds) Langley Common Rd	60	Category A 65 dB	81	Major
NSR4	Isaac Newton Road Residences	45	Category A 65 dB	77	Major
NSR5	Stable House	45	Category A 65 dB	53	Minor
NSR6	Archer Grove Residences	45	Category A 65 dB	59	Minor
NSR7	Princess Marina Drive Residences	45	Category A 65 dB	59	Minor

Table 14.22: Predicted Sound Pressure Level (SPL) at NSRs for Superstructure & Envelope Phase

NSR ID	Receiver	Baseline dB $L_{Aeq,T}$	BS5228-1 ABC Category	Superstructure & Envelope Predicted dB $L_{Aeq,T}$	Effect
NSR1	Oak Drive Residences	45	Category A 65 dB	51	Minor
NSR2	Field House	60	Category A 65 dB	74	Major
NSR3	1-27 (Odds) Langley Common Rd	60	Category A 65 dB	74	Major
NSR4	Isaac Newton Road Residences	45	Category A 65 dB	70	Moderate
NSR5	Stable House	45	Category A 65 dB	46	Minor
NSR6	Archer Grove Residences	45	Category A 65 dB	52	Minor

Table 14.23: Predicted Sound Pressure Level (SPL) at NSRs for Fit-Out Phase

NSR ID	Receiver	Baseline dB L _{Aeq,T}	BS5228-1 ABC Category	Fit-Out Predicted dB L _{Aeq,T}	Effect
NSR1	Oak Drive Residences	45	Category A 65 dB	49	Minor
NSR2	Field House	60	Category A 65 dB	72	Major
NSR3	1-27 (Odds) Langley Common Rd	60	Category A 65 dB	72	Major
NSR4	Isaac Newton Road Residences	45	Category A 65 dB	68	Moderate
NSR5	Stable House	45	Category A 65 dB	44	Negligible
NSR6	Archer Grove Residences	45	Category A 65 dB	50	Minor
NSR7	Princess Marina Drive Residences	45	Category A 65 dB	50	Minor

14.90 Tables 14.20 through to 14.23 show the predicted levels of sound at the NSRs for the various phases of the construction phases as detailed previously, prior to the implementation of mitigation measures.

14.91 The magnitude of the predicted effects at these NSRs has been considered to range from **Negligible** effect to **Major Adverse** effect, resulting in a **significant** effect, prior to the implementation of mitigation measures.

Construction Vibration Impacts

14.92 The piling has been considered to be the most dominant vibrational source out of the various phases. This is included in the Excavation and Substructure Phase. Extensive geometric attenuation calculations have been undertaken for each stage of the typical piling processes, as typically, piling would generate the highest levels of vibrational excitement at the Site in comparison with other construction phase activities. The vibration effects of the piling operations of the Proposed Development is shown in Table 14.24 below.

14.93 The vibration effects of the piling activities was calculated by defining the magnitude of impact through a comparison of the predicted vibration level to the significance criteria as detailed in Table 14.10 and then multiplying by the sensitivity of the receptors as defined in Table 14.8.

Table 14.24: Predicted Vibration at NSRs for Piling Operation During the Substructure Phase

NSR Reference	Receiver	Predicted PPV (mm/s)	Effect
NSR1	Oak Drive Residences	<1.0	Negligible
NSR2	Field House	1.0 – 10.0	Moderate
NSR3	1-27 (Odds) Langley Common Rd	1.0 – 10.0	Moderate
NSR4	Isaac Newton Road Residences	1.0 – 10.0	Moderate
NSR5	Stable House	<1.0	Negligible
NSR6	Archer Grove Residences	<1.0	Negligible
NSR7	Princess Marina Drive Residences	<1.0	Negligible

Operational Impacts

Site Suitability

- 14.94 The overall Site is considered to have a negligible to low risk when considered against the guidance in ProPG.
- 14.95 It is typically considered that a 15 dB level difference can be achieved across a partially open window.
- 14.96 Measurements obtained in the long-term measurement position 1 would be considered above the point at which a partially open window could be used to naturally ventilate the property during normal background ventilation conditions.
- 14.97 Based on the survey measurements and our observations on the Site, the primary source of noise impacting the Site to be from road traffic on the Langley Common Road.
- 14.98 Data collected from Common Field Lane shows this road is relatively quiet. However, the traffic information for the project predicts a 12% increase without the Proposed Development for the 2035 prediction, which our calculations show would result in a 0.5 dB increase to the road levels. As only attended survey measurements were carried out in this location, the transport data to predict has been used to predict propagation of noise from this noise source in accordance with CRTN (Calculation of Road Traffic Noise).
- 14.99 Road traffic levels on Langley Common Road have been derived from the transport consultant's data and allow for the potential 1 dB increase expected once the Proposed Development is complete.
- 14.100 Based on the noise propagation model, the areas of the Site shown in red in Figure 14.3 would require mitigation in order to allow openable windows to support the background ventilation strategy.
- 14.101 Within these areas, it is recommended that the proposed dwellings are situated so that their external amenity spaces are behind the building structures, and where practicable, sensitive rooms, such as bedrooms should not face the roads. This would satisfy the existing local policies as well as the parts 3a and 3b of Policy HC8 of the Local Plan Update 2023-2040 Proposed Submission Plan.
- 14.102 If this cannot be achieved due to other site constraints, the calculations show that suitable amenity sound levels can be achieved by surrounding gardens with a 1.8 m high close boarded fences meeting a minimum mass per unit area of 10 kg/m².

Predicted Sound Levels From Road Traffic Noise

- 14.103 The traffic flow calculations have been reviewed and a predicted increase along Langley Common Road of 0.3 dB due to the presence of the Proposed Development is expected when compared to that natural growth without the Proposed Development in the 2040 year.
- 14.104 All roads contained within the traffic flow predictions are shown to result in less than a 1 dB increase with the Proposed Development in place, when compared against the same year without the Proposed Development, with the exception of traffic levels along Baird Road. This is shown to have a vehicle increase of approximately 29% which is calculated to result in a 1.1 dB increase from vehicle movements alone.
- 14.105 As shown in Table 14.11, most of the traffic increases would equate to a **Negligible** impact for both the Do Nothing and the Do Something scenarios, when assessed in line with the DMRB LA111 guidance. It is therefore unlikely that there would be significant noise effects from the operational noise from the Proposed Development.
- 14.106 Traffic increase along Baird Road would result in a minor impact when assessed in isolation. However, it must be remembered that sound increase from one road is not experienced in isolation. This road has very low vehicle movement predictions when compared against other roads in the area, and the daily estimate of 750 vehicles falls below the proposed 1000 vehicles over an 18-hour assessment period considered a minimum for use of the guidance contained within CRTN.
- 14.107 Given that the majority of the sound increase will be driven by the increase of vehicles on other surrounding roads it is therefore considered likely that the increase on this road alone would not result in a minor impact and overall impact from road traffic noise increase would remain **Negligible**.

Predicted Sound Levels From Plant

- 14.108 At the time of writing, plant details were not known. Plant noise rating levels have therefore been proposed within the accompanying Noise and Vibration Assessment. The proposed noise rating levels are 45 dB L_{A,T} during the daytime and 33 dB L_{A,T} during the night-time hours. These proposed noise

rating levels are inclusive of any specific acoustic characteristics, such as tonality, impulsivity, cyclical or any other noise which would make the plant noticeable.

- 14.109 These levels have been set 5 dB above the representative background sound level at MP2, which is the point at which BS 4142:2014+A1:2019 suggests could result in an adverse impact, depending on the context. Adherence to these noise limits will ensure that there would be a **Minor Adverse** impact to **Negligible** impact to the existing NSRs.

MITIGATION

Construction Traffic Noise

- 14.110 There will be no noisy or vibratory works on Sundays or Bank Holidays. Noisy and/or vibratory construction works will be restricted to take place between the hours of 07.00 – 18.00 Monday to Friday and 08.00 to 13.00 on Saturdays, with vehicles mainly accessing the Site during these working hours. For logistical reasons, it may be necessary to have occasional deliveries outside of these hours, for example, if any abnormal loads are required for transporting large items such as the delivery of the tower crane. On-site construction working hours will be set out in the CEMP, to be secured by a planning condition to the planning permission.
- 14.111 Disturbance from construction vehicles to residents would be mitigated and minimised through implementation of best practicable means (BPM) as detailed within BS 5228 which and where possible, would include measures such as minimising engine idling time, avoid starting engines at the same time and scheduled arrival times to reduce waiting for access whilst stopped on the public highways.
- 14.112 In addition, the adverse impact from construction traffic would be mitigated through the Traffic Management Plan as referred to in the CEMP.

Construction Noise Mitigation

- 14.113 The Proposed Development would be constructed over phases, as shown in the Figure 14.4.
- 14.114 The assessment of potential construction noise effects has been undertaken for the Proposed Development. This has been produced and will be employed to mitigate the potential noise effects on nearby NSRs and secured by planning condition.
- 14.115 The following measures are referred to as the BPM which should also be adopted in addition to the CEMP, wherever practicable;
- All plant brought on to the Site will comply with the relevant EC / UK noise limits applicable to that equipment or will be no noisier than would be expected based the noise levels quoted in BS 5228-1:2009+A1:2014,
 - Plant is to be properly maintained and operated in accordance with manufacturer's recommendations. Electrically powered plant is preferred, where practicable, to mechanically powered alternatives,
 - When appropriate all mechanically powered plant will be fitted with suitable silencers,
 - Items of plant on the Site operating intermittently are to be shut down in the intervening periods between use,
 - Where feasible, all stationary plant would be located so that the noise effect at all occupied residential and commercial properties is minimised and, if practicable, every item of static plant when in operation is to be sound attenuated using methods based on the guidance and advice given in BS 5228-1:2009+A1:2014 or switched off,
 - In addition to this, equipment such as generators or pumps, which may be required to operate continuously, may be screened or enclosed to reduce the noise impact and where possible, positioned away from noise sensitive receptors,
 - Disturbance from construction activities will be minimised through the implementation of the CEMP, which is likely to include such mitigative measures such as minimising drop heights, lining chutes, maintaining a clear line of communication with the nearby residents,
 - Trade contractors would at all times apply the principle of BPM as defined in Section 72 of the Control of Pollution Act 1974 (UK) and carry out all work in such a manner as to reduce any disturbance from noise and vibration to a minimum,
 - The Proposed Development plots will be surrounded by hoarding, of minimum height of 2.4m, which provides some acoustic shielding at ground level. The hoarding consists of plywood sheets or similar,

with all knotholes, cracks and other joints sealed to minimise the escape of noise. It may be moved from time to time to suit the progress of the works,

- The timing of building operations will be critical in avoiding noise and vibration nuisance to surrounding areas and premises. The contractor would identify particularly sensitive periods in the works so that the potential problems can be minimised and that early and good public relations with the adjacent tenants and occupants of buildings are maintained, and
- Temporary noise and vibration monitors (throughout the ground enabling and the construction periods) would be located at locations agreed with the Council in close proximity to the Proposed Development.

14.116 At the detailed design stage of the Proposed Development, the primary method for the control of noise will be through a detailed Construction Noise & Vibration Impact Assessment in line with BS 5228 Parts 1 (Noise) and Part 2 (Vibration) and a CEMP in line with the requirements of the Council. This would be conditioned during the detailed design stage through future reserved matters applications.

14.117 The CEMP would contain appropriate noise limits at the nearby properties depending on their use and ownership. The noise levels and these limits will be continuously monitored and reported. The reports and monitoring will highlight when it is likely that the construction limits will be exceeded through live warning emails and SMS messages, so that construction activities can be effectively temporarily altered, or stopped, to ensure that limits are adhered to where practicable.

14.118 All construction works would be restricted to the same hours of operation as detailed above to minimise impact on residents.

Construction Vibration Mitigation

14.119 Piling is anticipated to be the greatest source of vibration during the construction works. If piling is to be used, then augered piling (CFA) is anticipated to be implemented for the Proposed Development. This type of piling produces the lowest levels of vibration across the various types of piling, so adverse vibration impacts would be minimised. In addition, through appropriate liaison with potentially impacted residents prior to undertaking the piling operations, potential disturbance would be reduced due to the increased tolerance of the resident due to prior notification.

14.120 Other vibration mitigation measures which are available include constructing a wave barrier when piling works are required close to existing noise and vibration sensitive receptors. However, due to the size constraints on the Site, these may only be suitable for very specific tasks or may not be practicable at all.

14.121 The use of vibratory compaction rollers would be avoided when working within 50m – 100m (depending on size) of the existing residential properties. Best practicable means would be adopted for all works. Once the detailed construction method statements have been finalised the precise mitigation measures to be implemented would be identified at the detailed design stage through future reserved matters applications.

Operational Mitigation

Building Services Plant Noise

14.122 All plant which is to be installed as part of the Proposed Development will be at suitably low operational noise levels or be mitigated as required to meet the requirements of BS 4142 as stated previously. This would satisfy the requirements of the Council for all phases of the Proposed Development.

14.123 Proposed mitigative strategies could include screening of plant behind rooftop mounted ASHP louvred enclosures or seeing plant located in a roof well, fully shielded by the roof line, as deemed appropriate through future BS 4142 noise impact assessments. The louvres in the ASHP enclosures would, where required, be either acoustic louvres or of solid construction. These would be designed to reduce the effect on both existing and future residents.

Road Traffic Noise

14.124 As set out in the Likely Significant Effects section of this Chapter, the Proposed Development has been shown to have negligible road effects in both the short and long term. Therefore, no specific mitigation for road traffic noise is required.

RESIDUAL IMPACTS

Construction Phase Noise

14.125 By implementing the mitigation measures as detailed above, the residual effects have been detailed below in Tables 14.25 to 14.29.

Table 14.25: Predicted Sound Pressure Level (SPL) at NSRs for Site Establishment Phase Post Mitigation

NSR ID	Receiver	Baseline dB $L_{Aeq,T}$	BS5228-1 Category	ABC	Site Establishment Predicted $L_{Aeq,T}$ dB	Effect
NSR1	Oak Drive Residences	45	Category A	65 dB	41	Negligible
NSR2	Field House	60	Category A	65 dB	64	Minor
NSR3	1-27 (Odds) Langley Common Rd	60	Category A	65 dB	64	Minor
NSR4	Isaac Newton Road Residences	45	Category A	65 dB	60	Minor
NSR5	Stable House	45	Category A	65 dB	36	Negligible
NSR6	Archer Grove Residences	45	Category A	65 dB	42	Negligible
NSR7	Princess Marina Drive Residences	45	Category A	65 dB	42	Negligible

Table 14.26: Predicted Sound Pressure Level (SPL) at NSRs for Excavation & Substructure Phase Post Mitigation

NSR ID	Receiver	Baseline dB $L_{Aeq,T}$	BS5228-1 Category	ABC	Excavation & Substructure Predicted $L_{Aeq,T}$ dB	Effect
NSR1	Oak Drive Residences	45	Category A	65 dB	42	Negligible
NSR2	Field House	60	Category A	65 dB	65	Minor
NSR3	1-27 (Odds) Langley Common Rd	60	Category A	65 dB	65	Minor
NSR4	Isaac Newton Road Residences	45	Category A	65 dB	61	Minor
NSR5	Stable House	45	Category A	65 dB	37	Negligible
NSR6	Archer Grove Residences	45	Category A	65 dB	43	Negligible
NSR7	Princess Marina Drive Residences	45	Category A	65 dB	43	Negligible

Table 14.27: Predicted Sound Pressure Level (SPL) at NSRs for Superstructure & Envelope Phase Post Mitigation

NSR ID	Receiver	Baseline dB $L_{Aeq,T}$	BS5228-1 Category	ABC	Superstructure & Envelope Predicted $L_{Aeq,T}$ dB	Effect
NSR1	Oak Drive Residences	45	Category A	65 dB	40	Negligible

NSR2	Field House	60	Category A 65 dB	63	Minor
NSR3	1-27 (Odds) Langley Common Rd	60	Category A 65 dB	63	Minor
NSR4	Isaac Newton Road Residences	45	Category A 65 dB	59	Minor
NSR5	Stable House	45	Category A 65 dB	35	Negligible
NSR6	Archer Grove Residences	45	Category A 65 dB	41	Negligible
NSR7	Princess Marina Drive Residences	45	Category A 65 dB	41	Negligible

Table 14.28: Predicted Sound Pressure Level (SPL) at NSRs for Fit-Out Phase

NSR ID	Receiver	Baseline dB L _{Aeq,T}	BS5228-1 ABC Category	Fit-Out Predicted dB L _{Aeq,T}	Effect
NSR1	Oak Drive Residences	45	Category A 65 dB	36	Negligible
NSR2	Field House	60	Category A 65 dB	59	Minor
NSR3	1-27 (Odds) Langley Common Rd	60	Category A 65 dB	59	Minor
NSR4	Isaac Newton Road Residences	45	Category A 65 dB	55	Minor
NSR5	Stable House	45	Category A 65 dB	31	Negligible
NSR6	Archer Grove Residences	45	Category A 65 dB	37	Negligible
NSR7	Princess Marina Drive Residences	45	Category A 65 dB	37	Negligible

- 14.126 It has been shown in the tables above that the predicted effects would be **Negligible to Minor Adverse** impact at all locations for all of the construction phases, following the implementation of mitigation measures.
- 14.127 Through the implementation of BPM, phased starting, reduced idling and further consideration in the CEMP, the residual effects for noise resulting from construction traffic has been classified as **Negligible to Minor**.

Construction Phase Vibration

- 14.128 Table 14.30 below sets out the predicted residual effects on NSRs from the construction phase vibration.

Table 14.30: Predicted Vibration at NSRs for Piling Operation During the Substructure Phase Post Mitigation

NSR Reference	Receiver	Predicted PPV (mm/s)	Effect
NSR1	Oak Drive Residences	<0.3	Negligible
NSR2	Field House	<0.3	Negligible
NSR3	1-27 (Odds) Langley Common Rd	<0.3	Negligible
NSR4	Isaac Newton Road Residences	<0.3	Negligible

NSR5	Stable House	<0.3	Negligible
NSR6	Archer Grove Residences	<0.3	Negligible
NSR7	Princess Marina Drive Residences	<0.3	Negligible

- 14.129 The predicted impact of construction vibration is considered as **Negligible** as shown in Table 14.30 above. Best practicable means will be used on Site to further reduce the vibration levels. Once the detailed construction method statements have been finalised, the precise mitigation measures to be implemented would be identified at the detailed design stage.

Operational Road Traffic Noise

- 14.130 The residual effect of the Proposed Development on road traffic noise levels is considered to be **Negligible**.

Operational Plant Noise

- 14.131 The residual effect of the Proposed Development from mitigated plant noise levels is considered to be **Negligible**.

CUMULATIVE IMPACTS

- 14.132 The predicted cumulative effects arising from the Proposed Development in combination with cumulative schemes on NSR locations in the vicinity of the Site have been considered within this section. The location of these schemes has been included in Figure 14.5 and set out in the table below.

Table 14.31: Details of Committed Developments Around The Site

Planning Reference	Address	Distance to Site	Direction From The Site	Description of the Scheme
Part of SS13	Land South of Cutbush Lane, Shinfield	3.4 km	North-west	Strategic residential site
17/2450 permission	East of Shinfield (Phase 2), South of Church Lane, Shinfield	4.05 km	North-west	473 Dwellings, committed site
SS13	Lodden Garden Village	2km	North-west	Strategic residential site
SS12	South Wokingham SDL	5.5km	North-east	Strategic residential site

Construction Phase Noise

- 14.133 Construction of the Proposed Development could occur simultaneously with the construction of some of the cumulative schemes. Note 1 of the DMRB LA 111, paragraph 3.5 states the following -

'A study area of 300m from the closest construction activity is normally sufficient to encompass noise sensitive receptors.'

- 14.134 In accordance with the DMRB, these four committed developments have not been considered further for Construction Phase Noise, as the guidance suggests that it is acceptable.

Construction Phase Vibration

- 14.135 Construction of the Proposed Development could occur simultaneously with the construction of some of the cumulative schemes. Note 1 of the DMRB LA 111, paragraph 3.29 states the following -

'A study area of 100m from the closest construction activity with the potential to generate vibration is normally sufficient to encompass noise sensitive receptors.'

- 14.136 In accordance with the DMRB, these four committed developments have not been considered further for Construction Phase Vibration, as the guidance suggests that it is acceptable.

Operational Phase Road Traffic Noise

14.137 Note 1 of the DMRB LA 111 paragraph 3.44 states the following -

*'1) the area within 600m of new road links or road links physically changed or bypassed by the project;
2) the area within 50m of other road links with the potential to experience a short term BNL change of more than 1.0dB(A) as a result of the project.'*

14.138 Due to the distances between the Site and the committed development sites, this has not been considered further. Furthermore, the transport assessment modelling has included the traffic predicted to be associated with the cumulative sites, so in itself already represents a cumulative assessment.

Operational Phase Plant Noise

14.139 Given the distances from the Proposed Development and the committed development sites, the plant noise would not create an overall impact to the wider noise environment.

SUMMARY

14.140 This assessment has considered the likely significant effects on noise and vibration from the Proposed Development.

14.141 An acoustic baseline survey was carried out in order to establish the prevailing noise environment at the Site.

14.142 In line with BS 8233:2014, the internal and external ambient noise levels were assessed and found to comply with the requirements of BS 8233 and also satisfy the World Health Organisation requirements through the majority of the Site without the need for mitigation. In a small area of the Site, noise mitigation strategies have been described in more detail within the accompanying Noise and Vibration Assessment (**Technical Appendix 14.1**). These include the use of relocation and orientation of houses and sensitive room types, and where this is not possible, through the use of uprated acoustic glazing and forced ventilation.

14.143 The external amenity spaces have also been assessed and the sound levels are below the recommended level in line with BS 8233 and the WHO in all public amenity spaces.

14.144 An assessment of the likely significant effects of construction noise generated by the construction phase of the Proposed Development has been carried out and noise mitigation measures to be implemented have been identified. Prior to the implementation of these mitigation measures, potential adverse impacts have been identified which should be adopted to reduce these impacts to minor adverse or negligible significance.

14.145 An assessment of the likely significant effects of construction vibration generated by the construction phase of the Proposed Development has been carried out and deemed to be negligible following the implementation of the mitigative measures.

14.146 Plant information is not available at this time. An assessment of the likely significant effects of plant noise generated by the operational Proposed Development has been undertaken which has provided guidance on the maximum permissible sound level for any externally mounted or vented plant, inclusive of any special acoustical characteristics. All plant will be installed in line with the requirements of BS 4142.

14.147 Effects from road traffic noise generated by the operational Proposed Development on existing residents in the vicinity of the Site and future occupants of the Proposed Development would be negligible and no mitigation measures are required.

14.148 An assessment has been made of the construction noise and vibration effects from the Proposed Development to other committed developments and existing residential receptors in close vicinity of the Site. The construction phase has been assessed and the noise and vibration impacts have been shown to be minor adverse and negligible for the majority of sensitive receptors, following the implementation of the proposed mitigation. Due to the distances between The Site and the committed development sites, construction noise and vibration will be negligible.

14.149 The operational noise from the Proposed Development has also been assessed in terms of increased road traffic and plant noise. The impact from this Proposed Development has been shown to be negligible and not significant, assuming the proposed mitigation is implemented. Likewise, the impact on existing and future residents from the increased road traffic and plant noise from the committed developments should be negligible and not significant, based on the distances involved.

- 14.150 The cumulative impact for this Proposed Development and the other committed developments would be negligible and not significant to existing or future residents.
- 14.151 Table 14.32 Provides an overall summary of the effects of the Proposed Development noise and vibration.

Table 14.32: Summary Table of Noise & Vibration Residual Effects

Description of Likely Significant Effects	Significance	Description of Mitigation	Description of Residual Effects	Significance
Demolition /Construction Phase				
Site Establishment	Major to Minor Adverse	Implementation of CEMP and best practicable means (BPM) to include but not limited to; training of staff; use of compliant and well maintained plant only; plant fitted with suitable silencers and baffles; shutting down plant when not in use; localised screening and enclosures; minimising drop heights of waste, spoils and materials, using lined chutes, adhering to the required hours of operation, continuous site hoarding around the perimeter and continuous noise and vibration monitoring.	Construction levels at NSRs predicted to be at or below Category A threshold from BS 5228	Negligible to Minor Adverse
Excavation & Substructure	Major to Minor Adverse			Negligible to Minor Adverse
Superstructure & Envelope	Major to minor adverse			Negligible to Minor Adverse
Fit-Out	Major Adverse to Negligible			Negligible to Minor Adverse
Substructure Vibration (Piling)	Moderate Adverse to Negligible	Use of CFA piling and vibro-compaction to be avoided <50m from residences	Vibration levels predicted to be low	Negligible
Operational Phase				
Internal sound levels	Moderate to Negligible	In small areas, mitigation may be required, such as re-orientation of dwellings	Acceptable internal sound levels	Negligible
External amenity sound levels	Negligible	Dwellings shielding amenity areas from roads in small area	Acceptable external sound levels	Negligible
Operational plant noise	Minor Adverse to Negligible	Mitigation may be required to ensure compliance with BS 4142	Reduced sound levels to all receivers	Negligible
Operational traffic noise	Negligible	Mitigation not required		Negligible
Cumulative – Construction				
Construction noise and vibration	N/A	Mitigation is not required as committed developments are sufficiently far away	Combined construction noise and vibration levels do not warrant further consideration under DMRB LA111	N/A
Cumulative - Operation				
Road and plant noise	N/A	Mitigation is not required as committed developments are sufficiently far away	Combined road noise levels due to increase in traffic do not warrant further consideration under DMRB LA111. Plant noise levels will be below levels considered to cause adverse impact in accordance with BS 4142	N/A

15 CUMULATIVE ASSESSMENT

INTRODUCTION

- 15.1 This chapter assesses the cumulative effects of the scheme arising from the construction and operation of the Proposed Development. Cumulative effects result from the combined impacts of multiple developments as well as multiple in-scheme impacts, for example, combined landscape and ecology impacts on the same sensitive receptor. The impacts from a single development or a single environmental impact may not be significant on their own but when combined with other developments or impacts these effects could become significant.
- 15.2 There are several definitions of cumulative effects depending on the context in which the term is applied. However, generally, cumulative effects can be defined as *'impacts that result from the incremental changes caused by other past, present and reasonably foreseeable future actions together with the project'* (Hyder 1999, Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions).
- 15.3 The guidelines also define impact interactions as *"The reactions between impacts whether between the impacts of just one project or between the impacts of other projects in the area."*
- 15.4 The Planning Practice Guidance: Environmental Impact Assessment (planning Paragraph: 024 Reference ID: 4-024-20170728; Revision date: 28/07/2017) states –
'Each application (or request for a screening opinion) should be considered on its own merits. There are occasions, however, when other existing or approved development may be relevant in determining whether significant effects are likely as a consequence of a proposed development. The local planning authority should always have regard to the possible cumulative effects arising from any existing or approved development'.
- 15.5 Cumulative Effects Assessment (CEA) is a systematic procedure for identifying and evaluating the significance of effects from multiple activities and developments. The purpose of CEA at project level is to consider the incremental contribution of any impacts arising from the activities associated with the development of the proposed scheme, which is the focus of the ES, together with impacts from any other significant activities that may be taking place in the vicinity.

METHODOLOGY

- 15.6 Cumulative effects are the result of multiple actions on receptors or resources. There are principally two types of cumulative effect:
- Type 1 – Where different environmental topic impacts are acting on one receptor, as a result of the scheme, and
 - Type 2 – Where environmental impacts are acting on one receptor but are the result of multiple projects in combination (including the scheme being assessed).
- 15.7 The significance of cumulative effects has been determined using the criteria shown in Table 15.1 below, which is taken from DMRB Volume 11, Section 2, Part 5.

Table 15.1: Determining Significance of Cumulative Effects

Significance	Effect
Severe	Effects that the decision-maker must take into account as the receptor/resource is irretrievably compromised.
Major	Effects that may become key decision-making issues.
Moderate	Effects that are unlikely to become issues on whether the project design should be selected, but where future work may be needed to improve on current performance.
Minor	Effects that are locally significant.
Not Significant	Effects that are beyond the current forecasting ability or are within the ability of the resource to absorb such change.

Type 1 Effects

- 15.8 This ES has identified a number of beneficial and adverse effects during demolition, construction and on completion and occupation of the Proposed Development. These include effects of minor, moderate and major significance. Several effects on one receptor or receptor group could theoretically interact or combine to produce a combined significant overall effect.
- 15.9 For some environmental effects, no interactions with other effects would occur and so no intra-project cumulative effects would arise. For example, impacts to daylight and sunlight availability do not interact with impacts on archaeology, or result from contaminated land. For other environmental effects it is apparent that interactions could occur and impact in different ways upon an individual receptor or receptor group, such that combined cumulative effects may occur. Combined cumulative effects are more likely to arise when the receptor or receptor group is more sensitive to change. Typical examples include ecological and human receptors (population).
- 15.10 For the purposes of assessing Type 1 effects, the identified residual effects, as set out within the individual technical chapters of the ES, have been reviewed against the receptors they affect. Where there is more than one effect on a particular receptor, there is a requirement to determine whether there is the potential for effect interactions. If there is the potential for effect interactions then consideration has been given as to whether there is the potential for any resultant combined cumulative effect.
- 15.11 Only residual effects which are classified as being of minor, moderate, or major significance have been considered in relation to the potential for combined effects. Residual effects of negligible significance have been excluded from the assessment of Type 1 effects as, by virtue of their definition, they are considered to be imperceptible to an environmental/socioeconomic resource or receptor.

Type 2 Effects

- 15.12 The assessment of Type 2 effects relies on interpretation of the assessments undertaken for the Proposed Development, with reference to the assessment and interpretation of data available for other nearby developments that do not form part of the existing baseline. Where available, reference has been made to ESs which have been prepared to support planning applications for other developments. For developments which are not EIA Development, and for which an ES is not available, professional judgement has been used to identify likely significant effects based on available data and using quantitative or qualitative assessment approaches. In addition, effects of other developments may not have been expressed in consistent forms or prepared using a similar methodology.
- 15.13 The IEMA publication Guidelines for Environmental Impact Assessment (IEMA, 2004) recommends that an EIA should assess the effects of a scheme cumulatively with other developments only when there are likely to be significant effects. When evaluating the potential for significant effects there is often considerable uncertainty in the assessment, although in general it can be assumed that effects of each development in isolation would need to be minor or above in order to result in a significant cumulative effect.
- 15.14 The Scoping Report set out a zone of influence for consideration of Type 2 projects – a 4km radius from the entrance to the Site, accepting that from a transport point of view, this distance may extend further depending on the distribution of traffic and sensitive receptors (air quality/noise and possibly habitats). The Council considered this zone of influence a reasonable starting point. The Scoping Report also identified sites above 100 dwellings as being reasonable to consider as part of the assessment.
- 15.15 These thresholds have been applied on the basis that beyond this distance significant cumulative effects are considered to be unlikely. It is accepted that some larger schemes outside this 4km radius could result in cumulative effects on a wider geographical scale.
- 15.16 For completeness the assessment has considered both sites that have planning permission and allocations in the emerging Local Plan as identified in the Table 15.2. It should be noted that the scope of committed development for the Transport Assessment has been established and agreed with the Council (and includes Local Plan allocations and other commitments including those with planning permission). For consistency with the transport modelling, the noise and air quality assessments used the modelled traffic figures. The assessment is necessarily high level in so far as is reasonable taking into account the availability of information at the time of the assessment.

Table 15.2: Type 2 Cumulative Impact Sites

Site Allocation	Site Name	Dwellings	Distance from Site	Permission	Reason for inclusion/Inclusion for further Assessment	Non-for
SS14.7	Greenacres Farm, Finchampstead	100	2.5km		Included within traffic modelling; Considered further	
SS14.11	North of Arborfield Road, Shinfield	191	3.5km	242484	Included within traffic modelling; considered further as part of Lodden Village	
SS14.12	East/west of Hyde Road, Shinfield	175	4.3km	Draft allocation	Included within traffic modelling; outside distance	
SS12	South Wokingham SDL	2,975	5.5km	Draft allocation	Included within Traffic modelling; Considered further at Council's request	
SS13	Hall Farm/Lodden Garden Village and South of Cutbush Lane, Shinfield	3,930+	2km	Draft allocation and application 252498 just submitted	Included within traffic modelling; Considered further at Council's request	
SS11	Arborfield Green SDL (excl The Site)	2447	Adjacent	Allocation and Yes, for most of it	Already included as part of baseline assessment assumptions	
	Reading FC training Ground, Finchampstead	140	2km	220822 approved	Under construction with completion anticipated by 2027; included within traffic modelling.	
	East Shinfield Phase 2, south of Church Lane		4.5km	Committed Site	Included within traffic modelling	
	South-east of Finchampstead Road, South Wokingham SDL	171	3.6km	192325, granted Dec 24	Included within traffic modelling; otherwise intervening development and other side of railway.	
	Toutley East, west of Twyford Road, Wokingham	130	5km	211777	Outside distance threshold	
	Gorse Ride, south Whittle Close, Finchampstead	249	3km	202133 approved	Already under construction with completion estimated 2027; included within traffic modelling	
	Ashridge Warren Farm, House Road, Wokingham	153	7km	201515	Too distant	
	Various employment applications at Cutbush Lane, Shinfield - Thames Valley Science Park		+4km	232833/232995/211841/182059 – all approved	Distance (including visually) from the Site, included within traffic modelling; too distant.	

15.17 With respect to the above projects, the Council specifically identified the highlighted schemes as requiring consideration. Notably these are the largest sites. The table identifies those other projects that have been given a level of further consideration.

DESIGN AND MITIGATION

15.18 Mitigation measures are proposed in the individual environmental chapters of this ES and no further mitigation measures have been proposed for the considered cumulative impacts. In terms of the other projects, it is assumed that they will have identified and incorporated their own appropriate mitigation measures.

MAGNITUDE AND IDENTIFICATION OF IMPACTS AND EFFECTS

Type 1 Cumulative Effects

15.19 Residual effects have been reviewed against receptors they affect and grouped together where they share similar characteristics or sensitivities into a single receptor type. The obvious example is

occupiers of existing properties nearby the Site as well as local roads – these are grouped as a ‘human population’ receptor set.

Construction Phase

- 15.20 For the human population group, potential significant cumulative adverse effects include –
- Noise impacts from construction activities on noise-sensitive receptors, ranging from **Major to Negligible** before mitigation and **Minor to Negligible** post mitigation (residual),
 - Visual impacts from activities on the Site, specifically Field Farm, and residents along Langley Common Road, identified as **Moderate/Major** both before and after mitigation.
- 15.21 Cumulatively, therefore, these residual cumulative effects on the identified human population receptor are considered to be **Moderate/Minor Adverse**.

Operational Phase

- 15.22 **No** potential significant cumulative adverse effects are identified for the human population receptor.

Type 2 Cumulative Effects

- 15.23 Residual effects arising from the identified cumulative schemes have been considered according to each technical environmental topic and are summarised below.

Transport

- 15.24 The strategic traffic model includes all the Local Plan allocations and committed developments and so represents a cumulative assessment in itself. **No significant** cumulative effects on transport criteria (driver delay, safety, etc) have been identified.

Archaeology

- 15.25 Below ground archaeology is site-specific. Any findings on the Site and the cumulative sites would be recorded, adding to the wider archaeological and historic understanding and knowledge of the local area – whilst this is beneficial to the local area, it is considered to be **not significant**.

Ecology

- 15.26 Each scheme would use Best Practice methods during construction, and would incorporate open space, new planting, BNG and SANG, all beneficial locally. Overall, however, it is considered that there would be **no significant** cumulative effects on the ecological resource.

Landscape and Visual

- 15.27 Loddon Garden Village site lies 1.3km to the north west of the Site, with no potential for any visual receptors to experience views of this site in combination with the Proposed Development, therefore there would be **no** significant cumulative visual impact.
- 15.28 In terms of landscape character, the south-eastern part of Loddon Garden Village is located within the same Borough Landscape Character Type (LCT J2: Aborfield Cross and Barkham Settled and Farmed Clay) as the Site. The Proposed Development, in combination with Loddon Garden Village, would increase the urbanisation of the western part of LCT J2, however the central and north eastern parts of the LCT would remain unchanged, and therefore the cumulative effect would be **Minor Adverse** at most.
- 15.29 With regard to the other cumulative schemes in Table 15.2 identified and considered for further assessment, none are assessed as having views into the Site or with each other, principally due to distances involved and intervening landscape features. Consequently, there are considered to be **no** cumulative visual or landscape effects.

Flood Risk/Drainage

- 15.30 It is reasonable to assume that standard good practice construction methods will be required as a condition of all development projects. Therefore, it is considered that there would be **no** potential for significant cumulative effects on local surface water resources/flood risk.
- 15.31 In terms of the operational phase, all projects would have to adhere to relevant local and national policy and relevant standards whether these be set by the Council or other statutory bodies. As a result, **no** significant cumulative effects are anticipated.

Air Quality

- 15.32 Due to the distance to the cumulative developments, there are unlikely to be any significant cumulative construction phase effects during construction of the Proposed Development even in the event construction programmes coincide. Best practice construction methods would be required by condition. Therefore, should construction of other developments (committed or proposed) occur simultaneously it is considered that there would be **no** potential for significant cumulative effects.
- 15.33 Traffic from the other developments has been included within the traffic data. The overall residual effects cumulative in air quality are considered to be **not significant**.

Climate Change

- 15.34 GHG emissions are global in nature and have no locally defined receptor. Therefore, unlike other EIA topics, it is neither appropriate nor meaningful to assess cumulative GHG impacts from nearby projects individually. Therefore, a cumulative impacts assessment has not been undertaken.
- 15.35 There are **no** anticipated significant cumulative or in-combination climate change effects – the climate risks are site-specific and managed on-site, and they are not expected to exacerbate impacts in other environmental topics when adaptive measures are integrated.

Noise

- 15.36 Due to the distance to the cumulative developments, there are unlikely to be any significant cumulative construction phase effects during construction of the Proposed Development even in the event construction programmes coincide. Best practice construction methods would be required by condition. Therefore, should construction of other developments (committed or proposed) occur simultaneously it is considered that there would be **no** potential for significant cumulative effects.
- 15.37 Similarly, it is considered that there would be **no** potential for significant cumulative effects once the development schemes are built out.

SUMMARY

- 15.38 From the assessment of the potential for Type 1 and Type 2 cumulative effects it can be seen that there is limited potential for either beneficial or adverse cumulative effects from the Proposed Development when considered together with the cumulative schemes.
- 15.39 **Moderate/Minor Adverse** Type 1 cumulative impacts tend to occur, and have been identified, during the enabling, demolition and construction stages of the Proposed Development, as a result of the combined nuisance resulting from increased noise levels, and increased visual intrusion nuisance effects due to daytime construction work.
- 15.40 The assessment of Type 2 cumulative effects concludes there will be **no significant** effects arising from the Proposed Development, combined with the cumulative schemes identified, on most topic areas at completion of the schemes. The exception to this is in respect of landscape effects arising from The Proposed Development and Lodden Garden Village on the landscape Character Type LCT J2, which are identified as **Minor Adverse**.

16 CONCLUSIONS

- 16.1 This ES has assessed how the Proposed Development would affect the local and wider environment in isolation and in combination with other development schemes.
- 16.2 A range of likely effects, both adverse and beneficial, both during the construction and after the completion of the Proposed Development have been identified. These are summarised in Tab 16.1. Overall, the residual effects have been identified as **Not significant** in all environmental topic areas assessed, including cumulatively, with the exception of –
- Visual effects on existing residents of Field Farm House and along Langley Common Road during construction and even after the completion of the Proposed Development with maturing landscaping – **Major/Moderate Adverse**, and
 - Cumulatively, visual and noise effects on the collective human population (residents) during construction – **Moderate Adverse**.
- 16.3 Cumulatively with Lodden Garden Village, urbanising effects on the landscape character of Character area LCT J2, are considered to be **Minor Adverse**.
- 16.4 The information provided within this ES is considered to be sufficient for the Council to determine the Application to which it relates and conclude that the environmental impact of the Proposed Development is not significant, and therefore acceptable.

Table 16.1: Summary of Residual Effects

TOPIC	DESCRIPTION OF LIKELY IMPACT	MITIGATION	DESCRIPTION OF RESIDUAL EFFECT	SIGNIFICANCE – (Year 10 Landscape/Visual)	
CONSTRUCTION					
Transport	Langley Common Rd -Biggs Lane-Site access	CTMP to manage traffic	Severance of communities	Negligible, Significant	Not Significant
	Langley Common Road -Biggs Lane-Site Access	As above	Driver/passenger delay	Negligible, Significant	Not Significant
	Langley Common Road -Biggs Lane-Site Access	As above	Non-motorised user delay	Negligible, Significant	Not Significant
	Langley Common Road -Biggs Lane-Site Access	As above	Non-motorised user amenity	Negligible, Significant	Not Significant
	Langley Common Road -Biggs Lane-Site Access	As above	Fear & intimidation on and by road users	Negligible, Significant	Not Significant
	Langley Common Road -Biggs Lane-Site Access	As above	Road user & pedestrian safety	Negligible, Significant	Not Significant
	Ecology	Statutory designated sites - Pollution	Embedded mitigation, best practice, CEMP	N/A	Nil
Statutory designated sites - Visitor impact		As above	N/A	Nil	
Non-statutory designated sites - Pollution		As above	N/A	Nil	
Non-statutory designated sites - Visitor impact		As above	N/A	Nil	
Ancient woodland – Pollution, dust		As above	N/A	Negligible, Significant	Not Significant
Ancient woodland – Visitor impact		As above	N/A	Negligible, Significant	Not Significant
Non-ancient woodland – Pollution, dust		As above	N/A	Negligible, Significant	Not Significant
Non-ancient woodland – Visitor impact		As above	N/A	Negligible, Significant	Not Significant
Barkham Brook - Pollution		As above	N/A	Negligible, Significant	Not Significant
Pond P1 – Pollution		As above	N/A	Negligible, Significant	Not Significant
Hedgerows – Habitat loss		As above	N/A	Negligible, Significant	Not Significant
Breeding birds – Habitat loss		As above	N/A	Slight Adverse, Not Significant	Not Significant

TOPIC	DESCRIPTION OF LIKELY IMPACT	MITIGATION	DESCRIPTION OF RESIDUAL EFFECT	SIGNIFICANCE – (Year 10 Landscape/Visual)	
	Bats – Habitat loss	As above	N/A	Negligible, Not Significant	
	Bats – Disturbance from light	As above	N/A	Negligible, Not Significant	
Heritage - Archaeology	Loss of archaeological remains	Preserve and record	Archaeological remains preserved by record	Slight Adverse, Not significant	
Landscape/ Visual	Viewpoint 1a: Field Farm House; Adjacent residents; Views of construction activities	CEMP	For the LVIA the construction effects would take account of mitigation set out in the CEMP. Residual effects are as assessed.	Moderate/Major Adverse, Significant	
	Viewpoint 5: Langley Common Road; Adjacent residents; Views of construction activities	CEMP	For the LVIA the construction effects would take account of mitigation set out in the CEMP. Residual effects are as assessed	Moderate/Major Adverse, Significant	
Water/Flood Risk	Major accident disaster – flood risk due to breach of defences		N/A	Negligible, Not Significant	
	Surface water flood event in excess of drainage design capacity	CEMP, Best Practice	N/A	Negligible, Not Significant	
	Aquifers and ground water flows	CEMP, best practice	N/A	Negligible, Not Significant	
	Water supply and demand		N/A	Negligible, Not Significant	
	Wastewater generation		N/A	Negligible, Not Significant	
Air Quality	Earthworks	CEMP, Best Practice	Dust	Negligible, Not Significant	
	Construction	CEMP, Best Practice	Dust	Negligible, Not Significant	
	Track out	CEMP, Best Practice	Dust	Negligible, Not Significant	
Climate Change	Climate hazards such as high temperatures, increased rainfall could create unsafe working conditions	CEMP, EMP, Best Practice	N/A	Negligible, Not significant	
Noise & Vibration	Site Establishment	CEMP, Best Practice	Construction levels at NSRs predicted to be at or below Category A threshold from BS 5228	Negligible-Minor, Not significant	
	Excavation & Substructure	CEMP, Best Practice	As above	Negligible-Minor, Not significant	
	Superstructure & Envelope	CEMP, Best Practice	As above	Negligible-Minor, Not significant	
	Fit-Out	CEMP, Best Practice	As above	Negligible-Minor, Not significant	
	Substructure Vibration (Piling)	CEMP, Best Practice	As above	Negligible, not significant	
Cumulative	Landscape/visual/noise impacts on human receptor group (Field Farm/Langley Common Road residents).	CEMP, Best Practice	Construction levels at NSRs predicted to be at or below Category A threshold from BS 5228.	Moderate/Minor adverse – significant	
	All topics with all schemes considered, except below on landscape character.	CEMP, Best practices, conditions	N/A or as each individual topic	Negligible, not significant	
	Landscape impacts on character area LCT J2 with Lodden Garden Village	CEMP, best practice		Minor Adverse – not significant	

TOPIC	DESCRIPTION OF LIKELY IMPACT		MITIGATION	DESCRIPTION OF RESIDUAL EFFECT	SIGNIFICANCE – (Year 10 Landscape/Visual)	
OPERATION						
Transport	Eversley Common Road/Observer Road/Biggs Road/Barkham Street/Bearwood Road	Road/Langley Road/Barkham Way/Baird Road/School Road	Travel Plan and sustainable option provision	Severance of communities	Negligible, significant	Not
	Eversley Common Way/Baird Road/School Street/Bearwood Road	Road/Langley Road/Observer Road/Biggs Road/Barkham Road	As above	Road vehicle driver/passenger delay	Negligible, significant	Not
	Barkham Road		As above	Road vehicle driver/passenger delay	Low	
	Eversley Common Road/Observer Road/Biggs Road/Barkham Street/Bearwood Road	Road/Langley Road/Barkham Way/Baird Road/School Road	As above	Pedestrian/cycle delay	Negligible, significant	Not
	Eversley Common Road/Observer Road/Biggs Road/Barkham Street/Bearwood Road	Road/Langley Road/Barkham Way/Baird Road/School Road	As above	Fear and intimidation on and by road users	Negligible, significant	Not
	Eversley Common Road/Observer Road/Biggs Road/Bearwood Road	Road/Langley Road/Barkham Way/Baird Road/Barkham Street	As above	Road user and pedestrian safety	Negligible, significant	Not
	School Road		As above	Road user and pedestrian safety	Low, Not significant	
Ecology	Statutory designated sites – Air Quality			N/A	Negligible, significant	Not
	Statutory designated sites – visitor impact		SANG provision	N/A	Minor Adverse, Not significant	
	Non-statutory designated sites – Air Quality			N/A	Negligible, significant	Not
	Non-statutory designated sites - Visitor impact		SANG provision	N/A	Negligible, significant	Not
	Ancient woodland – Visitor impact		SANG provision	N/A	Negligible, significant	Not
	Ancient woodland – Connectivity		Embedded	N/A	Negligible, significant	Not
	Non-ancient woodland and hedgerows – habitat creation		Embedded	N/A	Negligible, significant	Not
	Barkham Brook - pollution		As above	N/A	Negligible, significant	Not
	Barkham Brook – habitat management		As above	N/A	Negligible, significant	Not
	Breeding birds – habitat creation		As above	N/A	Negligible, significant	Not
Bats – habitat creation		As above	N/A	Negligible, significant	Not	

TOPIC	DESCRIPTION OF LIKELY IMPACT	MITIGATION	DESCRIPTION OF RESIDUAL EFFECT	SIGNIFICANCE – (Year 10 Landscape/Visual)
Heritage - Archaeology	Loss of archaeological remains.	N/A	Archaeological remains preserved by record.	Slight Adverse, Not significant
Landscape & Visual	Viewpoint 1a: Field Farm House; Adjacent residents;	Planting maturing	For residential receptors in longer term, the buffer and tree planting within and along boundaries of the Site will have matured to provide additional screening and filtering of views towards the Development.	Moderate Adverse, Significant
	Viewpoint 5: Langley Common Road; Adjacent residents;	Planting maturing	In long term establishment of structural planting along boundaries with Langley Common Road and internally within the Site would assist in softening and blending built form and its lighting into immediate context, however, a large proportion of receptors baseline view would be permanently lost and there would remain a noticeable change.	Moderate Adverse - Significant
Water/Flood Risk	Major accident disaster – flood risk due to breach of defences	N/A	N/A	Negligible, Not significant
	Surface water flood event in excess of drainage design capacity	SUDs	N/A	Minor Beneficial – Not significant
	Aquifers and ground water flows	SUDs	N/A	Negligible, Not significant
	Increased Water supply and demand	Water saving measures	N/A	Negligible, Not significant
	Increased Wastewater generation			Negligible, Not significant
Air Quality	NO ₂ , PM ₁₀ , PM _{2.5} in 2035	Travel Plan, EV's, Welcome Packs,	N/A	Negligible, Not significant
	NO ₂ , PM ₁₀ , in 2040	As above	N/A	Negligible, Not significant
	PM _{2.5} in 2040	As above	N/A	Negligible for some, Slight Adverse for some, Moderate Adverse for R46 – overall Not Significant
	NO ₂ , PM ₁₀ , PM _{2.5} NO _x 2040 on ecological receptors	As above	N/A	Negligible, Not significant
Climate Change	Increased frequency of heatwaves affecting site users, infrastructure & ecology/landscaping	Compliance with Part 0, use of cooling hierarchy; use of more resilient plants; improvements house building/infrastructure materials; risk management	N/A	Minor Adverse to Negligible, Not significant
	Low rainfall & drought affecting site users, infrastructure, ecology/landscaping	Water Resource Management Plans; compliance with Part G; sensitive planting regimes and use of drought-resilient planting; risk management	N/A	Negligible to Minor Adverse, Not significant
	Heavy rainfall & flooding affecting site users, infrastructure, ecology/landscaping	Use of Suds and attenuation basins	N/A	Minor Adverse, Not significant

TOPIC	DESCRIPTION OF LIKELY IMPACT	MITIGATION	DESCRIPTION OF RESIDUAL EFFECT	SIGNIFICANCE – (Year 10 Landscape/Visual)	
Noise & Vibration	Internal sound levels	Re-orientation of some buildings	Acceptable internal sound levels	Negligible, Not significant	Not
	External amenity sound levels	Shielded by buildings and orientation	Acceptable external sound levels	Negligible, Not significant	Not
	Operational plant noise	Mitigation may be required to ensure compliance with BS 4142	Reduced sound levels to all receivers	Negligible, Not significant	Not
	Operational traffic noise	N/A	N/A	Negligible, Not significant	Not
Cumulative	Urbanising effect on landscape character area LCT J2 in association with Lodden Garden Village	Associated Planting	Urbanising effect on landscape character area LCT J2 in association with Lodden Garden Village	Minor Adverse, Not significant	

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ABBREVIATIONS/GLOSSARY/REFERENCES

ABBREVIATIONS

AADT	Annual Average Daily Traffic
AAHT	Annual Average Hourly Traffic
ARCADY	Assessment of Roundabout Capacity And Delay
AoD	Above Ordnance Datum
AQMA	Air Quality Management Area
AQO	Air Quality Objectives
ANRG	Alternative Natural Recreation Greenspace
ATC	Automatic Traffic Counters
CEMP	Construction and Environmental Management Plan
CLP	Construction Logistics Plan
CTMP	Construction Traffic Management Plan
CIEEM	Chartered Institute for Ecology and Environmental Management
DAS	Design and Access Statement
DEFRA	Department for Environment, Food and Rural Affairs
DMP	Dust Management Plan
DMRB	Design Manual for Roads and Bridges
EA	Environment Agency
EC	European Commission
EIA	Environmental Impact Assessment
EMP	Ecology Mitigation Plan
ES	Environmental Statement
HGV	Heavy Goods Vehicle
HRA	Habitat Regulations Assessment
IEMA	Institute of Environmental Management and Assessment
IER	Important Ecological Receptor
IANL	Internal Ambient Noise Level
IRZ	Impact Risk Zone
ISEP	Institute of Sustainability and Environmental Professionals
LEMP	Landscape (and Ecological) Management Plan
LAQM	Local Air Quality Management
LCA	Landscape Character Area
LHA	Local Highway Authority
LVIA	Landscape and Visual Impact Assessment
MHCLG	Ministry of Housing, Communities & Local Government
NE	Natural England
NPPF	National Planning Policy Framework 2024
NTS	Non-Technical Summary
PC	Process Contribution
PEC	Predicted Environmental Concentration

PIA	Personal Injury Accident
PICADY	Priority Intersection Capacity and Delay
PPG	Planning Policy Guidance
PRoW	Public Right of Way
SAC	Special Area of Conservation
SANG	Suitable Alternative Natural Greenspace
SCI	Statement of Community Involvement
SPD	Supplementary Planning Document
SSSI	Site of Special Scientific Interest
SUDS	Sustainable Urban Drainage Systems
SWMP	Site Waste Management Plan
TA	Transport Assessment
TP	Travel Plan
TCPA	Town and Country Planning Act
TPO	Tree Preservation Order
Zol	Zone of Influence
ZTV	Zone of Theoretical Visibility
m	metres
km	kilometres

GLOSSARY

Addition of noise from several sources

Noise from different sound sources combine, on a logarithmic scale, to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than one alone and 3 identical sources produce a 5dB higher sound level.

Attenuation by distance

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g. stream of cars) drops off by 3dB for each doubling of distance.

dB(A)

The human ear is less sensitive to low (below 125Hz) and high (above 16kHz) frequency sounds. A sound level meter can be used to duplicate the ear's variable sensitivity to sound across a spectrum of frequencies. This is achieved by building a filter into the instrument with a similar frequency response to that of the average ear. This is called an "A-weighting filter". Measurements of sound made with this filter are called A-weighted sound level measurements and the unit is dB(A).

Designated Site

Site protected for its nature conservation value by either local policy or national legislation.

$L_{eq,T}$

The sound from noise sources often fluctuates widely during a given period of time. An average value can be measured, the equivalent sound pressure level L_{eq} . The L_{eq} is the equivalent sound level which would deliver the same sound energy as the actual fluctuating sound measured in the same time period (T).

L_{10,T}

This is the minimum level exceeded for not more than 10% of the time period (T). This parameter is often used as a “not to exceed” criterion for noise.

L_{90,T}

This is the minimum level exceeded for not more than 90% of the time period (T). This parameter is often used as a descriptor of “background noise” for environmental impact studies.

L_{fmax}

This is the maximum sound pressure level that has been measured over a period using a fast time constant.

Octave Bands

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 10 such octave bands whose centre frequencies are defined in accordance with international standards.

Protected Species

Species of plant or animal afforded legal protection by national/international legislation.

Subjective impression of noise

Sound intensity is not perceived directly at the ear; rather it is transferred by the complex hearing mechanism to the brain where acoustic sensations can be interpreted as loudness. This makes hearing perception highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a reasonable guide to help explain increases or decreases in sound levels for many acoustic scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud
20	About 4 times as loud

Barriers

Outdoor barriers can be used to reduce environmental noises, such as traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and its construction.

Reverberation control

When sound falls on the surfaces of a room, part of its energy is absorbed and part is reflected back into the room. The amount of reflected sound defines the reverberation of a room, a characteristic that is critical for spaces of different uses as it can affect the quality of audio signals such as speech or music. Excess reverberation in a room can be controlled by the effective use of sound-absorbing treatment on the surfaces, such as fibrous ceiling boards, curtains and carpets.

IANL

IANL or ‘Internal Ambient Noise Level’ refers to the recorded (or predicted) $L_{Aeq,T}$ within a dwelling, office, commercial unit or treatment space. IANL typically defines a design limit or range.

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