8. Air Quality and Dust

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8 Air Quality

8.1 Introduction

8.1.1 This chapter presents the assessment of air quality impacts and reports on the likely significance of effects during the construction and operational phases of the Proposed Scheme.

8.1.2 The chapter and supporting appendices have been written by WSP, following the Arun District Council (ADC) EIA scoping opinion of 21st November 2022.

8.1.3 The chapter provides a review of baseline conditions within the vicinity of the Site (including identifying any gaps in the baseline or further survey work required), identifies receptors sensitive to changes in air quality due to the construction and/or operation of the Scheme, evaluates the Scheme's likely impact on local air quality which may occur during the construction and/or operational phases, identifies the methodology to be applied to the EIA along with potential measures to reduce/mitigate any air quality effects.

8.2 Background

8.2.1 The Site

8.2.1.1 The Site is located within the administrative area of ADC where the air quality is deemed to be good and monitored pollutant concentrations are compliant with the air quality objectives as set out in current legislation (as discussed further in the Air Quality Policy Context section below). No Air Quality Management Areas (AQMA) have been declared within the district.

8.2.1.2 Air quality at the Site will be primarily influenced by emissions from road traffic using the A29 (Nyton Road), Westergate Street, B2233 (Barnham Road) and Church Lane.

8.2.2 The Scheme

8.2.2.1 The Scheme comprises a hybrid planning application with full consent being sought for the access off Westergate Street, east-west link road and bridge over the Lidsey Rife and outline consent for up to 400 residential dwellings. As such, the Scheme has the potential to generate impacts on local air quality during both the construction and operational phases. Notably through the generation of dust and particulate matter during the construction phase, which may result in nuisance and/or health effects at nearby sensitive receptors, and through an increase in airborne pollutants due to exhaust emissions from construction traffic and plant and from road traffic generated by the Scheme once it becomes operational, which may have an impact on air quality at nearby sensitive receptors.

8.2.3 Potential Cumulative Effects

8.2.3.1 The potential for cumulative effects with projects highlighted within the Scoping Opinion Response received from the ADC dated 21st November 2022 is assessed within a later section of this Chapter.

8.3 Air Quality Policy Context

8.3.1 A summary of the relevant air quality legislation and policy is provided below.

Air Quality Legislative Framework

8.3.2 Environmental Protection Act 1990 – Control of dust and particulates associated with Construction.

8.3.2.1 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 from industrial, trade or business premises or smoke, fumes or gases emitted from premises so as to be prejudicial to health or a nuisance"; and*
>
> *"Any accumulation or deposit which is prejudicial to health or a nuisance".*

8.3.2.2 Following this, Section 80 says that where a statutory nuisance is shown to exist, the local authority (in this case ADC) must serve an abatement notice. Failure to comply with an abatement notice is an offence and, if necessary, the local authority may abate the nuisance and recover expenses.

8.3.2.3 Statutory nuisance provisions are relevant to (amongst other things) the control of dust from demolition and construction. There are no statutory limit values for dust deposition above which 'nuisance' is deemed to exist. Nuisance is a subjective concept, and its perception is highly dependent upon the existing conditions and the change which has occurred. The party responsible for the premises giving rise to the emissions is responsible for ensuring use of Best Practicable Means to avoid a statutory nuisance.

8.3.3 Environment Act 1995

8.3.3.1 Part IV of the Environment Act 1995 required the Secretary of State to publish a national Air Quality Strategy and set up a system of Local Air Quality Management (LAQM) which set out a requirement for local authorities to periodically review and document local air quality within their area by way of staged appraisals with the aim of meeting the air quality objectives defined in the Regulations (as discussed below). Where the objectives are not likely to be achieved, an authority is required to designate an Air Quality Management Area (AQMA). For each AQMA the local authority is required to draw up an Air Quality Action Plan (AQAP) to secure improvements in air quality and show how it intends to work towards achieving compliance in the future.

8.3.4 Air Quality Regulations

8.3.4.1 The Air Quality (England) Regulations 2000 and the Air Quality (England) (Amendment) Regulations 2002 set objectives for ambient pollutant concentrations for the purposes of LAQM. The objectives for human health apply where there is relevant exposure, which can be defined as:

> *"... locations which are situated outside of buildings or other natural or man-made structures, above or below ground, and where members of the public are regularly present...".*

8.3.4.2 The Air Quality Standards Regulations 2010 and the Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020 set legally binding limit values for concentrations in outdoor air of major air pollutants that impact public health such as particulate matter (PM_{10} and $PM_{2.5}$) and nitrogen dioxide (NO_2). The limit values for NO_2 and PM_{10} are numerically the same concentration levels as the objectives.

8.3.5 Environment Act 2021

8.3.5.1 The Environment Act 2021[2], published in November 2021, provides a new framework for environmental protection in the UK. It aims to ensure environmental standards are maintained and improvements are achieved (particularly in relation to air quality, water, waste and resources) and bridge the gaps in legislation resulting from the UK's departure from the EU. The Environment Act 2021 does not replace the Environment Act 1995 but it does make amendments to strengthen environmental protections. In relation to air quality, it set a legally binding duty on the Secretary of State to bring forward at least two new air quality targets for $PM_{2.5}$ into secondary legislation.

8.3.5.2 Consequently, the following air quality targets were brought into law through the Environmental Targets (Fine Particulate Matter) (England) Regulations 2023 :

- An 'Annual Mean Concentration Target' of 10µg/m^3 to be met across England by 2040.
- A 'Population Exposure Reduction Target' to achieve a 35% reduction in population exposure by 2040, compared to a base year of 2018.

8.3.5.3 Under the Environment Act 2021 the Office for Environmental Protection was formed in order to perform the role of an objective and impartial environmental watchdog in the UK. Previously this role was held by the European Commission.

[2] Environmental Targets (Fine Particulate Matter) (England) Regulations 2023 – SI 2023 No.96

8.3.6 Environmental Improvement Plan 2023

8.3.6.1 Further to the new long-term targets for $PM_{2.5}$, the Government published their Environmental Improvement Plan 2023 which also sets out additional interim targets for $PM_{2.5}$, to be achieved by the end of January 2028. The interim targets are:

- The highest annual mean concentration in the most recent full calendar year must not exceed 12µg/m³ of $PM_{2.5}$.
- Compared to 2018, the reduction in population exposure to $PM_{2.5}$ in the most recent full calendar year must be 22% or greater.

8.3.6.2 For many parts of the UK, the primary pollutants of concern are those relating to road traffic emissions and, to a lesser extent, heating and commercial sources. The key pollutants of concern are therefore typically NO_2, PM_{10} and $PM_{2.5}$. The Air Quality Standards (AQS), in terms of objectives and limit values, that are relevant to this assessment are given in Table 8.1.

Table 8.1: Relevant air quality standards (AQS)

Site ID	Concentration (micrograms per cubic metre) (µg/m³)	Averaged as	Objective
Nitrogen dioxide (NO_2)	40	Annual mean	Not to be exceeded
	200	1-hour (hourly) mean	Not to be exceeded more than 18 times a year
Particulate matter less than 10 micrometres in diameter (PM_{10})	40	Annual mean	Not to be exceeded
	50	Daily mean	Not to be exceeded more than 35 times a year
Particulate matter less than 2.5 micrometres in diameter ($PM_{2.5}$)	20	Annual mean	Not to be exceeded
	12		2028 interim target
	10		2040 target

National Policy

8.3.7 Clean Air Strategy 2019

8.3.7.1 The Department for Environment, Food and Rural Affairs (Defra) published the Government's Clean Air Strategy in 2019 . This sets out measures, which aim to reduce emissions from all sources of air pollution, making air healthier to breathe, protecting nature and boosting the economy. The Strategy also proposes tough new goals to cut public exposure to airborne particulate matter, as per the recommendation made by the WHO.

8.3.7.2 Furthermore, the Strategy confirms that the Government will set new legislation to "create a stronger and a more coherent framework for action to tackle air pollution. This will be underpinned by new England-wide powers to control major sources of 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 mechanism." New enforcement powers will also be given at a national and local level, across all sectors of society.

8.3.8 UK Air Quality Strategy 2007

8.3.8.1 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 , . This predates that Air Quality Strategy and provides a framework for reducing air pollution in the UK with the aim of meeting the objectives and limit values prescribed in the Air Quality Regulations.

8.3.9 National Planning Policy Framework

8.3.9.1 The Government's overall planning policies for England are described in the National Planning Policy Framework (NPPF) . The core underpinning principle of the Framework is the presumption in favour of sustainable development, defined as: "... meeting the needs of the present without compromising the ability of future generations to meet their own needs".

8.3.9.2 One of the three overarching objectives of the NPPF is that planning should "to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy."

8.3.9.3 In relation to air quality, the following paragraphs from the document are considered relevant:

8.3.9.4 Paragraph 55, which states: "Local planning authorities should consider whether otherwise unacceptable development could be made acceptable through the use of conditions or planning obligations. Planning obligations should only be used where it is not possible to address unacceptable impacts through a planning condition.";

8.3.9.5 Paragraph 108, which relates to the need to consider transport related issues at the earliest stages of plan making and development proposals, so that: "...c) opportunities to promote walking, cycling and public transport use are identified and pursued; d) the environmental impacts of traffic and transport infrastructure can be identified, assessed and taken into account – including appropriate opportunities for avoiding and mitigating any adverse effects, and for net environmental gains...";

8.3.9.6 Paragraph 109, which states: "Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions, and improve air quality and public health.";

8.3.9.7 Paragraph 180, which states: "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.";

8.3.9.8 Paragraph 191, which states: "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.";

8.3.9.9 Paragraph 192, which states: '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.' And,

8.3.9.10 Paragraph 194, which states "The focus of planning policies and decisions should be on whether Scheme is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities."

Local Planning Policy

8.3.10 Arun Local Plan 2011-2031

8.3.10.1 The Arun Local Plan was adopted in July 2018 and sets out the spatial strategy for the district and the policies to achieve this strategy between 2011 and 2031.

8.3.10.2 In relation to air quality, the following policies are considered relevant:

8.3.10.3 Policy QE SP1: "The Council requires that all development contributes positively to the quality of the environmental and will ensure that development does not have a significantly negative impact upon residential amenity, the natural environment or upon leisure and recreational activities enjoyed by residents and visitors to the District...."

8.3.10.4 Policy QE DM3 – Air Pollution: "All major development proposals will be required to assess the likely impacts of the development on air quality and mitigate any negative impacts by:

a) Ensuring the development is located within easy reach of established public transport services;
b) Maximising provision for cycling and pedestrian facilities;
c) Encouraging the use of cleaner transport fuels on site, through the inclusion of electric car charging points; and
d) Contributing towards the improvement of the highway network where the development is predicted to result in increased congestion on the highway network.

8.3.10.5 Development proposed nearby any Air Quality Management Area (AQMA) declared within the District within the Plan period, will require an air quality assessment to identify likely impacts of development upon the designated area. Developers will be required to ensure delivery of the actions set out within any Air Quality Action Plan. [...] Developments shall also be consistent with all other Local Plan policies".

Guidance

8.3.11 A summary of the guidance referred to in the undertaking of this assessment is provided below:

8.3.12 National Planning Practice Guidance – Air Quality

8.3.12.1 This guidance provides a number of guiding principles on how the planning process can take into account the impact of new development on air quality, and explains how much detail air quality assessments need to include for Schemes, and how impacts on air quality can be mitigated. It also provides information on how air quality is taken into account by local authorities in both the wider planning context of Local Plans and neighbourhood planning, and in individual cases where air quality is a consideration in a planning decision.

8.3.13 Local Air Quality Management Review and Assessment Technical Guidance

8.3.13.1 Defra has published technical guidance for use by local authorities in their review and assessment work . This guidance, referred to in this document as LAQM.TG(22), has been used where appropriate in the assessment presented herein.

8.3.14 Land-use Planning & Development Control: Planning for Air Quality

8.3.14.1 Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) have published guidance that offers comprehensive advice on when an air quality assessment may be required; what should be included in an assessment; how to determine the significance of any air quality impacts associated with a development; and the possible mitigation measures that may be implemented to minimise these impacts.

8.3.15 Guidance on the Assessment of Dust from Demolition and Construction

8.3.15.1 This document, referred to in this report as the IAQM Construction Dust Guidance, was published by the IAQM to provide guidance to developers, consultants, and environmental health officers on how to assess the impacts arising from construction activities. The emphasis of the methodology is on classifying sites according to the risk of impacts (in terms of dust nuisance, PM_{10} impacts on public exposure and impact upon sensitive ecological receptors) and to identify mitigation measures appropriate to the level of risk identified.

8.3.16 Air Quality and Emissions Mitigation Guidance for Sussex

8.3.16.1 ADC has in conjunction with the members of the Sussex-air partnership produced the emissions mitigation guidance for Sussex. The guidance deals with the pollutants from transport which are regulated under the local air quality management regime and sets out specific measures which the Sussex-air partnership seek to address the impacts of air quality.

8.3.17 West Sussex County Council Guidance on Parking at New Developments

8.3.17.1 ADC adheres to the West Sussex County Council Guidance on Parking on New Developments, which lays out the requirements rules to be adhered to with respect to parking for new developments.

8.4 Air Quality Assessment Methodology

8.4.1 Consultation

8.4.1.1 Table 8.2 summarises the consultation undertaken in preparing this assessment

Table 8.2: Summary of Consultation

Body / organisation	Individual / Statutory Body / organisation	Date and form of consultation	Summary of outcome of discussions
ADC	Joanne Lewis Senior Environmental Health Officer (EHO)	WSP made a request for consultation via email on the 10th July 2023.	The EHO agreed with the proposed approach to be taken for the assessment. The EHO requested that the assessment ensure takes into account the new targets for **$PM_{2.5}$**. Further to this, consideration be given to any network changes and cumulative effects at existing and proposed receptors associated with the scheme.

8.4.2 Scope

8.4.2.1 The scope of the air quality assessment has been established through the EIA scoping process and consultation with the EHO for ADC.

8.4.2.2 Table 8.3 provides confirmation of the effects that have been scoped into the assessment and additional evidence for any effects scoped out of the assessment since submission of the EIA Scoping Report.

Table 8.3: Assessment of Scope

Study Effect	Scoped in or out?	Justification
Construction Phase		
Effect of dust and PM_{10} releases generated by on-site construction activities on nearby sensitive human receptors.	In	There are sensitive human receptors within 250m of construction activities and within 50m of the routes that will be used by construction vehicles on the public highway, up to 250m from the Site entrance. The dust risk beyond 200m of construction activities will be negligible and any effects will not be significant beyond this distance.
Increases in ambient pollutant concentrations due to exhaust emissions from site plant (including Non-Road Mobile Machinery (NRMM)) (affecting local air quality at existing sensitive receptors).	In	As operation of NRMM will be limited to working hours and then only when and where required within the Site, the exhaust emissions are unlikely to have a substantial impact on pollutant concentrations at receptors. In line with paragraph 7.30 of LAQM.TG(22), a quantitative assessment is not necessary but a qualitative assessment has been undertaken only for completeness.
Increases in ambient pollutant concentrations due to exhaust emissions from construction vehicles accessing and leaving the site (affecting local air	Out	Expected construction traffic flows have been compared to the assessment screening criteria set out in the EPUK/IAQM Land-Use Planning Guidance[Error! Bookmark not defined.]. As construction traffic flows are low and do not exceed the relevant screening criteria (i.e. a change in Annual Average Daily Traffic (AADT) flows of 500 Light Duty Vehicles (LDVs) and/or 100 Heavy Duty Vehicles (HDVs)) on any given route, it can be concluded that construction

Likely Effect	Scoped in or out?	Justification
quality at existing sensitive receptors).		traffic is unlikely to have a significant effect on local air quality and has been scoped out of the assessment.
Operational Phase		
Increases in ambient pollutant concentrations due to exhaust emissions from road traffic generated during the operational phase (affecting local air quality at existing sensitive receptors).	In	A screening exercise was undertaken using criteria given in Table 6.2 of the EPUK/IAQM Land-Use Planning Guidance and the vehicle trip generation for the operational phase of the Scheme. The expected changes in traffic flows during the operational phase exceed the EPUK/IAQM scoping criteria. Assessment of impacts on local air quality due to changes in operational traffic and the effect on nearby sensitive human receptors has therefore been scoped in. In terms of ecological receptors, paragraph 1.3.1 in guidance published by IAQM defines the type of designated habitats that require consideration and when, which depends on whether or not they include features that are sensitive to an increase in pollutants and whether they lie within 200m of an 'affected road' as determined by specific changes to the traffic flow and composition on a road due to a proposal. There are no international/national/local designated sites located within 200m of an "affected road". Therefore, ecological receptors are not considered any further.
Effect of exhaust emissions from existing and proposed road traffic on the local road network on local air quality at future receptors within the Scheme.	In	The Scheme will introduce new sensitive receptors in the area. The potential exposure of future occupants of the Scheme to poor air quality was therefore reviewed. Consideration was given to locations where members of public might reasonably be expected to spend one hour or more close to traffic, according to the LAQM.TG(22). The relevant AQS of concern would therefore both long-term and short-term objectives NO_2 AQS.
Emissions of Nox from combustion plant on local air quality.	Out	Details of onsite energy requirements were not available at the time of writing.

8.4.3 Method of Baseline Data Collation

8.4.3.1 A desk study was undertaken to establish the baseline air quality conditions in and around the Site. This included:

- Review of ADC's latest review and assessment reports;
- Review of air quality data for the area surrounding the Site, including data from ADC, Defra , the Environment Agency's Public Register for Permitted Installations as well as the local authority's register of Part A2 and Part B processes .
- Desk study to confirm the locations of nearby existing receptors that may be sensitive to changes in local air quality.
- Review of the traffic data provided by the Project Transport Consultants.

- Review of the design information and parameter plans for the Scheme.

8.4.4 Extent of Study Area

8.4.4.1 The air quality assessment considers the impacts on local air quality at the Site and in the surrounding area. For the construction dust assessment, the study area extends to 200m of the Site boundary and includes all receptors within this distance.

8.4.4.2 The study area for the operational phase assessment has been defined by the extent of the traffic modelling and consideration of those roads likely to have the greatest influence on air quality near to the Site and those roads expected to experience a significant change in traffic volume and composition due to the Scheme becoming operational (i.e. those roads most likely to exceed the screening criteria provided in the joint EPUK and IAQM guidance). The assessment therefore considers the effects of the Scheme on air quality at existing sensitive receptors (as defined later in this chapter) located near to the modelled road network. In addition, sensitive receptors have been located within the Site itself where there will be new exposure.

Construction Phase

8.4.5 Construction Dust Assessment

8.4.5.1 A qualitative assessment of the likely significant impacts on local air quality due to the generation and dispersion of dust and PM_{10} during the construction phase has been undertaken using: the relevant assessment methodology published by the IAQM; the available information for this phase of the Scheme provided by the Client and Project Team; and professional judgement.

8.4.5.2 Dust comprises particles typically in the size range 1-75 micrometres (µm) in aerodynamic diameter and is created through the action of crushing and abrasive forces on materials. The larger dust particles fall out of the atmosphere quickly after initial release and therefore tend to be deposited in proximity to the source of emission. Dust is therefore unlikely to cause long-term or widespread changes to local air quality; however, its deposition on property, ecological habitats, and cars can cause 'soiling' and discolouration. This may result in complaints of nuisance through amenity loss or perceived damage caused, which is usually temporary.

8.4.5.3 The smaller particles of dust (less than 10µm In aerodynamic diameter) are known as PM_{10} and represent only a small proportion of total dust released; this includes a finer fraction, known as $PM_{2.5}$ (with an aerodynamic diameter less than 2.5µm). As these particles are at the smaller end of the size range of dust particles, they can remain suspended in the atmosphere for longer periods of time than the larger dust particles and can therefore be transported by wind over a wider area. PM_{10} (and $PM_{2.5}$) are small enough to be drawn into the lungs during breathing, which for sensitive members of the public could have a potential impact on health.

8.4.5.4 The IAQM Construction Dust Guidance methodology assesses the risk of potential dust and PM_{10} impacts from the following four sources: demolition; earthworks; general construction activities and trackout. It takes into account the nature and scale of the activities undertaken for each source and the sensitivity of the area to an

increase in dust and PM_{10} levels to assign a level of risk. Risks are described in terms of there being a low, medium or high risk of dust impacts. Once the level of risk has been ascertained, then site specific mitigation proportionate to the level of risk is identified, and the significance of residual effects determined. A summary of the IAQM Construction Dust Guidance assessment methodology is provided in Appendix 8.1.

8.4.6 Emissions from Construction Plant / NRMM

8.4.6.1 In addition to impacts on local air quality due to on-site construction activities, exhaust emissions from construction plant / NRMM may have an impact on local air quality in the vicinity of the Site itself. As information on the number of site plant / NRMM associated with the construction phase was not available at the time of writing, a qualitative assessment of their impact on local air quality has been undertaken using professional judgement and by considering the following:

- The number and type of construction site plant / NRMM likely to be generated by this phase of the Scheme;
- The number and proximity of sensitive receptors to the Site; and
- The likely duration of the construction phase and the nature of the construction activities undertaken.

Operational Phase

8.4.7 Road Traffic Emissions (Dispersion Modelling)

8.4.7.1 For the prediction of impacts due to emissions arising from road traffic during the operation of the Scheme, the dispersion model ADMS Roads (version 5.0.1.0) has been used. This model uses detailed information regarding traffic flows on the local road network, surface roughness, and local meteorological conditions to predict pollutant concentrations at specific receptor locations, as determined by the user.

8.4.7.2 The pollutants considered in the assessment of operational effects include NO_2, PM_{10}, and $PM_{2.5}$), as road traffic is a major source of these pollutants and their concentrations tend to be close to, or in exceedance of, the objectives in urban locations such as the Scheme.

8.4.7.3 For the assessment, three scenarios were modelled, as follows:

- 2019 – Model Verification and Assessment Baseline;
- 2038 – Without Development; and
- 2038 – With Development.

8.4.7.4 2019 is the most recent year for which monitoring data and meteorological data are both available to enable verification of the model results, and so this year has been used as the baseline year for this assessment. 2038 is the anticipated opening year of the Scheme.

8.4.8 Traffic Data and Vehicle Emissions Factors

8.4.8.1 A summary of the traffic data used in the assessment (provided by WSP traffic consultants) can be found in Appendix 8.2. It includes details of the Annual Average Daily Traffic (AADT) flows, vehicle speeds (kph) and the percentage of HDVs for the local road network in all assessment years considered. To ensure a conservative assessment, traffic speeds were reduced at junctions in line with guidance provided in LAQM.TG(22), and using professional judgement.

8.4.8.2 The traffic flows for the 'without development' scenario includes flows for committed developments in the locality of the Scheme but do not include any contribution to road traffic from the Scheme itself. The traffic flows for the 'with development' scenario include contributions to road traffic from the Scheme itself and the nearby committed developments.

8.4.8.3 Vehicle emission factors for use in the assessment have been obtained using the latest Emissions Factors Toolkit (EFT) (version 11, published in November 2021) available on the Defra website . The EFT allows for the calculation of emission factors arising from road traffic for all years between 2018 and 2050. For the predictions of future year emissions, the toolkit takes into account factors such as anticipated advances in vehicle technology and changes in vehicle fleet composition, such that vehicle emissions are assumed to reduce over time. However, the outputs for 2031-2050 are limited to England (excluding London) only and are provided in support of climate assessments and appraisals only. As such, the 2019 emissions factors have been adopted for the baseline / verification year and using 2030 as a conservative year for the 2038 scenarios.

8.4.9 Meteorological Data

8.4.9.1 Meteorological data, such as wind speed and direction, is used by the model to determine pollutant transportation and levels of dilution by the wind. Meteorological data used in the model was obtained from the Met Office observing station at Shoreham Island for 2019. This station is located approximately 26km south-east of the Site and is considered to provide representative data for the assessment.

8.4.10 Selection of Background Concentrations

8.4.10.1 Background NO_2, PM_{10} and $PM_{2.5}$ concentrations used in the assessment have been taken from the national maps provided on the Defra website, where background concentrations of those pollutants included within the AQS have been mapped at a grid resolution of 1x1km for the whole of the UK . Estimated concentrations are available for all years between 2018 and 2030. As noted for the EFT above, the maps assume that background concentrations will improve (i.e. reduce) over time, in line with the predicted reduction in vehicle emissions and emissions from other sources. Again, 2019 values have been adopted for the baseline assessment and 2030 for the future year scenarios.

8.4.10.2 It should be noted that for PM_{10} and $PM_{2.5}$, the background maps present both the 'total' estimated background concentrations and the individual contributions from a range of emission sources (for example, motorways, aircraft, domestic heating etc.). When detailed modelling of an individual sector is required as part of an air

quality assessment, the respective contribution can be subtracted from the overall background estimate to avoid the potential for 'double-counting'. However, as the available transport data did not cover all roads within each sector, removal of specific sectors has not taken place.

8.4.10.3 Further details on the background concentrations are provided in Section Four of this report.

8.4.11 Model Verification and Processing of Results

8.4.11.1 The ADMS Roads dispersion model has been widely validated for this type of assessment and is considered to be fit for purpose.

8.4.11.2 Model validation undertaken by the software developer will not have included validation in the vicinity of the Scheme. To determine the performance of the model at a local level, a comparison of modelled results with the results of monitoring carried out within the study area was undertaken. This process of verification aims to minimise modelling uncertainty and systematic error by correcting modelled results by an adjustment factor to gain greater confidence in the final results, and was carried out following the methodology specified in Chapter 7, Section 4, of LAQM.TG(22).

8.4.11.3 Details of the verification factor calculations are presented in Appendix 8.3. A factor of 2.58 was obtained for NO_2 during the verification process. This factor was applied to the model road-nOx outputs prior to conversion to annual mean NO_2 concentrations utilising the NOx to NO_2 calculator (version 8.1, released August 2020) and relevant NO_2 background concentrations provided by Defra.

8.4.11.4 Hourly mean NO_2 concentrations have not been calculated. LAQM.TG(22) advises that exceedances of the 1 hour mean NO_2 objective are unlikely to occur where annual mean concentrations are below 60µg/m³ (and it provides guidance on the approach that should be taken if either measured or predicted annual mean NO_2 concentrations are 60µg/m³ or above). Use of this criterion has been adopted within the assessment.

8.4.11.5 As local roadside monitoring data are not available for PM_{10} or $PM_{2.5}$, the modelled road-PM_{10} and road-$PM_{2.5}$ components have also been adjusted using the verification factor obtained for NOx before addition of the appropriate background concentration. The number of days with PM_{10} concentrations greater than 50µg/m³ was then estimated using the relationship with the annual mean concentration described in LAQM.TG(22).

8.4.11.6 Once processed, the predicted concentrations were compared against the relevant objective levels for NO_2, PM_{10} and $PM_{2.5}$ set out in Table 8.1.

8.4.12 Selection of Sensitive Receptors

8.4.12.1 Sensitive locations are places where the public or sensitive ecological habitats may be exposed to pollutants resulting from activities associated with the Scheme. These will include locations sensitive to an increase in dust deposition and PM_{10} exposure as a result of on-site construction activities, and locations sensitive to

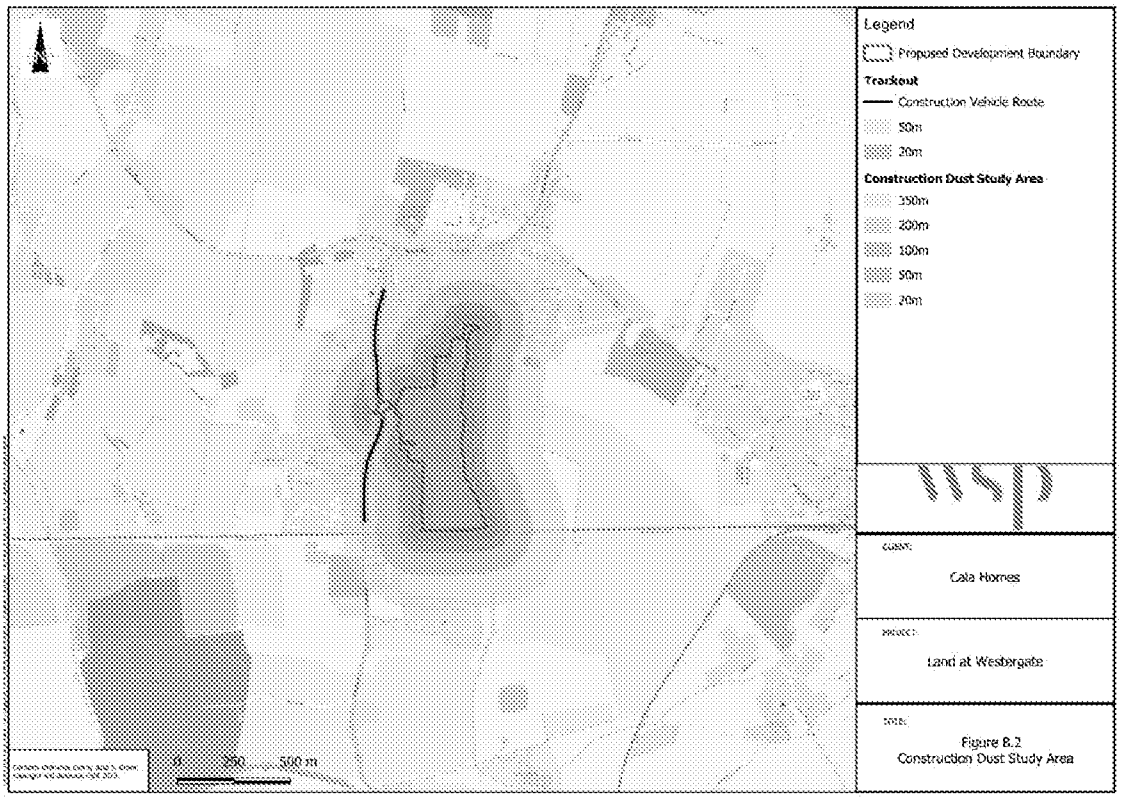
exposure to airborne pollutants emitted from the exhausts of site plant / NRMM and operational phase road traffic.

8.4.13 Construction Phase

8.4.13.1 The IAQM construction dust assessment is undertaken where there are: 'human receptors' within 250m of the site boundary, or within 50m of the route(s) used by construction vehicles on the public highway, up to 250m from the site entrance(s); and/or 'ecological receptors' within 50m of the site boundary, or within 50m of the route(s) used by construction vehicles on the public highway, up to 250m from the site entrance(s). It is within these distances that the impacts of dust soiling and increased particulate matter in the ambient air will have the greatest impact on local air quality at sensitive receptors.

8.4.13.2 Figure 8.1 illustrates the extent of the study area for consideration of construction phase impacts. Human receptors are present within the defined distances and have been considered within the assessment. However, there are no ecological sites within the defined distances; therefore, ecological receptors have been screened out of the assessment.

Figure 8.1 Construction Dust Study Area



8.4.14 Operational Phase

8.4.14.1 In terms of locations that are sensitive to pollutants emitted from engine exhausts, these will include places where members of the public are likely to be regularly present over the period of time prescribed in the AQS.

For instance, on a footpath where exposure will be transient (for the duration of passage along that path) comparison with a short-term standard (i.e. 15 minute mean or 1 hour mean) may be relevant. At a school or adjacent to a private dwelling, where exposure may be for longer periods, comparison with a long-term standard (such as 24 hour mean or annual mean) may be more appropriate. Box 1.1 of LAQM.TG(22) provides examples of the locations where the air quality objectives should/should not apply.

8.4.14.2 To complete the assessment of operational phase impacts, a number of 'receptors' representative of locations of relevant public exposure were identified at which pollution concentrations were predicted. Receptors have been located adjacent to the roads that are likely to experience the greatest change in traffic flows or composition, and therefore NO_2 and particulate matter concentrations, as a result of the Scheme.

8.4.14.3 To complete the exposure assessment, pollution concentrations were also predicted at a number of locations within the Site. The receptors have been positioned at the façade of proposed properties; relevant exposure is considered likely to occur. The locations of the assessment receptors are shown on Figure 8.2 and listed in Table 8.4 below.

Figure 8.2: Operational Phase Traffic Model and Receptors

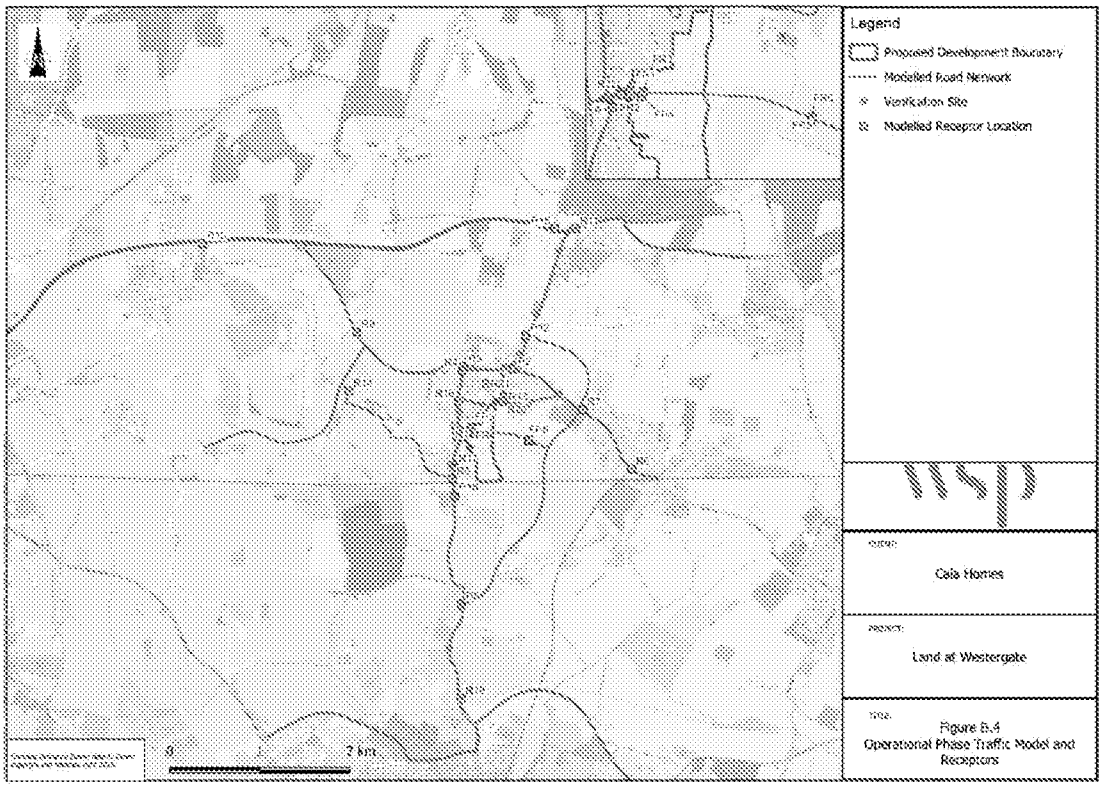


Table 8.4: Receptor Locations Used in the Operational Phase Assessment

Receptor	Description/ Address	Grid Reference		Height above Ground Level (m)
		X	Y	
Existing Receptors				
R1	Residential property at Westergate Street	493881.5	104829.4	1.5
R2	Residential property at Barnham Road	494463.59	105583.9	1.5
R3	Residential property at Nyton Road	493911.81	105611.2	1.5
R4	Residential property at Westergate Street	493890.59	105567.7	1.5
R5	Residential property at Westergate Street	493784	104363.5	1.5
R6	Residential property at Barnham Road	495774.5	104471.7	4.5
R7	Residential property at Barnham Road	495233.41	105133.1	1.5
R8	Residential property at Westergate Street	493883.91	102974.2	1.5
R9	Residential property at Nyton Road	492721.19	105996.4	1.5
R10	Residential property at Arundel Road	491009.19	106981.6	1.5
R11	Travelodge Hotel at Fontwell Avenue	495152.81	107145.1	4.5
R12	Residential property at Fontwell Avenue	494599.09	105956.1	1.5
R13	Residential property at Church Lane	494356.41	105276.5	1.5
R14	Residential property at Hook Lane	492634.19	105341.8	1.5
R15	Residential property at Arundel Road	494916.5	107145.9	1.5
R16	Residential property at Westergate Street	493850.69	105226.6	1.5
R17	Residential property at Westergate Street	493785.19	104517.5	1.5
R18	Residential property at Westergate Street	493812	104171.3	1.5
R19	Residential property at Shripney Road	493878.09	101924.3	1.5
R20	Eastergate Church of England Primary School	494344.31	105222.3	1.5
R21	Ormiston Six Villages Academy	494157.5	105420.9	1.5
R22	Residential property at Access Road	493912.59	104886.8	1.5
R23	Residential property at Access Road	493912.31	104876	1.5
Proposed Receptors				
FR1	Future Receptor 1	493949	104890.3	1.5

FR2	Future Receptor 2	493949.5	104870.8	1.5
FR3	Future Receptor 3	493996.41	104888.9	1.5
FR4	Future Receptor 4	493989.81	104869.3	1.5
FR5	Future Receptor 5	494624.59	104781.3	1.5
FR6	Future Receptor 6	494628.81	104795.2	1.5

Significance Criteria

8.4.15 Construction Phase

8.4.15.1 The IAQM Construction Dust assessment methodology recommends that significance criteria are only assigned to the identified risk of dust impacts occurring from a construction activity with appropriate mitigation measures in place. For almost all construction activities, the application of effective mitigation should prevent any significant effects occurring to sensitive receptors and therefore the residual effect will normally be negligible.

8.4.15.2 For the assessment of the impact of exhaust emissions from site plant / NRMM used on-site the significance of residual effects have been determined using professional judgement and the principles outlined in the EPUK/IAQM guidance including:

- The existing and future air quality in the absence of the development;
- The extent of current and future population exposure to the impacts; and
- The influence and validity of any assumptions adopted when undertaking the prediction of impacts.

8.4.16 Operational Phase

8.4.16.1 The approach provided in the EPUK/IAQM guidance has been used within this assessment to assist in describing the air quality effects of additional emissions from traffic generated by the Scheme once operational.

8.4.16.2 This guidance recommends that the degree of an impact is described by expressing the magnitude of incremental change in pollution concentration as a proportion of the relevant assessment level and examining this change in the context of the new total concentration and its relationship with the assessment criterion, as summarised in Table 8.5.

Table 8.5: Impact Descriptors for Individual Human Health Receptors

Long Term Average Concentration at Receptor in Assessment Year	% Change in Concentration Relative to Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

Notes

AQAL = Air Quality Assessment Level, which for this assessment related to the UK Air Quality Strategy objectives.

Where the %change in concentrations is <0.5% of the AQAL, the change is described as 'Negligible' regardless of the total concentration.

When defining the total concentration as a percentage of the AQAL, the 'without Development' concentration should be used where there is a decrease in pollutant concentration and the 'with Development' concentration where there is an increase.

Where concentrations increase, the impact is described as 'adverse', and where it decreases as 'beneficial'.

8.4.16.3 The EPUK/IAQM guidance notes that the criteria in Table 8.5 should be used to describe impacts at individual receptors and should be considered as a starting point to make a judgement on the significance of effects, as other influences may need to be accounted for. The EPUK/IAQM guidance states that the assessment of overall significance should be based on professional judgement, taking into account several factors, including:

- The existing and future air quality in the absence of the development;
- The extent of current and future population exposure to the impacts; and
- The influence and validity of any assumptions adopted when undertaking the prediction of impacts.

8.4.16.4 The EPUK/IAQM guidance states that for most road transport related emissions, long-term average concentrations are the most useful for evaluating the impacts. The guidance does not include criteria for determining the significance of the effect on hourly mean NO_2 concentrations or daily mean PM_{10} concentrations. The significance of effects of hourly mean NO_2 and daily mean PM_{10} concentrations arising from the operational phase have therefore been determined qualitatively using professional judgement and the principles described above.

8.4.16.5 The EPUK/IAQM guidance says that 'Where the air quality is such that an air quality objective at the building facade is not met, the effect on residents or occupants will be judged as significant, unless provision is made to reduce their exposure by some means. For people working at new developments in this situation, the same

will not be true as occupational exposure standards are different, although any assessment may wish to draw attention to the undesirability of the exposure.'

8.4.17 Limitations and Assumptions

8.4.17.1 Assumptions have been made with respect to the dust risk assessment and the number of vehicles which will be passing over paved and/or unpaved roads during the construction phase of the Scheme, in other areas of the dust risk assessment where information was not available, professional judgement was used in the completion of the dust risk assessment.

8.4.17.2 In relation to the operational phase assessment, there are uncertainties associated with both measured and predicted concentrations. The model used in this assessment (ADMS Roads) relies on input data (including predicted traffic flows), which also have uncertainties associated with them. The model itself simplifies complex physical systems into a range of algorithms. In addition, local micro-climatic conditions may affect the concentrations of pollutants that the ADMS Roads model will not take into account.

8.4.17.3 Traffic data for use in the assessment was provided by WSP traffic consultants. In the calculation of traffic flows the transport consultants will have made assumptions regarding trip generation, traffic distribution, and growth rates for the local area etc.

8.4.17.4 In order to reduce the uncertainty associated with predicted concentrations, model verification has been carried out following guidance set out in LAQM.TG(22). As the model has been verified against local monitoring data and adjusted accordingly, there can be reasonable confidence in the predicted concentrations.

8.4.17.5 Professional judgement has been used for aspects of the construction dust assessment where information could not be obtained and/or provided.

8.5 Baseline

8.5.1 ADC's Review and Assessment of Air Quality

8.5.1.1 In their latest ASR , ADC concludes that generally air quality levels are good within the District, with the air quality objectives for NO_2 being met (as per Table 8.1). As such, there are currently no AQMAs within ADC's administrative boundary , .

8.5.2 Local Emission Sources

8.5.2.1 The Scheme is located in a semi-urban area where air quality is mainly influenced by emissions from vehicles using the local road network, in particular from road traffic using the A29 (Nyton Road), Westergate Lane, B2233 (Barnham Road) and Church Lane. There are also likely to be emissions from agricultural sources.

8.5.2.2 According to the Environment Agency's public register xvii for permitted installations there is one Part A1 (i.e., large scale) installation within 2km of the Site. This is the Lidsey Landfill Site (permit number EPR/CP3735SM) located approximately 0.9km south-west of the Scheme. The landfill has the capacity to dispose of and store more than 10 tonnes of waste per day excluding inert waste. Due to the distance from the Scheme and the activities undertaken at the installation, it is not expected to have an influence on the local air quality conditions of the Scheme.

8.5.2.3 According to ADC's public register there are two smaller permitted process (i.e., Part A2 and B) (a waste management facility and petrol station) located within 2km of the Schemexviii. The closest of these installations is the petrol station which is located approximately 400m to the north of the Site, along Nyton Road. It is anticipated that it will have a negligible impact on air quality at the Scheme, given its distance from this Site and the mitigation measures that will be employed, as will be recorded in their environmental permit which is regulated by the Local Authority.

8.5.3 Local Authority Air Quality Monitoring Data

8.5.3.1 ADC do not undertake any automatic monitoring within their administrative area. As such, no monitoring data is available for PM_{10} or $PM_{2.5}$. However, ADC does undertake NO_2 monitoring using passive diffusion tubes at 22 monitoring locations, three of which are located within 2km of the Scheme. Recent results from these three monitoring sites are provided in Table 8.6 and their locations illustrated in Table 8.3.

Figure 8.3: Baseline Air Quality and Constraints

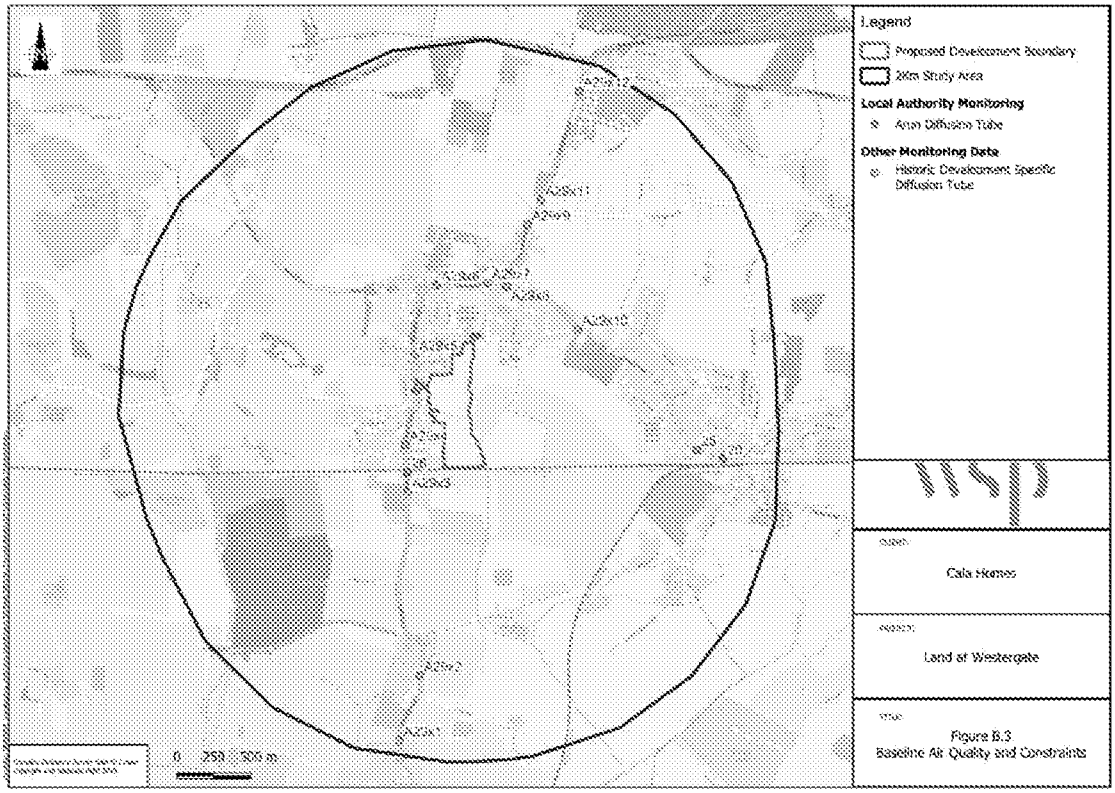


Table 8.6: Annual mean NO_2 concentrations ($\mu g/m^3$) recorded at sites within 2km of the Site

Site ID	Location	Site Type	X, Y	Distance to Application Site (km)	Monitored NO_2 concentration ($\mu g/m^3$)				
					2017	2018	2019	2020*	2021*
20	20 Barnham Road, Barnham	DT - Roadside	495950, 104396	1.6	20.7	20.0	18.5	12.9	13.9
25	Barnham Road, Barnham	DT - Roadside	495772, 104458	1.4	-	-	-	14.8	14.8
26	A29, Lidsey Road	DT - Roadside	493801, 104307	0.25	-	-	-	14.9	15.0

- indicates that the monitoring site was closed.

*2020 and 2021 monitoring data is not considered to be representative of normal conditions nor when making comparisons of long-term trends due to national lockdown restrictions attributed to the outbreak of the COVID-19 pandemic.

Data was obtained from the ADC 2022 Air Quality ASR.

8.5.3.2 The results in Table 8.6 show that the annual mean objective of 40µg/m³ was met at all monitoring sites and in all years. The data also suggests that in the five-year period between 2017 and 2021 inclusive there was also a general decrease in annual mean NO_2 concentrations at Site 20 (although as noted above, the results for 2020 and 2021 should be treated with some caution as they may not be representative of typical conditions).

8.5.3.3 For all sites, the monitored annual mean NO_2 concentrations are below 60µg/m³; therefore, in line with LAQM.TG(22) guidance, it can be assumed that the hourly mean objective for NO_2 was also met.

8.5.4 Other Local Monitoring Data

8.5.4.1 A five-month air quality monitoring survey was carried out as part of planning application for the A29 Realignment Scheme submitted in 2019 (planning reference: WSCC/052/20). Roadside NO_2 monitoring was carried out at 12 locations between October 2019 and February 2020. The data are reproduced in Table 8.7 and the locations shown in Figure 8.3. Further to this, the data has been annualised to provide an estimate of the 2019 annual mean concentrations by the A29 Realignment Scheme project team.

8.5.4.2 All 2019 annualised concentrations were well below the NO_2 objective of 40µg/m³. The highest concentration was recorded at A29-11 (located at Northfields farm/Fontwell Avenue, Chichester, approximately 1km from the Site) with a concentration of 32.7 µg/m³.

Table 8.7: Other Local Monitoring Data NO_2 concentrations (µg/m³).

Site ID	Location	X, Y	Distance to Application Site (km)	Annual Mean 2018 Annualised NO_2 concentration (µg/m³)
A29 - 1	The Robin Hood, Bognor Regis	493742, 102481	1.88	22.3
A29 - 2	Caravan Park, Bognor Regis	493881, 102937	1.40	16.8
A29 – 3	7 Lidsey Rd, Woodgate, Chichester	493811, 104173	0.30	25.4
A29 - 4	20 Orchard Gardens, Woodgate, Chichester	493784, 104491	0.26	32.5
A29 - 5	Westergate St, Westergate, Chichester	493858, 105105	0.17	25.7
A29 - 6	12 Westergate Mews, Nyton Rd, Westergate	494013, 105595	0.40	32.0
A29 - 7	Nyton Rd, Eastergate, Chichester	494363, 105607	0.37	31.6
A29 - 8	War Memorial, Eastergate, Chichester	494509, 105583	0.40	25.0
A29 - 9	1 Fontwell Ave, Eastergate, Chichester	494528, 105741	0.56	27.9
A29 - 10	Church Lane, Eastergate, Chichester	494970, 105306	0.68	13.5
A29 - 11	Northfields Farm/Fontwell Av, Chichester	494713, 106190	1.0	32.7
A29 - 12	Fontwell Roundabout, Fontwell, Arundel	494965, 106897	1.88	23.4

8.5.5 Defra's Pollution Climate Mapping Model

8.5.5.1 Defra's Pollutant Climate Mapping (PCM) model provides estimates of roadside and background pollutant concentrations for years between 2018 and 2030 inclusive. Approximately 151,000 road links in 381 local

authorities are included in the PCM model, of which two links are within the administrative areas of ADC. There are no PCM modelled road links within 2km of the Scheme.

8.5.5.2 Background concentrations of NO_2, PM_{10} and $PM_{2.5}$ used within the assessment (as obtained from Defra's website) are summarised in Table 8.8.

Table 8.8: Background Pollutant Concentrations (µg/m³)

Coordinates (centroid) based on OS grid square (x,y)	Annual mean concentration (µg/m³) rounded to 1 dp					
	2018			2038*		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
494500, 104500	8.6	14.5	9.1	6.7	13.5	8.4
494500, 105500	9.6	13.9	9.2	7.4	12.9	8.5
493500, 104500	9.3	14.2	9.3	7.1	13.3	8.5
*2030 background concentration data has been used as opening year indicative concentrations, due to 2038 anticipated background concentrations not being available at the time of writing.						

8.5.5.3 The data in the table above indicates that estimated background concentrations for the study area are well below the relevant AQS for NO_2 and PM_{10} (40µg/m³ for both pollutants), both for the base and the opening years. Estimated background concentrations of $PM_{2.5}$ are also below the current and future limit values.

8.5.6 Modelled Baseline – 2019

8.5.6.1 The results of the dispersion modelling are provided in Appendix 8.4. These results show that in the 2019 modelled baseline scenario, annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$were compliant with the respective air quality objectives at all assessment receptors. The maximum annual mean NO_2 concentration of 36.8µg/m³ was modelled at receptor R15 (a residential dwelling north of Arundel Road). Furthermore, as the annual mean NO_2 concentrations were all below 60µg/m³, it is unlikely that hourly mean NO_2 concentrations would exceed the hourly mean objective.

8.5.6.2 The above-mentioned modelled baseline concentrations are in line with the air quality review undertaken by the ADC, as presented within their latest Annual Status Report.

8.5.7 Modelled Future Baseline – 2038

8.5.7.1 In the absence of the Proposed Scheme, it is anticipated that the future baseline would remain broadly similar to the existing baseline. With anticipated improvements in vehicle technology and the increased uptake of low and zero-emission vehicles, it is anticipated that there may be gradual improvements in air quality. This is already indicated by ADC's local monitoring data (summarised in Table 8.6), which suggests an overall downward trend in concentrations at the nearby monitoring sites, and Defra's background maps (Table 8.8)

which predict a reduction in background concentrations with time. Furthermore, the results of the dispersion modelling (discussed later in this Chapter), indicate that in the opening year of 2038, annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$ are likely to be reduced from the 2019 baseline scenario and will meet the respective objectives at all of the assessment receptors.

8.5.8 Summary

8.5.8.1 The Scheme is located in an area where the main influence on air quality is emissions from road traffic, specifically from Westergate Street and Nyton Road.

8.5.8.2 Whilst there are two permitted installations present within 2km of the Site, they are expected to have a negligible impact on local air quality conditions at the Scheme.

8.5.8.3 ADC's air quality monitoring data indicates NO_2 concentrations measured within 2km of the Site are consistently below the respective air quality objective and may be improving over time . Background concentrations of NO_2, PM_{10} and $PM_{2.5}$ are also predicted to be well below the relevant objectives given for the grid squares covering the Scheme.

8.5.8.4 Furthermore, the existing and future baseline modelling results indicate pollutant concentrations will be acceptable within Site.

8.6 Likely Significant Environmental Effects During Construction

8.6.1 Dust and PM_{10} Arising from On-Site Activities

8.6.1.1 Construction activities that have the potential to generate and/or re-suspend dust and PM_{10} include

- Site clearance;
- Preparation of temporary access/egress to the Application Site and haulage routes;
- Earthworks;
- Materials handling, storage, stockpiling, spillage and disposal;
- Movement of vehicles and construction traffic within the Application Site (including excavators and dumper trucks);
- Use of crushing and screening equipment/plant;
- Exhaust emissions from site plant, especially when used at the extremes of their capacity and during mechanical breakdown;
- Construction of buildings, roads and areas of hardstanding alongside fabrication processes;
- Internal and external finishing and refurbishment; and
- Site landscaping after completion.

8.6.1.2 The majority of the releases are likely to occur during the 'working week'. However, for some potential release sources (e.g., exposed soil produced from significant earthwork activities) in the absence of dust control mitigation measures, dust generation has the potential to occur 24 hours per day over the period during which such activities are to take place.

8.6.2 Assessment of Potential Dust Emission Magnitude

8.6.2.1 The IAQM assessment methodology, given in Appendix 8.1, has been used to determine the potential dust emission magnitude for the following four different dust and PM_{10} sources: demolition; earthworks; construction; and, trackout. The findings of the assessment are presented below.

8.6.3 Demolition

8.6.3.1 No demolition activities will be undertaken therefore consideration of this source is not required.

8.6.4 Earthworks

8.6.4.1 The total area of the Site is more than 110,000m^2, the soil type is loamy which has the potential for suspension when dry due to its small particle size. Therefore, the potential dust emission magnitude is large for earthwork activities.

8.6.5 Construction

8.6.5.1 The total volume of buildings to be constructed on the Site will be more than 75,000m^3; therefore, the potential dust emission magnitude is large for construction activities. The anticipated construction materials for the Scheme have the potential to be dusty and include steel, cement, wood, tiling and other materials.

8.6.6 Trackout

8.6.6.1 The number of HDV movements is between 20 to 50 per day, with the unpaved roads that HDVs will travel being less than 50m. The surface material of the unpaved road has the potential to be moderately dusty, as such the dust emission magnitude is medium for trackout activities.

8.6.6.2 Table 8.9 gives the potential dust emission magnitude determined for each construction activity considered.

Table 8.9: Potential Dust Emission Magnitude

Activity	Dust Emission Magnitude
Demolition	N/A
Earthworks	Large
Construction Activities	Large
Trackout	Medium

8.6.7 Assessment of Sensitivity of the Study Area

8.6.7.1 A wind rose generated using the meteorological data used for the dispersion modelling of operational phase impacts is provided in Appendix 8.3. This shows that the prevailing wind direction is from the south-west and north-north-west, therefore, receptors located to north-east and south-south-east of the Application Site are more likely to be affected by dust and particulate matter emitted and re suspended during the construction phase.

8.6.7.2 Under low wind speed conditions, it is likely that most dust would be deposited in the area immediately surrounding the source. The nearest human sensitive receptors are the residential receptors along St. Richards Road and Elmcroft Place. To the north-east of the Scheme is the Eastergate Church of England Primary School and further residential receptors along Church Lane. There are also residential receptors to the west (downwind) of the Scheme on Westergate and Meadows Way, to the east and south-east are agricultural fields. In accordance with the IAQM guidance, residential and school receptors would be classed as 'high sensitivity' receptors. As there are more than 32 high sensitivity receptors within 20m of the Site boundary, the overall sensitivity of the surrounding are to dust soiling is classed as 'high'.

8.6.7.3 The background PM_{10} concentrations relevant to the study area (as presented in Table 8.8), are all less than 24µg/m^3, therefore, in accordance with the IAQM guidance, the sensitivity of the study area to an increase in ambient PM_{10} concentrations during the construction phase is 'low'.

8.6.7.4 For trackout (for both dust soiling and human health), there are approximately 100 residential receptors within 20m of the potential routes that could be used by construction traffic and, therefore, the sensitivity to trackout is low.

8.6.7.5 The sensitivity of the area to changes in dust and PM_{10} for each of the construction activities considered is summarised in Table 8.10.

Table 8.10: Sensitivity of the Study Area

Potential Impact	Sensitivity of the Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	N/A	High	High	High
Human Health	N/A	Low	Low	Low

8.6.8 Risk of Impacts

8.6.8.1 The predicted dust emission magnitude has been combined with the defined sensitivity of the area to determine the risk of impacts during the construction phase, prior to mitigation. Table 8.11 provides a summary of the risk of dust impacts for the Scheme. The risk category identified for each construction activity has been used to determine the level of mitigation required.

Table 8.11: Summary Risk Table to Define Site Specific Mitigation

Potential Impact	Sensitivity of the Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	N/A	High	High	Medium
Human Health	N/A	Low	Low	Low

8.6.9 Plant & NRMM

8.6.9.1 The greatest impact on air quality due to emissions from vehicles and plant associated with the construction phase will be in the areas immediately adjacent to the site access. It is anticipated that construction traffic will access the site via Pine Close. Due to the size of the Site, it is considered likely that the construction traffic will be low in comparison to the existing traffic flows on these roads.

8.6.9.2 Final details of the exact plant and equipment likely to be used on Site will be determined by the appointed contractor, it is considered likely to comprise dump trucks, tracked excavators, diesel generators, asphalt spreaders, rollers, compressors and trucks. The number of plant and their location within the Site are likely to be variable over the construction period.

8.6.9.3 Based on the current local air quality in the area, the type and proximity of sensitive receptors, and the likely numbers of construction vehicles and plant that will be used, a negligible to slight adverse impact is anticipated, prior to mitigation. However, such impacts will be short-term and temporary for the duration of the construction phase and will not result in any long-term or permanent changes in local air quality. As such, no significant adverse effects are anticipated.

8.7 Likely Significant Environmental Effects Post Construction

8.7.1 Full results of the operational phase dispersion modelling are presented in Appendix 8.4 and a summary is provided below.

8.7.2 Annual Mean NO_2 Concentrations

8.7.2.1 The AQS for annual mean NO_2 concentrations is 40µg/m^3. In 2038, the opening year of the Scheme, predicted annual mean NO_2 concentrations, are below the relevant AQS at all of the modelled receptor locations, both with and without the Scheme in operation. The highest concentrations are predicted to occur at receptor R19 (a residential property on Shripney Road) and are 17.4µg/m^3 and 17.5 µg/m^3 in the 'without Development' and 'with Development' scenarios respectively.

8.7.2.2 Road traffic generated by the Scheme is predicted to increase pollutant concentrations at all but three of the 23 existing assessment receptors. The greatest increase in concentrations due to the Scheme is 1.1µg/m^3

(equivalent to 3% of the AQS) and is predicted to occur at receptor locations R22 and R23 (a residential property on the Access Road). However, as total concentrations at these receptors are less than 75% of the AQS, in accordance with the guidance, the impact (i.e. the change in concentrations) is described as 'negligible'.

8.7.2.3 For all remaining receptors, the predicted changes in annual mean NO_2 concentrations equal to or less than 3% of the relevant AQS with predicted concentrations are 75% or less of the AQS. Therefore, in accordance with the EPUK/IAQM Land-Use Planning guidance, the impact of increased emissions associated with the Scheme on annual mean NO_2 concentrations is negligible.

8.7.3 Hourly Mean NO_2 Concentrations

8.7.3.1 Annual mean NO_2 concentrations predicted by the model in all scenarios were below 60µg/m³ and therefore, in line with LAQM.TG(22) guidance, hourly mean NO_2 concentrations are unlikely to cause a breach of the hourly mean AQS. The impact of the Scheme on hourly mean NO_2 concentrations at existing sensitive receptors is, therefore, negligible.

8.7.4 Annual Mean PM_{10} Concentrations

8.7.4.1 The AQS for annual mean PM_{10} concentrations is 40µg/m³. In 2038, the opening year of the Scheme, annual mean PM_{10} concentrations, both with and without the Scheme, are predicted to be well below the relevant AQS at all modelled receptor locations. The highest concentrations are predicted at receptor R19 (a residential receptor on Shripney Road) and are 18.2µg/m³ and 18.3µg/m³ in the 'without Development' and 'with Development' scenarios respectively.

8.7.4.2 The predicted changes in annual mean PM_{10} concentrations are all equal to or less than 2% of the annual mean AQS and total predicted concentrations are less than 75% or less of the AQS. Therefore, based on the EPUK/IAQM Land-Use Planning guidance, the impact of the increased emissions associated with the Scheme on annual mean PM_{10} concentrations is negligible.

8.7.5 Daily Mean PM_{10} Concentrations

8.7.5.1 The AQS for daily mean PM_{10} concentrations is 50µg/m³ to be exceeded no more than 35 times a year. The results of the dispersion modelling indicate that in 2038, the maximum number of days exceeding 50µg/m³ is one (1) in all modelled scenarios.

8.7.5.2 The increased emissions associated with the operation of Scheme do not change the number of days experiencing concentrations greater than 50µg/m³ at any of the receptor locations. The impact on daily mean PM_{10} concentrations is thus also negligible.

8.7.6 Annual Mean $PM_{2.5}$ Concentrations

8.7.6.1 Annual mean concentrations of $PM_{2.5}$ are predicted to be well below the current AQS of 20µg/m³ in all modelled scenarios and at all assessment receptors. In the opening year (2038), the highest concentration is 11.4µg/m³

both 'without' and 'with' the Scheme'. This is predicted to occur at receptor R19 (a residential property on Shripney Road). The predicted changes in annual mean $PM_{2.5}$ concentrations are all equal to or less than 2% of the relevant AQS and total concentrations are less than 75% of the current AQS. Therefore, based on the EPUK/IAQM Land-Use Planning guidance, the Scheme will have a negligible impact on annual mean $PM_{2.5}$ concentrations.

8.7.6.2 It is noted that the predicted $PM_{2.5}$ concentrations also meet the new 2028 interim target of 12µg/m³. Although, concentrations do exceed the 2040 guideline concentrations of 10µg/m³ at a number of receptors. It should be further noted that the 'with Scheme' predicted concentrations are based off conservative estimations, which do not take into account improvements in technology and improvements in air quality beyond 2030.

8.7.7 Future Receptor Exposure Assessment

8.7.7.1 Pollutant concentrations predicted within the Site are predicted to meet the respective objectives at all proposed receptor locations. The highest predicted annual mean NO_2 concentration is 8.9µg/m³, the highest predicted annual mean PM_{10} concentration is 14.2µg/m³ (with 0 days predicted to exceed 50µg/m³), and the highest predicted annual mean $PM_{2.5}$ concentration is 9.1µg/m³.

8.7.7.2 The annual mean NO_2 concentrations predicted by the model are all below 60µg/m³, therefore hourly mean NO_2 concentrations are also likely to be compliant. Therefore future occupants of the Scheme will not be exposed poor air quality and the Site is considered acceptable for the proposed end-use.

8.8 Mitigation

8.8.1 Construction Phase Mitigation

8.8.1.1 Based on the assessment results, mitigation will be required. Recommended mitigation measures for a high-risk site are given below.

8.8.1.2 General Communication

- A stakeholder communications plan that includes community engagement before work commences on site should be developed and implemented.
- The name and contact details of person(s) accountable for air quality and dust issues should be displayed on the site boundary. This may be the environment manager/engineer or the site manager. The head or regional office contact information should also be displayed.
- A Dust Management Plan (DMP), which may include measures to control other emissions, in addition to the dust and PM_{10} mitigation measures given in this report, should be developed and implemented, and approved by ADC.

8.8.1.3 Site Management

- All dust and air quality complaints should be recorded, and causes identified. Appropriate remedial action should be taken in a timely manner with a record kept of actions taken including of any additional measures put in place to avoid reoccurrence.
- The complaints log should be made available to ADC on request.
- Any exceptional incidents that cause dust and/or air emissions, either on or offsite should be recorded, and then the action taken to resolve the situation recorded in the log book.

8.8.1.4 Monitoring

- Daily onsite and offsite inspections should be undertaken, where receptors (including roads) are nearby to monitor dust. The inspection results should be recorded and made available to ADC when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of site boundary, with cleaning to be provided if necessary.
- The frequency of site inspections should be increased when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.

8.8.1.5 Preparing and maintaining the site

- Plan the site layout so that machinery and dust causing activities are located away from receptors, as far as is practicable.
- Where practicable, erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
- Where practicable, fully enclose the 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 onsite, cover appropriately.
- Where practicable, cover, seed or fence stockpiles to prevent wind whipping.

8.8.1.6 Operating vehicle/machinery and sustainable travel

- Ensure all vehicle operators 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.
- A maximum-speed-limit of 15mph on surfaced and 10mph on unsurfaced haul roads and work areas should be imposed.

- A Construction Logistics Plan should be produced to manage the sustainable delivery of goods and materials.
- A Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing) should be considered.

8.8.1.7 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 and particulate matter suppression or 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 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.

8.8.1.8 Waste Management

- Avoid bonfires and burning of waste materials.

8.8.1.9 Measures specific to Earthworks

- Re-vegetate earthworks and exposed areas and soil stockpiles to stabilise surfaces as soon as practicable.
- Stockpile surface areas should be minimised (subject to health and safety and visual constraints regarding slope gradients and visual intrusion) to reduce area of surfaces exposed to wind whipping.
- Where practicable, windbreak netting/screening should be positioned around material stockpiles and vehicle loading/unloading areas, as well as exposed excavation and material handling operations, to provide a physical barrier between the Application Site and the surroundings.
- Where practicable, stockpiles of soils and materials should be located as far as possible from sensitive properties, taking account of the prevailing wind direction.
- During dry or windy weather, material stockpiles and exposed surfaces should be dampened down using a water spray to minimise the potential for wind whipping.
- Only remove the cover in small areas during work and not all at once.

8.8.1.10 Measures specific to 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.
- For smaller supplies of fine powder materials, ensure bags are sealed after use and stored appropriately to prevent dust.
- All construction plant and equipment should be maintained in good working order and not left running when not in use.

8.8.1.11 Measures specific to Trackout

- 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 in frequent use.
- Avoid dry sweeping of large areas.
- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
- Inspect onsite 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 log-book.
- Where practicable, hard surfaced haul routes should be installed, 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 10m from receptors where possible.

8.8.1.12 Detailed mitigation measures to control construction traffic should be discussed with ADC to establish the most suitable access and haul routes for the site traffic. The most effective mitigation will be achieved by ensuring that construction traffic does not pass along sensitive roads (i.e. residential roads, congested roads, via unsuitable junctions, etc.) where possible, and that vehicles are kept clean (through the use of wheel washers, etc.) and sheeted when on public highways. Timing of large-scale vehicle movements to avoid peak hours on the local road network will also be beneficial.

8.8.2 Operational Phase

8.8.2.1 The results of the modelling show that pollutant concentrations are anticipated to meet their respective objectives at all assessment receptors, both existing and proposed. The change in pollutant concentrations attributable to road traffic emissions associated with the operational phase of the Scheme (i.e. impacts on local air quality) are negligible. Site specific mitigation is therefore not required to protect existing receptors.

8.8.2.2 There should be consideration given to the mitigation measures outlined within the Sussex Air Quality and Emissions Mitigation Planning Guidance. Where for residential developments: all gas-fired boilers to meet a minimum standard of <40mg/NOx/kWh. There should be further consideration should be given to renewable sources of energy (e.g. air source heat pumps) and the requirements for electric vehicle charging. Notwithstanding the above, air quality benefits would still be achieved through promotion of active and sustainable travel choices and the implementation of travel planning measures to reduce the number of vehicle trips generated by the Scheme. It is understood that a Travel Plan will be prepared for the Scheme, however, at the time of writing the Travel Plan is not yet available.

8.9 Residual Effects

8.9.1 Construction Phase

8.9.1.1 The residual effects of dust and PM_{10} generated by construction activities, following the application of the mitigation measures described above and good site practice, will be negligible and not significant.

8.9.2 Operational Phase

8.9.2.1 The Scheme is predicted to cause negligible increases in NO_2, PM_{10} and $PM_{2.5}$ concentrations at all of the assessment receptors. At all modelled receptor locations, concentrations are predicted to meet the relevant objectives for NO_2, PM_{10} and $PM_{2.5}$, both with and without the Scheme in operation.

8.9.2.2 The residual effects of the operational phase of the Scheme on local air quality are therefore negligible and not significant, according to the assessment criteria.

8.10 Cumulative Effects

8.10.1 Construction Phase

8.10.1.1 Cumulative effects may arise when several developments are under development at the same time, which together may affect the local air quality conditions. The following committed developments are within 700m of the Site and therefore there could be cumulative effects should construction occur on the sites at the same time: i) housing development at Nyton Nursery Nyton Road Westergate (AL/102/17/RES); and ii) A29 Realignment Scheme (WSCC/052/20).

8.10.1.2 The Nyton Nursery development is already under construction and is likely to be completed / near completion prior to the commencement of works for the Scheme. Therefore, cumulative effects are unlikely to arise.

8.10.1.3 Construction activities associated with the A29 Realignment Scheme is highly likely to occur at the same time as the construction of the Scheme. The air quality assessments submitted with the planning applications for this development conclude that emissions to air from construction activities will be negligible following the implementation of best practice measures on site to supress the generation of dust and particulate matter and its dispersion off-site. Therefore, with the implementation of best practice mitigation measures at the Scheme, cumulative effects of dust and PM_{10} generated by construction activities and emissions from construction vehicles are likely to be negligible and not significant.

8.10.2 Operational Phase

8.10.2.1 Once the Scheme becomes operational, it will generate additional traffic on the local road network. Where one or more developments are located in close proximity, traffic generated by each development will be distributed onto the same roads within the local network. The greatest effects will therefore be on sensitive receptors located adjacent to those roads likely to experience a change in traffic volume or composition due to the operation of the developments, in combination.

8.10.2.2 As noted in the sections above the traffic data provided for use in the air quality assessment includes traffic contributions from the identified committed developments (as appropriate). The model results for the future year scenarios are therefore inherently cumulative as they take into account the contributions to total pollutant concentrations associated with the committed developments. A separate cumulative assessment is therefore not required.

8.11 Summary

8.11.1 An air quality assessment has been undertaken to determine the potential effect of the Scheme on local air quality during both the construction and operational phases.

8.11.2 The baseline air quality conditions for the area the Scheme falls within are good overall. For the construction phase, a qualitative assessment of the potential impacts on local air quality from construction activities has been carried out for this phase of the Scheme using the IAQM Construction Dust guidance assessment methodology. This identified that overall there is a High Risk of dust soiling impacts and a Low Risk to human health due to increases in particulate matter concentrations as a result of construction activities. However, through good site practice and the implementation of suitable mitigation measures, the impact of dust and PM_{10} releases would be significantly reduced. The residual effects of dust and PM_{10} generated by construction activities on air quality are therefore negligible and not significant. The NRMM and associated plant equipment which will be used for the Scheme will have a negligible effect on local air quality during the construction phase.

8.11.3 In addition, a quantitative assessment of the potential impacts of the operational phase of the Scheme was undertaken using ADMS-Roads dispersion modelling software to predict the changes in NO_2, PM_{10} and $PM_{2.5}$ concentrations that would occur due to traffic generated by the Scheme.

8.11.4 The results show that the AQS for NO_2, PM_{10} and $PM_{2.5}$ will be met at all assessment receptor in 2038, the anticipated opening year of the Scheme, both without and with the Scheme in operation. The predicted changes in NO_2, PM_{10} and $PM_{2.5}$ concentrations as a result of the operation of the Scheme are all equal to or less than 3% of the relevant AQS and total concentrations are <75% of the AQS. Therefore, according to the assessment significance criteria, the residual effects will be negligible and not significant. The concentrations at future receptor sites in the 'with Scheme' scenario are predicted to be very low for NO_2, PM_{10} and $PM_{2.5}$. Further to this, mitigation measures have been identified and provided as per the construction dust assessment undertaken and applicable guidance's.

8.11.5 The cumulative effects of the Scheme and locally committed developments will also be negligible for both the construction and operational phases.

8.11.6 Based on the above, it is considered that the development proposals comply with national and local policy for air quality.

8.12 References

8.12.1 Below is a list of air quality references:

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- The National Archives (2010) The Air Quality Standards Regulations 2010 - Statutory Instrument 2010 No. 1001 [online]. Available at: https://www.legislation.gov.uk/uksi/2010/1001/contents/made [Accessed September 2022].
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- Defra (2021) Part IV of the Environment Act 1995 as amended by the Environment Act 2021 - Environment (Northern Ireland) Order 2002 Part III, Local Air Quality Management Technical Guidance (TG22) [online]. Available at: https://laqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-TG22-August-22-v1.0.pdf [Accessed July 2023].
- EPUK and IAQM (2017) Land-Use Planning & Development Control: Planning for Air Quality [online]. Available at: https://laqm.defra.gov.uk/documents/LAQM-TG16-April-21-v1.pdf [Accessed July 2023].
- IAQM (2023) Guidance on the assessment of dust from demolition and construction Version 1.1 [online]. Available at: https://iaqm.co.uk/wp-content/uploads/2013/02/Construction-dust-2023-BG-v6-amendments.pdf [Accessed September 2023].
- Sussex-air (2021) Air Quality and Emissions Mitigation Guidance for Sussex [online] Available from: https://www.midsussex.gov.uk/media/5608/sussex-aq-guidance-2021.pdf [Accessed August 2023].
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- https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html
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8.13 Glossary

8.13.1 Below is a list of air quality terms:

Term	Definition
AADT	Annual Average Daily Traffic. A daily total traffic flow (24 hrs), expressed as a mean daily flow across all 365 days of the year.
Accuracy	A measure of how well a set of data fits the true value.
ADC	Arun District Council
Adjustment	Application of a correction factor to modelled results to account for uncertainties in the model
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances within a specific timescale (see also air quality standard).
Air quality standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups (see also air quality objective).
Ambient air	Outdoor air in the troposphere, excluding workplace air.
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year.
AQMA	Air Quality Management Area.
Conservative	Tending to over-predict the impact rather than under-predict.
Data capture	The percentage of all the possible measurements for a given period that were validly measured.
Defra	Department for Environment, Food and Rural Affairs.
Dust	Dust comprises particles typically in the size range 1-75 micrometres (µm) in aerodynamic diameter and is created through the action of crushing and abrasive forces on materials

EFT	Emissions Factor Toolkit, published by Defra.
EHO	Environmental Health Officer
Emission rate	The quantity of a pollutant released from a source over a given period of time.
Exceedance	A period of time where the concentration of a pollutant is greater than the appropriate air quality standard.
Fugitive emissions	Emissions arising from the passage of vehicles that do not arise from the exhaust system.
HDV/HGV	Heavy Duty Vehicle/Heavy Goods Vehicle.
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management.
LDV	Light Duty Vehicle
Model adjustment	Following model verification, the process by which modelled results are amended. This corrects for systematic error.
NRMM	Non-Road Mobile Machinery
NO_2	Nitrogen dioxide.
NO_x	Nitrogen oxides.
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 micrometres.
Road link	A length of road which is considered to have the same flow of traffic along it. Usually, a link is the road from one junction to the next.
Trackout	The transport of dust and dirt from the construction / demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network. This arises when HDVs leave the construction / demolition site with dusty materials, which may then spill onto the road, and/or when HDVs transfer dust and dirt onto the road having travelled over muddy ground on site.

µg/m³ micrograms per cubic metre	A measure of concentration in terms of mass per unit volume. A concentration of 1µg/m³ means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
Uncertainty	A measure, associated with the result of a measurement, which characterizes the range of values within which the true value is expected to lie. Uncertainty is usually expressed as the range within which the true value is expected to lie with a 95% probability, where standard statistical and other procedures have been used to evaluate this figure. Uncertainty is more clearly defined than the closely related parameter 'accuracy', and has replaced it on recent European legislation.
Validation (modelling)	Refers to the general comparison of modelled results against monitoring data carried out by model developers.
Verification (modelling)	Comparison of modelled results versus any local monitoring data at relevant locations.
WHO	World Health Organisation

9. Noise & Vibration

9.1 Introduction

9.2 The Site

9.3 The Scheme

9.4 Potential Cumulative Effects

9.5 Chapter Structure

9.6 Noise Policy

9.7 Noise and Vibration Assessment Methodology

9.8 Baseline Conditions

9.9 Future Baseline Conditions

9.10 Likely Significant Effects – During Construction

9.11 Likely Significant Effects – Post Construction

9.12 Mitigation Integrated within the Proposed Development

9.13 Mitigation – Construction Noise and Vibration

9.14 Residual Effects

9.15 Cumulative Effects

9.16 Summary

9 Noise & Vibration

9.1 Introduction

9.1.1 This chapter has been prepared by 24 Acoustics Ltd and assesses the likely significant effects of the development on the environment in respect of noise and vibration. This chapter also describes the methods used to assess the effects; the baseline conditions at the site and surrounding area; the mitigation measures required to prevent, reduce or offset any likely significant adverse effects; and the likely residual effects after these measures have been adopted.

9.1.2 An assessment of the likely significant effects of the development with respect to noise has been undertaken, including for both the construction phase (temporary) effects and operational phase (permanent) effects. The likely significant effects of vibration during the construction phase (temporary) on residential receptors has also been considered.

9.1.3 A separate noise impact assessment report has been undertaken by 24 Acoustics (reference R10022-1 Rev 1, included at Appendix 9.1) which assesses the impact of existing transportation sources, including the proposed link road, upon the development.

9.1.4 This section is written by Kiel Edwards BSc AMIOA, Consultant at 24 Acoustics with 8 years' experience in the assessment of noise and vibration. The project was supervised by Principal Consultant Stephen Gosling BEng MIOA. Other staff provide supporting roles under full supervision.

9.2 The Site

9.2.1 The site is located in Westergate, approximately 5 miles east of Chichester, in a mixed residential and agricultural area. Residential properties lie to the west, on Westergate Street, and to the north with Eastergate Primary School located to the northwest.

9.2.2 A railway line follows the site's southern boundary with farmland and residential properties further south.

9.2.3 The site's topography is relatively uniform with no significant variation in ground height relative to the surrounding area.

9.3 The Scheme

9.3.1 It is proposed to develop the site for residential use, with up to 400 dwellings comprising a mixture of houses and apartments, accessed via a new link road off Pine Close to the west. The new road will provide a link to larger sites allocated for development to the east.

9.3.2 The scheme will introduce noise sources to the surrounding area in the form of road traffic and, on a temporary basis, construction activity.

9.4 Potential Cumulative Effects

9.4.1 The potential for cumulative effects with projects highlighted within the Scoping Opinion Response received from Arun District Council dated 21st November 2022 are assessed within further sections of the Noise Chapter.

9.5 Chapter Structure

9.5.1 The following sections describe relevant noise related policy relating to the proposals, an outline of the assessment methodology and baseline conditions as well as an assessment of residual and cumulative effects and mitigation.

9.6 Noise Policy

National Planning Policy Framework and Noise Policy Statement for England

9.6.1 Paragraph 191 of the National Planning Policy Framework (NPPF) states that planning policies and decisions should:

- 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 life
- Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason

9.6.2 The NPPF also refers to the Noise Policy Statement for England (NPSE) which is intended to apply to all forms of noise, including environmental noise, neighbour noise and neighbourhood noise. The NPSE sets out the Government's long-term vision 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' which is supported by the following aims:

- Avoid significant adverse impacts on health and quality of life
- Mitigate and minimise adverse impacts on health and quality of life

9.6.3 The NPSE defines the concept of a 'significant observed adverse effect level' (SOAEL) as 'the level above which significant adverse effects on health and quality of life occur'. The following guidance is provided within the NPSE:

"It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available."

Planning Practice Guidance

9.6.4 The Planning Practice Guidance (PPG) is written to support the NPPF with more specific planning guidance. The PPG reflects the NPSE and states that noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment. It also states that opportunities should be taken, where practicable, to achieve improvements to the acoustic environment. The PPG states that noise can over-ride other planning concerns but should not be considered in isolation from the other economic, social, and environmental dimensions of the proposed development.

9.6.5 The PPG expands upon the concept of SOAEL [together with Lowest Observable Adverse Effect Level (LOAEL) and No Observed Effect Level (NOEL)] as introduced in the NPSE and provides a table of noise exposure hierarchy for use in noise impact assessments in the planning system.

9.6.6 In general terms, it is considered that a noise impact with an effects level which is lower than SOAEL is acceptable (providing the effect is mitigated to a minimum).

Local Planning Guidance – Arun Local Plan

9.6.7 The Arun Local Plan 2011-2031 includes the following policies which are relevant for assessing noise impacts from new development.

9.6.8 Policy D DM1: 'Aspects of form and design quality' states that, when considering applications for development, Arun District Council (ADC) will have regard to the impact of the development as follows:

"Have minimal impact to users and occupiers of nearby property and land. For example, by avoiding significant loss of sunlight, privacy and outlook and unacceptable noise and disturbance."

9.6.9 Policy QE SP1: 'Quality of the Environment' states:

"The Council requires that all development contributes positively to the quality of the environment and will ensure that development does not have a significantly negative impact upon residential amenity, the natural environment or upon leisure and recreational activities enjoyed by residents and visitors to the District."

9.6.10 Policy QE DM1: 'Noise Pollution' requires the following to support proposals for new noise generating development:

"A noise report which provides accurate information about the existing noise environment, and the likely impact of the proposed development upon the noise environment. The report must also demonstrate that the development meets appropriate national and local standards for noise, as set out in Annex 1 of the Planning Noise Advice Document: Sussex, and any mitigation measures required to ensure noise is managed to an acceptable level."

IEMA Guidelines for Environmental Noise Impact Assessment: 2014

9.6.11 The IEMA guidelines consider the process of assessing noise impacts and are relevant for developments where an EIA is required. The guidelines consider the main steps of a noise impact assessment for EIA purposes, i.e. scoping, baseline studies, noise prediction, assessment, mitigation and reporting.

British Standard 5228:2009+A1:2014

9.6.12 British Standard 5228 is the relevant standard for assessing noise and vibration during the construction of the development. Part 1 of the standard addresses noise and Part 2 addresses vibration.

9.6.13 BS 5228 Parts 1 and 2 make reference to a number of factors which are likely to affect the significance and acceptability of noise and vibration from construction sites. These are:

- Site location;
- Existing ambient noise levels / existing ambient vibration levels;
- Duration of operations;
- Hours of work;
- Attitude of site operator;
- Noise characteristics / vibration characteristics; and
- The effect of vibration on adjacent buildings.

9.6.14 BS 5228: Part 1 - Noise

9.6.14.1 Part 1 of BS 5228 provides guidance concerning methods of predicting and measuring noise from construction activities, and assessing the impact on those exposed to construction noise.

9.6.14.2 It is generally recognised that for industrial noise the likelihood of complaints is related to the difference between the noise from the industrial source and the existing background noise level. BS 5228, however, recognises that this relationship between response and noise level differences may well be different for construction noise activities, and a greater difference may be tolerated when it is known that the operations are of a relatively short duration.

9.6.14.3 It would be anticipated that the longer the construction activities are scheduled for, the closer the perception of a construction site to a permanent industrial facility, particularly if the construction activities take place at night. It is therefore important to consider the duration of the proposed works in addition to the hours of construction working within the context of the development area.

9.6.15 BS 5228: Part 2 - Vibration

9.6.15.1 Part 2 of BS 5228 provides guidance on the control of vibration from construction activities and assessing its impact on those exposed to it.

9.6.15.2 The standard does not recommend absolute criteria for vibration but advises that the peak particle velocity (PPV) descriptor should be used as an indicator of both human response and effects on buildings. Table 9.1 is reproduced from BS 5228 and provides guidance on the effects of vibration levels in terms of human response.

Table 9.1: Guidance on Effects of Vibration Levels - Human Response

Vibration level (ppv)	Perception response
0.14 mm/s	Vibration might just be perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 mm/s	Vibration might just be perceptible in residential environments.
1 mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.

Source: BS 5228 Part 2 – Vibration

Calculation of Road Traffic Noise and Design Manual for Roads and Bridges

9.6.16 The Department of Transport Publication 'Calculation of Road Traffic Noise' (CRTN) provides guidance and methodology for the assessment and prediction of noise levels from road traffic.

9.6.17 The Design Manual for Roads and Bridges LA111 provides a method for the assessment of road traffic effects by assessing the change in the $L_{A10,18\ hour}$.

9.7 Noise and Vibration Assessment Methodology

Limits and Assumptions - Baseline Noise Measurements

9.7.1 Environmental noise surveys have been undertaken to minimise uncertainty of ambient noise levels at the Site. Calibration of all instrumentation was checked before and on completion of the surveys and no drift in calibration level was observed. The calibration of all equipment is traceable to National Standards.

Limits and Assumptions - Noise from General Construction Activity

9.7.2 BS 5228 provides methods for predicting the likely noise levels from construction works, which are based on detailed information including the type and number of each plant item, their location and the length of time they are in operation. As there is no detailed information currently available regarding the specific construction plant and techniques that will be in operation on the site during the construction period, accurate prediction is not possible at this stage.

Significance Criteria and Receptors

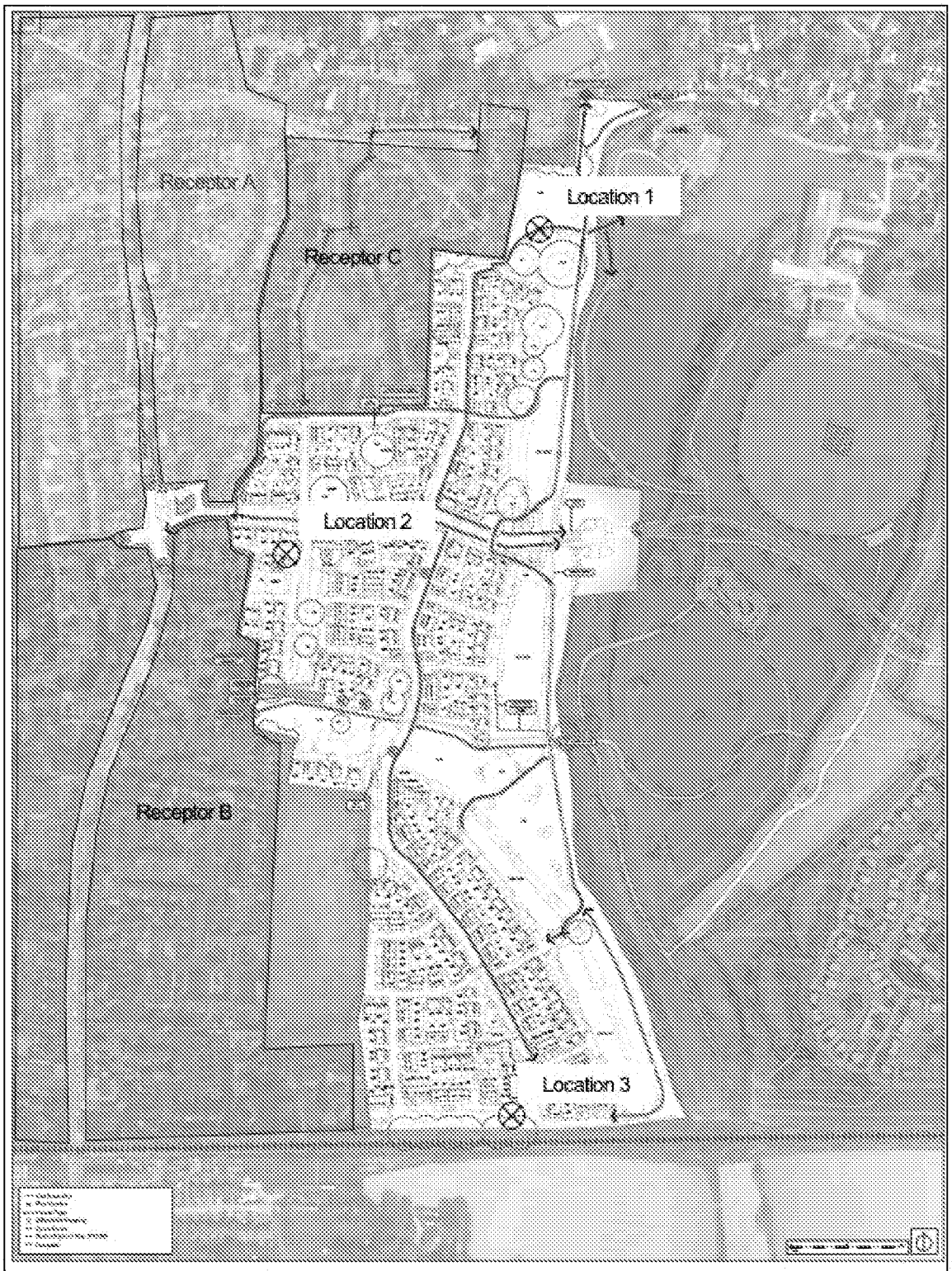
9.7.3 Existing noise sensitive receptors have been identified from plans of the surrounding area and during site visits. The nearest noise sensitive receptor groups are shown in

9.7.4 Figure 9.1 and described below:

- Receptor A: Residential properties northwest of the development site off Westergate Street;
- Receptor B: Residential properties to the southwest of the site off Westergate street.
- Receptor C: Residential properties to the north of the development on St Richards Road

9.7.5 Future noise sensitive receptors, within the development itself, will also be considered for when residents are occupying the first phases of the development and construction work is still ongoing.

Figure 9.1: Measurement Locations and Sensitive Receptors



Project: Westergate	Title: Measurement Locations and Sensitive Receptors		24Acoustics
DWG No: Figure 9-6	**Scale:** N.T.S.	Rev: -	
Date: August 2023	Drawn By: KE		

Value of Receptor Sensitivity

9.7.6 The sensitivity of the identified receptors has been based on the relative importance, using the scale in Table 9.2.

Table 9.2: 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.
Moderate	The receptor/resource has moderate capacity to absorb change without significantly altering its present character, or is of high importance.
Low	The receptor/resource is tolerant of change without detriment to its character, is of low or local importance.

9.7.7 Based on the methodology in Table 9.2, it is considered that the existing noise sensitive receptors considered herein are of local importance and hence of low sensitivity.

9.8 Baseline Conditions

9.8.1 Baseline conditions have been determined at the site by noise measurement. An environmental noise survey was undertaken on site between 20th and 27th April 2023. The following instrumentation was used during the surveys:

- 2xRion precision sound level meter Type NL-52
- Svan precision sound and vibration meter Type 958
- Brüel & Kjær acoustic calibrator Type 4231

9.8.2 Calibration of all instrumentation was checked before and on completion of the measurements and no drift in calibration level was observed. The calibration of all equipment is traceable to National Standards.

9.8.3 Weather conditions during the measurements were variable with short periods of rain and wind speeds exceeding 5 m/s. Measurements affected by meteorological conditions have been removed from the design levels.

9.8.4 The noise monitors were fitted with environmental wind shields. The meters were configured to monitor in 1 minute sample periods and were set up to measure and store overall A-weighted statistical parameters including the LAeq, LA10, LA90, and LAmax,f sound pressure levels.

9.8.5 The measurement locations are described below and can be seen in

9.8.6 Figure 9.1.

- Location 1 – To the southern site boundary, facing the rail line, at a height of 1.5m above local ground level in free-field conditions. Approximately 10m from the centre of the railway.
- Location 2 – To the west of the site, near to residential properties on Pine Close and Westergate Street, at a height of 2m above local ground level in free-field conditions;
- Location 3 – To the north of the site, approximately 100m from Eastergate Primary School's playing fields, at a height of 2 m above local ground level in free-field conditions. Adjacent to residential properties on St Richards Road.

9.8.7 The results of the baseline noise survey are summarised in Table 9.3.

Table 9.3: Baseline Noise Survey Results

Location	Daytime Level (06:00 - 00:00) dB $L_{A10,\ 18\ hour}$
1 - Southern site boundary	49
2 - West of site	48
3 - North of site	48

9.8.8 Traffic noise from the surrounding local road network is the primary component of ambient noise levels across the site.

9.9 Future Baseline Conditions

9.9.1 Table 9.4 describes the calculated change in road traffic noise level at the most affected receptor locations (A and B) from the 2019 baseline case and 2031/2038 baseline levels, as a result of the additional vehicle movements projected for the future scenarios without the development.

Table 9.4: Change in Road Traffic Noise - Future Without Development

Scenario	Predicted Change in $L_{A10,\ 18\ hour}$ from 2019 Baseline, dB	
	Receptor A	Receptor B
2031 Baseline without Development	0.6	0.3
2038 Baseline without Development	0.5	0.7

9.10 Likely Significant Effects - During Construction

Noise and Vibration from General Construction Activity

9.10.1 The assessment concentrates on the potential noise impacts in line with BS 5228 for construction works and methods of mitigation.

9.10.2 A construction management plan will provide construction working hours. Typical operational hours for construction activities are shown below:

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

9.10.3 It is anticipated that construction noise (assessed under BS 5228) may give rise to a short-term noise effect during periods where noisy activity (e.g. piling, plant movement and operation) is taking place at the closest points to nearby existing and future noise-sensitive properties (including properties within receptor Zones A, B and C). There is potential, therefore, for a short-term, adverse effect of minor significance, although the impact will reduce as construction workings move away from sensitive receptors. For the majority of the time, when workings are more distant from noise-sensitive properties, it is anticipated that any effects will not be significant and are therefore considered negligible.

9.10.4 Based on the above, as a worst-case, there is the potential for temporary, minor adverse effects from construction noise.

9.10.5 Detailed assessments of short term and temporary noise and vibration associated with construction noise and vibration will be undertaken when the construction and piling methods are determined.

Noise from Construction Vehicles

9.10.6 Noise from HGVs and construction vehicles has the potential to affect properties near the site access points (i.e. properties on Pine Close, 6 to 10 m from the centre of the access road), depending on the vehicle type, routes, time of day and number of movements.

9.10.7 The estimated volumes of construction traffic utilising the site access road have been provided by the transportation consultants (WSP) and are summarised in Table 9.5.

Table 9.5: Estimated Construction Traffic Flows

	Construction Traffic Flows AAWT 18 hour		
	Non-HGV	HGV	Total
Arrivals	64	16	80

Departures	64	16	80
Total	128	32	160

9.10.8 HGV movements would be dispersed across the working day. The arrival and departure of light vehicles would be concentrated during the morning and evening periods, but would be significantly less than the predicted levels of traffic during the operational phase of the development.

9.10.9 Calculations have been undertaken of HGV movements to the closest habitable windows on Pine Close from the centre of the site's access road. Calculations use a source noise level of 68 dB LAeq T at 5m for a slow moving HGV (taken from 24 Acoustics' library database) and assess HGV movements over a full working day (08:00 to 18:00 hours).

9.10.10 Existing ambient noise levels have been determined from the measurement results at Location 2 (identified in
9.10.11 Figure 9.1), providing an ambient noise level of 49 dB LAeq 10 hour during typical construction hours (08:00 to 18:00). It is relevant to note that this measurement location is at a greater distance from the road network than properties on Pine Close and, therefore, ambient noise levels at the receptor property will be higher.

9.10.12 Table 9.6 describes the predicted change in ambient noise levels assuming all construction HGV movements in Table 9.5 pass a single receptor on Pine Close.

Table 9.6: Change in Road Traffic Noise - Construction HGV Movements

Receptor	Increase in Road Traffic Noise Level
Property at Pine Close	0.9 dB

9.10.13 Based on the above, as a worst-case there is a negligible temporary effect anticipated at properties near the site access road due to noise from construction vehicles.

9.10.14 It is anticipated that noise from HGV/construction vehicles will be managed via a Construction Traffic Management Plan (CMTP), which will include measures to control the noise impact from construction vehicles for each phase of the development to ensure that construction noise and HGV/construction vehicle noise levels are minimised.

9.11 Likely Significant Effects - Post Construction

9.11.1 The increase in noise level from road traffic, as a result of the projected future traffic flows has been assessed in accordance with the guidance of CRTN and the DMRB. The calculations have been based upon the baseline and projected flows provided by the project transportation consultants (WSP) for the following scenarios:

- Baseline year (2019) – The current baseline prior to the development;
- 2031 Baseline without the development – The future baseline including committed developments, without the development;
- 2031 Future with the development - The future baseline including committed developments, with the whole of the development;
- 2038 Baseline without the development – The future baseline including committed developments, without the development;
- 2038 Future with the development - The future baseline including committed developments, with the whole of the development.

9.11.2 The above scenarios have been selected in order to assess the increase in noise level from road traffic due to the development, compared to the current (2019) baseline. The future baseline scenarios include all committed developments, to allow cumulative effects to be assessed.

9.11.3 In relation to traffic noise, the DMRB rates impacts through consideration of the change in LA10,18 hour for the short and long-term as reproduced in Table 9.7 and Table 9.8.

Table 9.7: Classification of Magnitude of Noise Impacts in the Short-Term

Predicted Change in $L_{A10,18\ hour}$	Magnitude of Impact
0	No change
0.1 - 0.9	Negligible
1 - 2.9	Minor
3 - 4.9	Moderate
5+	Major

Table 9.8: Classification of Magnitude of Noise Impacts in the Long-Term

Predicted Change in $L_{A10,18\ hour}$	Magnitude of Impact
0	No change
0.1 - 2.9	Negligible
3 - 4.9	Minor
5 - 9.9	Moderate
10+	Major

Traffic Noise Impact

9.11.4 An assessment of noise comparing the 2019 baseline scenario with the 2031/2038 baseline + development scenario has been produced to assess the potential Increase In noise levels from local road traffic associated with the development.

9.11.5 Calculations have been undertaken of the change in road traffic noise level at receptors A and B from the 2031 and 2038 baseline scenarios along Westergate Street, as a result of the additional vehicle movements projected for the future scenarios with the development. The results are summarised in Table 9.9.

Table 9.9: Change in Road Traffic Noise - With Development

Receptor	Predicted Change in $L_{A10,\ 18\ hour}$ from Forecast 2031/2038 Baseline, dB	
	2031 with Development	2038 With Development
A	< 0.1	< 0.1
B	< 0.1	< 0.1

9.11.6 As assessed in accordance with Table 9.7 and Table 9.8, the change in road traffic noise levels at receptors A and B is considered to have no effect in the short-term and in the long-term. This is likely due to the relatively small scale of the development and associated traffic movements compared to the wider committed developments in the area.

Noise from Substations

9.11.7 As requested by Arun District Council, consideration has been given to noise from proposed electrical substations within the development. Modern substations emit low noise levels and combined with an enclosure means that very low noise levels are anticipated.

9.12 Mitigation Integrated within the Proposed Development

9.12.1 A 3m high noise barrier is proposed to the southern site boundary with the railway line. The barrier will have a minimum surface density of 15 kg/m^3 and comprise a solid construction with no holes or gaps. Two and a half storey dwellings and three storey dwellings may be included within the site in accord with the parameter plans; these are generally located centrally within the site along the alignment of the spine road. The provision of this noise barrier will serve to reduce noise from the rail line across the development and will also mitigate railway noise levels at existing adjacent properties.

9.13 Mitigation – Construction Noise and Vibration

9.13.1 Construction noise and vibration will be controlled to acceptable levels by implementation of appropriate best practice measures, following the general recommendations of BS 5228. Construction noise may also be controlled by way of limiting hours of work.

9.13.2 A Construction Environmental Management Plan (CEMP) will be developed for each phase to ensure that construction noise levels are minimised, and this is expected to be enforced via a planning condition.

9.13.3 Mitigation measures to control construction noise and vibration are likely to Include the following:

- All plant items will be properly maintained and operated according to manufacturers' recommendations in such a manner as to avoid causing excessive noise. All plant items should be sited so that the noise effects at nearby noise-sensitive properties are minimised;
- Where appropriate, plant items will be fitted with silencers or acoustic enclosures;
- Hoarding will be erected around the construction works to shield residential properties from noisy activities;
- Deliveries will be scheduled to arrive during daytime hours only and vehicles will be routed so as to minimise disturbance to local residents. Delivery vehicles will be prohibited from waiting within the site or on the public highway with their engines running;
- If necessary, operating times of particularly noisy activities may be reduced;
- Good communication will be maintained with the occupants of nearby residential properties to inform them of works progress;
- Construction vibration will be considered whenever the piling method for the construction works has been identified.

9.13.4 A Construction Traffic Management Plan (CMTP) will also be provided, which will include measures to control the noise impact from construction vehicles.

9.14 Residual Effects

Construction Phase

9.14.1 Implementation of the CEMP and mitigation measures described in the above sections will ensure that noise and vibration impacts associated with construction workings will be negligible for the majority of the duration of the workings.

Operational Phase

9.14.2 With implementation of the mitigation measures described above, and subject to detailed design of the site layout, the potential noise impacts from these proposed uses will result in no effect in the short and long term.

9.15 Cumulative Effects

9.15.1 The predicted operational noise levels have been based on the future baseline scenarios, which include the traffic growth associated with the surrounding committed developments.

9.15.2 Calculations demonstrate no increase in road traffic noise levels at the nearest receptor locations due to the development when compared with the 2031 and 2038 baseline. Road traffic noise levels associated with the development will have no effect in the short and long term when accounting for the cumulative effects of the surrounding committed developments.

9.16 Summary

Methodology

9.16.1 A review of construction noise and vibration has been undertaken and recommendations made for appropriate management of noise and vibration during the construction period. The impact of changes in levels of traffic noise due to the development (along with other committed developments) has been determined.

9.16.2 Where necessary, recommendations have been made for mitigation measures.

Baseline conditions

9.16.3 Baseline conditions have been determined at the site by noise measurement. The future baseline conditions for the assessment of road traffic noise have been assessed based on traffic flow data from the project transport consultants.

Likely Significant Effects

9.16.4 The effect of construction activities are considered to be minor adverse in the short-term. Construction vehicle movements will have a negligible temporary effect, with no effects from future vehicle movements associated with the development.

Mitigation Measures

9.16.5 A construction environmental noise management plan (CEMP) will be developed to ensure that construction noise levels are minimised and target compliance with relevant national and local standards/guidance.

9.16.6 The detailed design of the development will incorporate noise mitigation measures, including a noise barrier to the southern site boundary and appropriate specification of the proposed dwellings' façade constructions, in order to provide suitable internal and external noise levels to future occupiers.

Residual Effects

9.16.7 Suitable management of construction vehicles and construction noise and vibration, with the proposed mitigation measures, will result in a negligible residual effect.

9.16.8 Implementation of the proposed mitigation measures will result in a potential minor adverse significance and negligible effect. Table 9.10 contains a summary of the potential effects of the development.

Table 9.10: Table of Significance - Noise and Vibration

Potential Effect	Nature of Effect	Significance	Mitigation/ Enhancement Measures	Geographical Importance	Residual Effects
Construction					
Noise	Temporary	Minor Adverse	Good management of construction noise and mitigation measures	Local	Negligible
Vibration	Temporary	Minor Adverse	Good management of construction vibration if impact piling method is required	Local	Negligible
Operational					
Traffic Noise	Permanent	No effect	None Required	Local	Negligible
Cumulative Effect					
Construction	Temporary	Minor Adverse	Good management of construction noise and mitigation measures	Local	Negligible
Operational traffic noise	Permanent	No effect	Good management of construction vibration if impact piling method is required	Local	Negligible

10. Built Heritage and Archaeology

10.1 Introduction

10.2 Background

10.3 Chapter Structure

10.4 Policy Context

10.5 Assessment Methodology

10.6 Baseline

10.7 Likely Significant Environmental Effects During Construction

10.8 Likely Significant Environmental Effects Post Construction

10.9 Mitigation

10.10 Residual Effects

10.11 Cumulative Effects

10.12 Summary

10.12 References

10.12 Glossary

10 Built Heritage and Archaeology

10.1 Introduction

10.1.1 This chapter describes the baseline conditions, and the potential effects of the proposed development with respect to archaeology [both structures and below ground deposits heritage resources, both known and the predicted potential] and built heritage [categories including designated and non-designated built assets] within the proposed development area and the immediate site environs.

10.1.2 Additional comprehensive detail / Information will also be presented in a stand-alone document [A Desk Based Assessment [see assessment methodology detailed below]] that will be submitted in support of and informing the forthcoming application. It is recommended that the DBA should be read in association with this ES chapter, attached at Appendix 10.1.

10.1.3 The Desk Based Assessment will be submitted as a main body text with supporting Appendices [A1-A5].

10.1.4 Appendices within the DBA [Appendices 4A and 4B] will focus on built heritage assets within conservation areas proximal to the application site area.

10.1.5 This report includes conclusions and recommendations relating to the effect of the proposed development on archaeology and built heritage assets. The recommendations consider strategies to avoid, reduce or mitigate effects on heritage assets, within both archaeological and built heritage asset groups, that could arise from alteration or impact on the described heritage assets by the proposed development.

10.1.6 About the Author: DAS Ltd are an established [20 years plus continuous operation] West Sussex based archaeological unit that provides heritage and archaeological consultancy and field work services to the development and local authority government sectors.

10.1.7 Operations include preliminary first order, consultancy relating to heritage aspects of land purchase and development through to full excavation and publication of results for both privately and public sector developments.

10.2 Background

10.2.1 This assessment study incorporates portions of three modern civil parishes, those of Aldingbourne, Barnham and Eastergate. To the west are the modern settlements of Woodgate and Westergate and towards the north, a third modern settlement of Eastergate, which traverses the northern portion of the Site.

10.2.2 The proposed development site is situated on the low-lying Lower Sussex Coastal Plain, the centre of which is located at National Grid Reference SU 94165 04710, and at heights of approximately +7.0 to +10.0m AOD (Above Ordnance Datum). The Site is situated within the modern civil parishes of Eastergate, Barnham and Aldingbourne, administrative district of Arun, county of West Sussex. The site area is estimated at c. 9.50 ha.

10.2.3 The ES is submitted to inform a Hybrid Application 1) Full Planning Application for western section of East/West Link Road with new access, road bridge and associated works; 2) Outline Planning Application with all matters reserved for up to 400 No. dwellings with access & associated works.

10.3 Chapter Structure

10.3.1 This report will begin by detailing Policy Context referenced within this chapter. This will include review / listing of Statutory Legislation, and 'Industry' guidance notes referred to within the study.

10.3.2 Assessment methodology will then be reviewed, describing assessment criteria used to assess the significance of both archaeological and built heritage assets reviewed within the study area, including the application site and immediate environs. This will include a statement regarding assumptions and limitations. A statement summarising consultation that has been undertaken is also made.

10.3.3 A description of existing, 'Baseline', conditions relating to Built Heritage assets is made focusing on The Square Eastergate and Church Lane Eastergate Conservation areas located to the north and north west of the application site. Built Heritage review is followed by description of 'Baseline' conditions for archaeology within the site and immediate site area.

10.3.4 The chapter will then assess Significant environmental effects both During and Post Construction for all classes of reviewed heritage assets. Assessment is made against stated criteria. [

10.3.5 A 'draft mitigation' proposal in relation to predicted archaeological assets and, where relevant, built assets is made.

10.3.6 Residual and cumulative effects are assessed.

10.4 Policy Context

10.4.1 Statutory Legislation. The statutory legislation most relevant to this report comprises of:

- The Ancient Monuments and Archaeological Areas Act, 1979: It is a criminal offence to carry out any works on or adjacent to a Scheduled Monument without Scheduled Monument Consent. The Act makes no reference to the setting of Scheduled Monuments.

- Planning (Listed Buildings and Conservation Areas) Act 1990: In considering whether to grant planning permission for development which affects a listed building or its setting, the decision maker shall have special regard to the desirability of preserving the building or its setting (section 66). Special attention shall be paid to the desirability of preserving or enhancing the character or appearance of a conservation area (section 72).

National Planning Policy

10.4.2 The National Planning Policy Framework (NPPF revised 2023) includes as a planning principle (Paragraph 8) an environmental objective which is "to contribute to protecting and enhancing our natural, built and historic environment..." Section 16 of the NPPF then goes on to describe provisions specifically relating to conserving the historic environment.

10.4.3 Paragraph 195 advises local planning authorities to require an applicant to describe the significance of heritage assets affected by their proposal, including any contribution made to their setting. It states that "the level of detail should be proportionate to the assets' importance and no more than is sufficient to understand the potential impact of the proposal on their significance".

10.4.4 The glossary to the NPPF describes significance in relation to heritage policy as "The value of a heritage asset to this and future generations because of its heritage interest. That interest may be archaeological, architectural, artistic or historic. Significance derives not only from a heritage asset's physical presence but also from its setting".

10.4.5 The 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 surrounding evolve. Elements of a setting may make a positive or negative contribution to the significance of the asset, may affect the ability to appreciate that significance or may be neutral'.

Local Planning Policy

10.4.6 The development site lies within the policy area of Arun District Council (ADC) (Adoption Arun Local Plan 2011-2031 (July 2018).

10.4.7 The Arun Local Plan covers the period 2011-2031 for the area of Arun District (excluding the area covered by the South Downs National Park Authority) and was adopted on the 18th of July 2018.

10.4.8 Sections specific to building conservation and archaeological heritage are contained within:

Local Policy: Arun District Council Local Plan 2011-2031 (2018) Arun Local Plan (Section 16: Building & Conservation and Archaeological Heritage) (2011-2013) adopted July 2018.

With specific reference to:

- Policy HER SP1. (Historic Environment)
- Policy HER DM 1 (Listed Buildings).

- Policy HER DM2 (Locally Listed Buildings or Structures of Character).
- Policy HER DM3 (Conservation Areas).
- Policy HER DM4 (Areas of Character).
- Policy HER DM5 (Remnants of the Portsmouth and Arundel Canal)
- Policy HER DM6 (Sites of Archaeological Interest).

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- 16.6 Portsmouth and Arundel Canal 201
- 16.7 Archaeological heritage 201

10.4.9 There is supporting guidance within the policy which requires that any development involving ground disturbance to have a desk based archaeological assessment and may require field evaluation.

10.4.10 Notice is also taken of ADC's Report to and decision of Planning Policy Sub-Committee (30th June 2020) regarding compilation of new list of non-designated heritage assets)

Guidance [industry specific].

10.4.11 Best practice guidance notes and standards relevant to the historic environment, and consulted in the production of this report comprise:

- Chartered Institute for Archaeologists Code of Conduct and Standard Guidance documents;
- National Planning Practice Guidance (2019, 2021 and updated vers. 2023)
- Historic England (2015) Historic Environment Advice Note 2 Making changes to Heritage assets,
- Historic England (2017), Historic Environment Advice Note 3, 2nd Edition, The setting of Heritage Assets, and
- Historic England (2008), Conservation Principles; Policy Guidance for Sustainable Management of the Historic Environment.
- WSCC, ESCC, CDC 2017, (updated 2019) Sussex Archaeological Standards

10.4.12 Conservation Principles (HE, 2008) sets out Historic England's approach to understanding heritage significance, and describes four groups of heritage 'values' which are referred to below:

- Evidential value: the potential of a place to yield evidence about past human activity.

- Historical value: the ways in which past people, events and aspects of life can be connected through a place to the present-it tends to be illustrative or associative.
- Aesthetic value: the ways in which people draw sensory and intellectual stimulation from a place.
- Communal value; the meanings of a place for the people who relate to it, or for whom it figures in their collective experience or memory.

10.4.13 Historic Environment Advice Note 3, 2nd edition, The Setting of Heritage Assets (HE 2017) recommends a staged approach to assessing effects on setting comprising the following stages:

1) Identify which heritage assets and their settings are affected;
2) Assess the degree to which these settings make a contribution to the significance of the heritage assets(s) or allow significance to be appreciated;
3) Assess the effects of the proposed development, whether beneficial or harmful, on that significance or the ability to appreciate it;
4) Explore ways to maximise enhancement and avoid or minimise harm;
5) Make and document decision and monitor outcomes.

10.5 Assessment Methodology & Significance Criteria

10.5.1 The assessment is based on information derived from the following data sources:

- The vertical and oblique aerial photographic collections of the National Monuments Record Centre of English Heritage at Swindon;
- The National Heritage List for current data on designated heritage assets;
- The National Monuments Record (Historic England);
- The West Sussex Historic Environment Record (HER) (WSCC);
- The Chichester Local Studies Library;
- The West Sussex Record Office, (including local studies published reference sources and maps held in their collections);
- British Geological Survey mapping; and
- A series (6 total) of site walkover survey of the site area and proximal Conservation Areas and key surrounding areas, by Christopher Pine and Neville Hall of Development Archaeology Services Limited.

10.5.2 A search of the West Sussex Historic Environment Record (HER) was undertaken for listed buildings and other designated sites such as scheduled monuments, historic battlefields and historic parks and gardens, archaeological sites and findspots and previous archaeological investigations within a 2.5km radius that was centred on National Grid Reference TF 9456 0440.

10.5.3 Copies of selected published Ordnance Survey maps of the area of the Site were obtained from the West Sussex Record Office and comprise Figures 4-8 within the DBA, set out below (See

10.5.4 Figure 10.1, Figure 10.2, Figure 10.3, Figure 10.4 and Figure 10.5). The results of the historical map regression are similarly presented within the DBA. Published reference sources were also consulted at the Record Office and the Chichester Local Studies Library.

10.5.5 A more detailed and thorough description of built heritage assets within the two conservation areas proximal to the Site is presented in Appendix 4 of the submitted DBA.

Figure 10.1: Extract from the First Edition 25 inch to one mile scale Ordnance Survey [O.S.] map of 1860, map sheet no. Sussex 62. The assessment site is shown outlined in red.



Figure 10.2: Composite extracts from the Second Edition six inch to one-mile scale Ordnance Survey [O.S.] maps of 1899, map sheet nos. Sussex 62NW, 62NE, 62SE & 62SW. The assessment site is shown outlined in red.



Figure 10.3: Composite extracts from the Third Edition six inch to one-mile scale Ordinance Survey [O.S.] maps of 1913-1914, map sheet nos. Sussex 62NW, 62NE, 62SE & 62SW. The assessment site is shown outlined in red.



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Figure 10.4: Composite extracts from the 1:10,560 scale Ordnance Survey (O.S.) maps of 1961-1963, map sheet nos. SU 90 SSE, SU 90 SW, SU 90 NE & SU 90 NW. The assessment site is shown outlined in red.

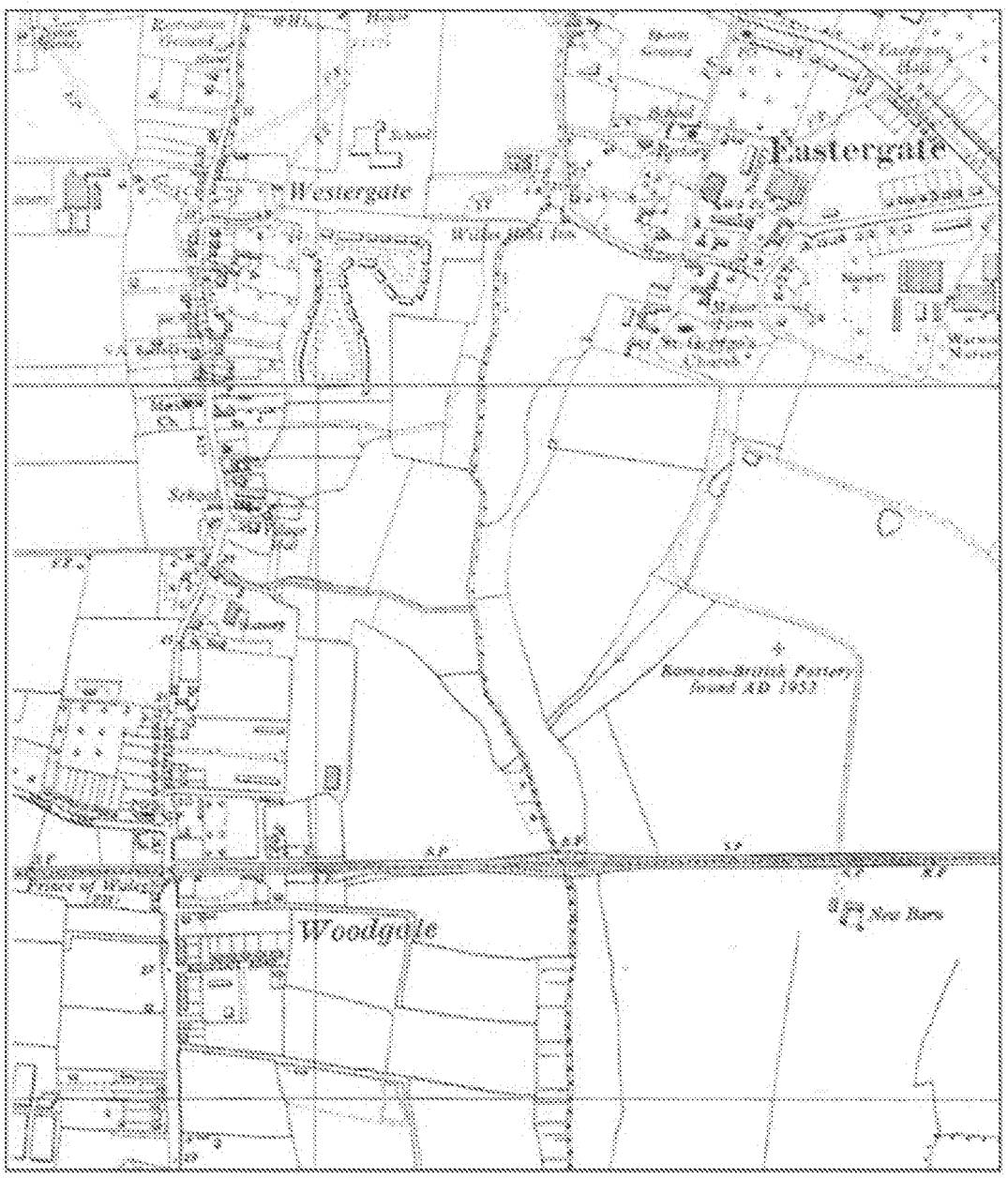
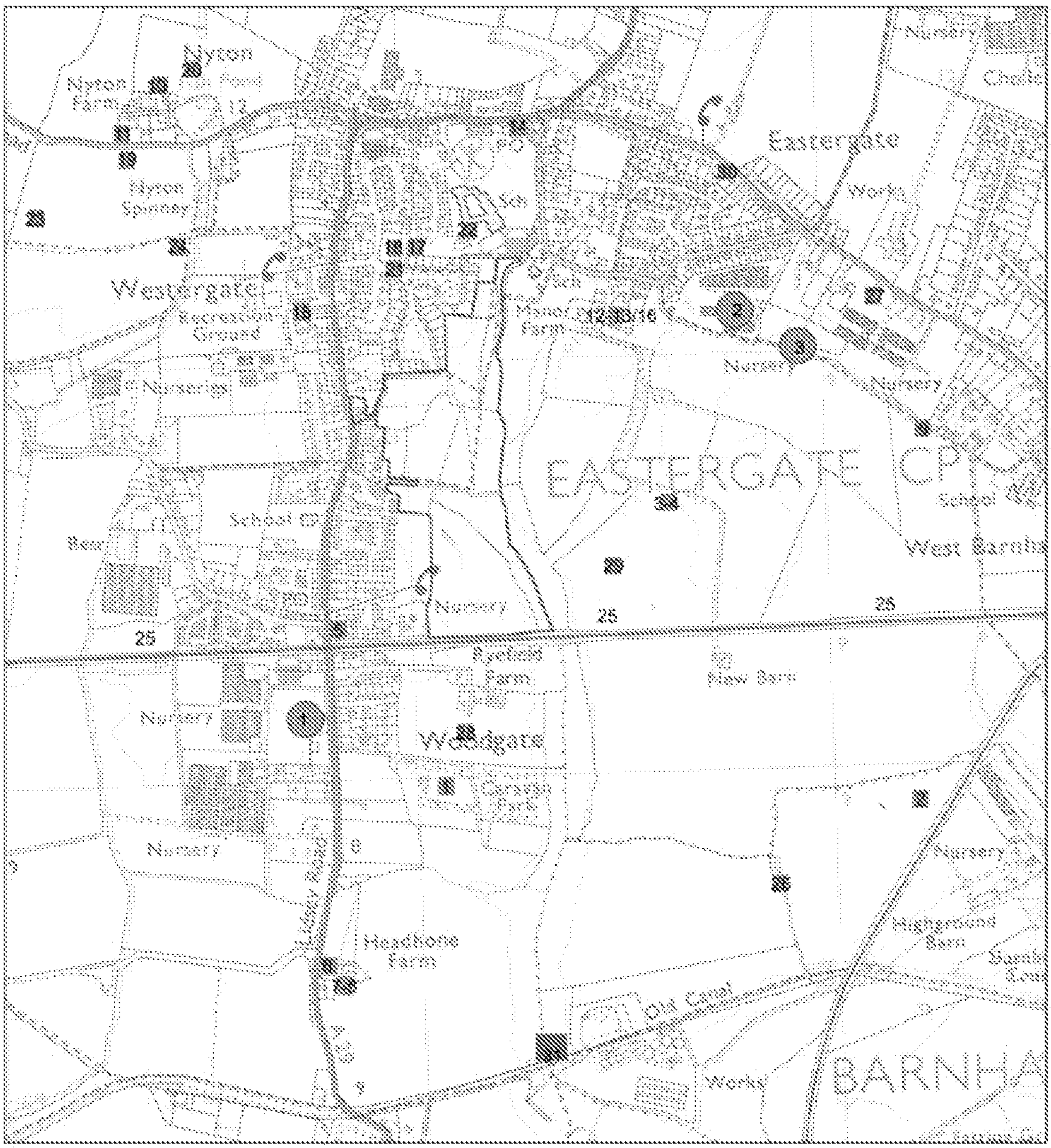


Figure 10.5: Cultural heritage sites within the vicinity of the assessment site at a scale of 1:12,500.



10.5.6 Consultation

10.5.7 DAS Ltd consulted at pre-data search stages and after compilation of reviewed data sets [suppled as a 'draft DBA copy] with ADC's appointed Archaeological officer. In addition, reference was made to Scoping Opinion advice given relating to Historic Environment & Archaeology [21:11:2022]

10.5.8 Assessing Heritage Significance

10.5.9 The significance of a heritage asset is described in terms of the value of the heritage asset because of its heritage interest (architectural, archaeological, artistic or historic) and is also described in relation to the asset's heritage values (evidential, historical, communal, and aesthetic.

10.5.10 For designated assets (Listed buildings, scheduled Monuments, Registered Parks and Gardens, Registered Battlefields, World Heritage Sites and Conservation Areas). the importance is high or very high as these assets meet the national criteria for designation under the relevant legislation. Listed Buildings and registered Parks and Gardens are graded (I* II* and II) according to relative significance.

10.5.11 The relative significance of each non-designated heritage asset within the historic environment baseline has also been determined to provide a framework for comparison. These categories do not reflect a definitive level of significance or value of a heritage asset, but a provisional one based om the asset's heritage values to provide an analytical tool that can inform later stages of assessment and the development of appropriate mitigation, where needed. Some non-designated heritage assets can be of equivalent importance to designated heritage assets. In these cases, their relative importance means they must be treated as if they were designated assets.

Table 10.1: Criteria for determining heritage significance

Significance	Description
Very High	Internationally and nationally important resources: World Heritage Sites, Grade I and Grade II* listed buildings and Registered Parks and Gardens. Some Scheduled Monuments, especially those associated with a World Heritage Site.
High	Nationally important resources: Grade II listed buildings, Conservation Areas, Scheduled Monuments, Grade II Registered Parks and Gardens, Registered Battlefields
Moderate	Regionally important resources: Non designated heritage assets and landscape features with high or moderate evidential, historical, aesthetic and / or communal values.
Low	Locally important resources: Non designated heritage assets and landscape features with low evidential, historical, aesthetic and / or communal value
Negligible	Assets with low to very low or no evidential, historical, aesthetic and / or communal values, ore where remains are known to have been significantly altered or destroyed.

Unknown	Assets and structures of uncertain character, extent and / or date where importance cannot be readily predicted.

10.5.12 The effects of the proposed development have been determined by comparing the significance of the known heritage assets (or potential for heritage assets with archaeological interest) against the magnitude of likely effect. The significance of a heritage asset can be harmed or lost by alteration or destruction of the asset or development within its setting.

10.5.13 In policy terms (NPPF paragraph 201 and 202), harm to the significance of a heritage asset can be substantial or less than substantial. Planning practice guidance identifies harm is a high test. This normally associated with total loss of a heritage asset's significance. Major adverse effects on heritage assets of moderate or high heritage significance are equivalent to substantial harm.

10.5.14 Less than substantial harm is a broader bandwidth and the degree of less than substantial harm is a professional judgement encompassing minor changes through to more significant effects. The conclusion in this report identify the overall significant effects of the proposed development on heritage assets in accordance with the following scale:

- None: no discernible change to any heritage asset, of any significance
- Minor: minor adverse changes to the significance of a heritage asset of moderate or high heritage significance, or significant adverse changes or total loss of significance to a heritage asset of low or negligible heritage significance
- Moderate: moderate adverse changes to the significance of a heritage asset of low or moderate heritage significance.

Magnitude of Change

10.5.15 Assessing the effect of the proposed development in relation to the historic environment baseline is then considered by comparing the relative significance of the heritage asset against predicted magnitude of change. This includes the assessment of the effects on the setting of heritage assets to determine whether, and to what degree, the heritage significance of an asset may be harms by development within its setting.

10.5.16 The description of magnitude of change, provided in Table 10.2, relate to harm to or loss of significance of the asset (and not, where development only affects its setting, the degree of change within that setting).

Table 10.2: Magnitude of Effect

Magnitude	Definition
High	Total loss or substantial harm to key elements, or features or characteristics of the baseline (predevelopment) conditions such that post development character or composition or attributes of baseline will be fundamentally lost or changed.
Moderate	Partial loss or harm to one or more important elements or features or characteristics of the base line (pre development) conditions such that post development character or composition or attributed of base line will be partially changed
Low	Minor loss. Change arising from the loss or alteration will be discernible but underlying character or composition or attributes of the baseline condition will be similar to pre-development circumstances or patterns.
Negligible/None	No loss or harm to heritage significance. Change barely distinguishable.

Significance of Effect

10.5.17 Determining the overall significance of effect is then a professional judgement that compares the magnitude of effect against the relative sensitivity of the heritage asset affected.

Table 10.3: Significance of Effect

Magnitude	Importance of Receptor				
	Very High	High	Moderate	Low	Negligible
High	Major	Major or Moderate	Moderate	Low	Negligible
Moderate	Major or Moderate	Moderate	Low	Low or Negligible	Negligible or None
Low	Moderate or Low	Low	Low or Negligible	Negligible	None

Negligible/ None	None	None	None	None	None

10.5.18 Heritage policy makes a distinction between substantial and less than substantial harm (NPPF, paragraphs 201-202). For the purpose of this assessment, major adverse effects are equivalent to substantial harm.

10.5.19 Moderate and low effects are equivalent to less than substantial harm. Effects that are negligible are less than substantial and are also not significant.

Assumptions and Limitations

10.5.20 Monument data from the HER and NMR consists of secondary information derived from varied sources. This data, as well as that derived from other secondary sources, is generally accurate. There are however several limitations to the data set, generic to any historic environment assessment. For example, where the known archaeological data relates to chance finds, or cropmark evidence, the full extent, date and nature of the asset is often uncertain. Also, a number of records, especially older records such as antiquarian finds, excavations or observations often fail to accurately locate assets.

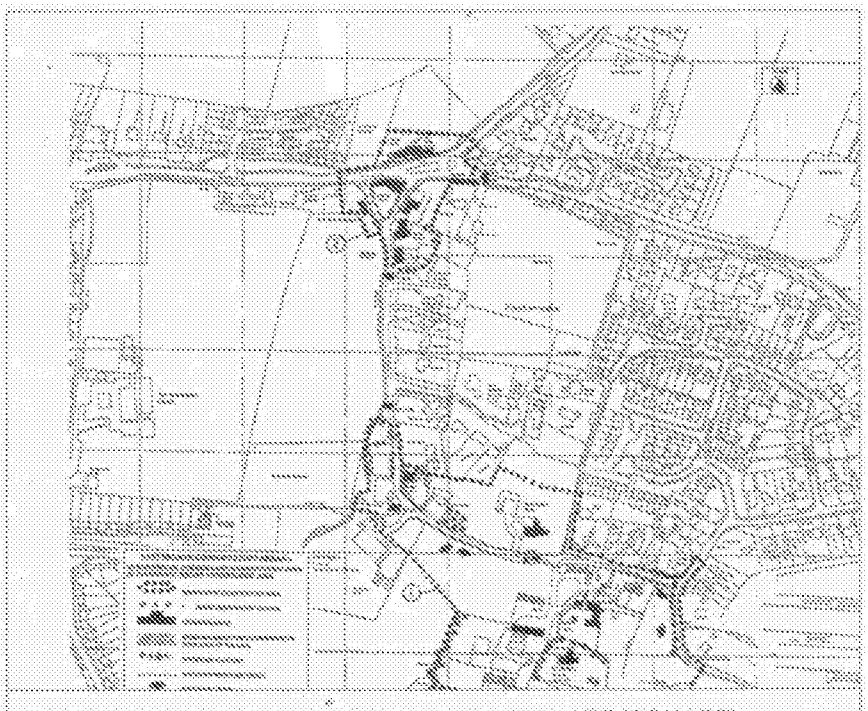
10.5.21 Due to these limitations, it is possible that previously unrecorded heritage assets with archaeological interest could survive within the proposed area of development. Additionally, due to the buried and invisible nature of archaeological assets, there is often an element of uncertainty regarding the survival, condition, nature and extent of any such assets, which walk over survey, cannot always clarify.

10.6 Baseline Conditions

10.6.1 Existing Conditions

10.6.1.1 The baseline conditions are those which describe the state of the environment and here specifically the built heritage resource, prior to the onset of any proposed development. In this case, these conditions have been assessed through searches and assessment of conditions presented within the submitted accompanying DBA [Appendices 4A and 4B], see Figure 10.6 and Figure 10.7, and a summary of the conclusions presented below.

Figure 10.6: Description of Character and Appearance of Conservation Areas



EASTERGATE (CHURCH LANE) AND EASTERGATE (SQUARE) CONSERVATION AREAS

Description of the Character and Appearance of the Conservation Areas

The village of Eastergate is situated on the A29, some 5 miles north of Bognor Regis. The Conservation Areas were designated in June 1982.

The Church Lane Conservation Area retains its rural character and the essential historic characteristics of a rural, agricultural, settlement based on the Manor House (18th Century), St. George's Church (Norman) and farm buildings, including a granary on staddle stones.

The rural character of the area is further enhanced by impressive views across open fields towards this group of buildings and the village generally.

By contrast, the area of Eastergate Square is more urban in its character with a close knit grouping of buildings of various styles and ages fronting the main roads, reflecting the historic development of the village at a road junction.

In addition to the attractiveness of individual buildings and their grouping, a variety of brick and flint walling and boundary hedges contribute to the special character of these Conservation Areas.

Figure / Plan ES2

[reproduced from DBA Appendix 4A Figure 1]

Figure 10.7: Location of Conservation Areas relative to proposed development

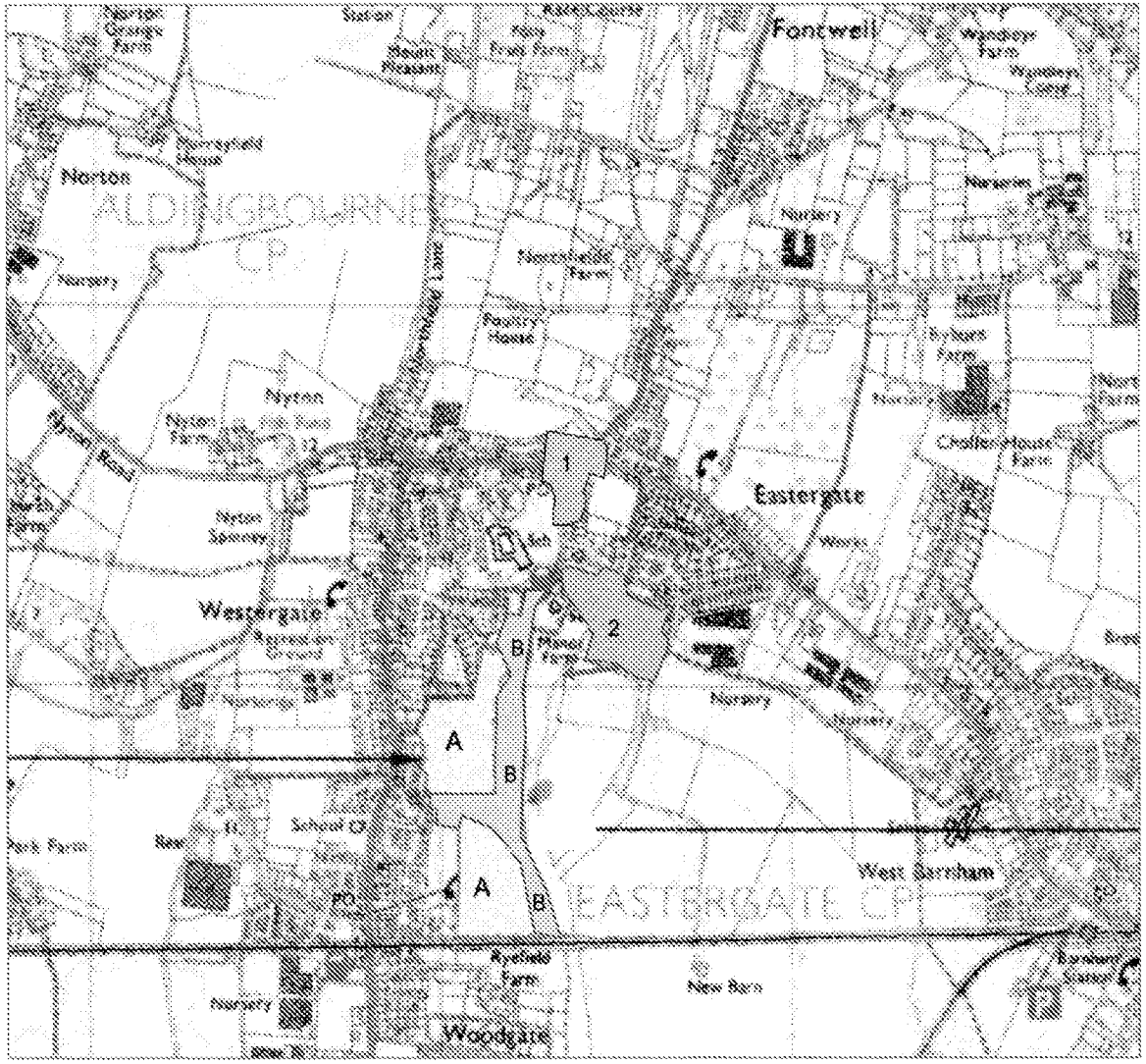


Figure 4. [from Appendix 4B of accompanying DBA]

Location of Conservation Areas relative to proposed application site area and build/landscpe areas within the application site.

1: The Square Conservation Area

2: Church Lane Consevation Area

B: Proposed landscpaed / open areas witin the application site

A: Main development 'build' footprint areas

Figure / Plan ES1

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10.6.1.2 This assessment study incorporates portions of three modern civil parishes, those of Aldingbourne, Barnham and Eastergate. To the west are the modern settlements of Woodgate and Westergate and towards the north, a third modern settlement of Eastergate, which traverses the northern portion of the assessment site.

10.6.1.3 The assessment site is situated on the low-lying Lower Sussex Coastal Plain, the centre of which is located at National Grid Reference TF 9456 0440, and at heights of approximately +5mAOD to the south, rising to +9-12m AOD (Above Ordnance Datum) to the north. The assessment site is situated within the modern civil parishes of Eastergate, Barnham and Aldingbourne, administrative district of Arun, county of West Sussex.

Conservation Areas

10.6.1.4 The Site lies proximal though not within two Conservation Areas. Reviewed Conservation Areas include: The Square Eastergate; Church Lane Eastergate, set out at Figure / Plan ES 1. A summary description [From ADC's description] of both the Church Lane and Eastergate [The Square] conservation areas are given at Figure 10.6 and Figure 10.7.

10.6.1.5 No Listed Buildings or significant heritage assets lie within the Proposed Development boundary. The main concentrations of designated Listed buildings and non-designated buildings and buildings of character lie within the two proximal Conservation Areas - The Square Eastergate and Church Lane Eastergate.

10.6.1.6 A fuller record including plans showing Conservation Areas relative to the proposed site layout and location of assets within each Conservation Area is shown within Appendix 4 of the DBA submitted to accompany the application.

10.6.1.7 A summary list of built assets within each Conservation Area is presented below, including a case by case assessment of the asset's significance and potential effect of the proposed development based on criteria presented in Table 10.1, Table 10.2 and Table 10.3 of this document. These criteria have been used throughout the study.

10.6.2 The Square Conservation Area:

10.6.2.1 Description of Built assets within: The Square Eastergate, Church Lane

The centre of the SQUARE EASTERGATE CONSERVATION AREA sits approximately 0.7km from the north western corner of the proposed development site. This Conservation Area is centred around the northern junction of Church Lane and the B223 [Yapton Road].

10.6.2.2 THE LONG HOUSE, NYTON ROAD

Listed Building Grade: II

List Entry Number: 1353814

Details: C18. Two storeys. Four windows. Painted brick. Modillion eaves cornice. Tiled roof. Glazing bars intact. Modern porch. This building forms a Group with Elm Tree Stores, Shelley House, The White House, Flint House and Nos 1-3 Malthouse Cottages in Church Lane, Eastergate.

Heritage significance, magnitude and significance of effect of proposed development: The asset is considered to be of local significance and have a moderate to low heritage significance. Magnitude of effect is considered to be negligible to none. Significance of effect negligible / none.

10.6.2.3 ARGYLL HOUSE, NYTON ROAD

Listed Building Grade: II

List Entry Number: 1232582.

Details: Early C19. Two storeys. Two windows. Glazing bars missing. Porch of solid type. Ground floor wing of two windows to west. This building forms part of a Group with Elm Tree Stores, Shelley House, The White House, Flint House and Nos 1-3 Malthouse Cottages.

Walkover notes: Both Argyll House and the adjacent Long House sit to the north of the busy B2233 trunk road. These buildings form / lie adjacent to northern boundary of the conservation area with a 'pasture' field. The buildings lie minimally 0.75km from the northern edge of the proposed development site area. The northern conservation area boundary lies c. less than 50 metres from the Nyton Road [extra care development and the Peckham Chase residential development.

Heritage significance, magnitude and significance of effect of proposed development: The asset is considered to be of local significance and have a moderate to low heritage significance. Magnitude of effect is considered to be negligible to none. Significance of effect negligible / none.

10.6.2.4 EASTERGATE MEMORIAL

Listed Building Grade: II

List Entry Number: 1274452

Details: War memorial. Circa 1920. Sculptor Morris Harding RBS SO. Catafalque type structure built of solid stone blocks, six courses in height with the top course shaped to represent a mound on which a full-sized lion sits. Below the lion's paws is a carved wreath surrounding a FOR VALOUR inscription carved in Art Nouveau style. Below this on the front face of the cenotaph is an eleven-line inscription in bold and well-spaced capitals defining the purpose of the memorial. Names carved round the base. A remarkably realistic effect at the rear

is the handling of the lion's tail. The whole is a dignified piece of symbolism, somewhat in the manner of Lutyens, highly original in concept and imaginatively sited. Additions have been made for the Second World War.

Walkover notes: This monument is located within a traffic island where the A29 and B2233 meet. Interestingly the listing description [see above] records the monument as being imaginatively sited. The author would suggest the monument might be considered as sited 'at risk! The location within a busy road traffic junction means the monument is at risk, as suggested by several impact scars around the monuments basal pedestal.

Heritage significance, magnitude and significance of effect of proposed development: The asset is considered to be of high heritage significance. Magnitude of effect is considered to be negligible to none. Significance of effect negligible / none.

10.6.2.5 SHELLEY HOUSE AND THE ELM TREE STORES, CHURCH LANE

Listed Building Grade: II

List Entry Number: 1353883.

Details: One building. L-shaped C18 building. Two storeys. Three windows. Painted brick. Stringcourse. Tiled roof. Glazing bars intact. The shop premises are the north west wing with a modern curved shop front in old style.

Walkover notes: The building fronts to the B2233 with the rear being characterised by piecemeal development of low elevation store and associated buildings. The buildings sit within a 'triangle' of mixed brick and flint perimeter walling.

Heritage significance, magnitude and significance of effect of proposed development: The asset is considered to be of high heritage significance. Magnitude of effect is considered to be negligible. Significance of effect negligible.

10.6.2.6 THE WHITE HOUSE, CHURCH LANE

Listed Building Grade: II

List Entry Number: 1233557

Details: C18. Two storeys. Three windows. Faced with rough plaster. Modillion eaves cornice. Tiled roof. Glazing bars intact. Doorway with Doric pilasters and pediment. West wall faced with flints.

Walkover notes: This building sits by itself isolated at the eastern junction of the B2233 and one of the dual spurs at the north of Church Lane. The southern elevation is masked / bounded by the listed Flint House immediately to the south.

Heritage significance, magnitude and significance of effect of proposed development: The asset is considered to be of high heritage significance. Magnitude of effect is considered to be negligible. Significance of effect negligible.

10.6.2.7 OLD FARM COTTAGE, CHURCH LANE

Listed Building Grade: II

List entry No. 1353809.

Details: C18 or earlier. Two storeys. Two windows. Painted brick. Thatched roof. Casement windows.

Walkover notes: This building occupies a counterpoint position to The White House as it sits on the west side of a second spur of Church Lane that joins the B2233. The main font element of the building is augmented by a tiled roof modern extension

Heritage significance, magnitude and significance of effect of proposed development: The asset is considered to be of high heritage significance. Magnitude of effect is considered to be negligible. Significance of effect negligible.

10.6.2.8 FLINT HOUSE, CHURCH LANE

Listed Building. Grade II

List entry No. 1027647.

Details: L-shaped building. South wing C17. North east wing C18. Two storeys. Four windows facing west, three windows facing south. Faced with squared knapped flints with red brick dressings and quoins. Tiled roof. Gable to west end of south wing. Casement windows. Doorway with flat hood on brackets.

Walkover notes: This building may be considered as forming a localised grouping with Malthouse Cottages 1-3 that lie to the immediate south.

Heritage significance, magnitude and significance of effect of proposed development: The asset is considered to be of high heritage significance. Magnitude of effect is considered to be low to negligible. Significance of effect negligible.

10.6.2.9 MALTHOUSE COTTAGES, 1-3, CHURCH LANE

Listed Building. Grade II

List entry No. 1233536.

Details: One building. C17. Two storeys. Four windows. Faced with knapped flints with red brick dressings, quoins and stringcourse. Tiled roof. Casement windows. Two blocked smaller original windows. Large buttress at south end.

Walkover notes: These 'terraced' flint cottages occupy the eastern side of Church Lane and are the most southerly of the group pf listed buildings that lie immediately to the south of the B2233. In style and structure, they may be considered as sub-group with the more northerly though adjacent Flint House.

Heritage significance, magnitude and significance of effect of proposed development: The asset is considered to be of high heritage significance. Magnitude of effect is considered to be low to negligible. Significance of effect negligible.

10.6.2.10 MERRYEND

Listed Building Grade: II

List Entry Number: 1027742

Detail: C18. Two storeys. Three windows. Faced with flints with brick dressings and quoins, all now painted. Tiled roof. Casement windows. C19 addition of two window-bays to the west in painted brick with slate roof. This building, the most westerly of the listed grouping lies immediately south of the B2233.

Heritage significance, magnitude and significance of effect of proposed development: The asset is considered to be of high heritage significance. Magnitude of effect is considered to be low to negligible. Significance of effect negligible.

10.6.3 The Church Lane Eastergate Conservation Area

10.6.3.1 **THE CHURCH LANE EASTERGATE CONSERVATION AREA lies at the north western corner of the proposed** development area Its southern boundary contacts the north western boundary of the proposed development area. At this southern boundary and to the south of this boundary land use is retained, within the proposed development, as open 'park space'. This Conservation Area is accessed via Church Lane with significant buildings along the north of Church Lane. The centre of the Conservation Area is focused on the Manor Farm yard area that is associated with St Georges Church and its associated curtilage.

10.6.3.2 **List entry: 1233516 Parish church of St. George, Church Lane, Eastergate**. Grade II* Chancel, nave with shingled bell-turret at west end and north vestry. Largely Norman though much restores with later windows. Vestry C19th addition.

Walkover notes / observations: The church building sits biased within the north west curtilage of a c. 7,000m^2 church / grave yard. The site is bounded predominantly by mature mixed hedgerows. To the immediate north

the churchyard lies adjacent to the garden of Eastergate House. The western boundary lies adjacent to a farmyard / farm building complex consisting predominantly of Mid C20th agricultural buildings. To the east the graveyard contacts open grass / paddock areas. To the south, external to the east west aligned mature hedge line lies an east west aligned 'paddock' area of c. 2,500m^2. The southern boundary of the paddock area runs parallel and adjacent to a concrete service / farm track. The church building and associated grave/church yard site within the south east of the designated 'Conservation Area'

Heritage significance, magnitude and significance of effect of the proposed development:
The asset is considered to be of high to very high heritage significance. The heritage significance is invested in the fabric of the building and partly, though to a lesser extent in its location as a 'centre / focus' within the Church Lane Conservation Area.
There will be no physical impact on the fabric of the building.

Magnitude of effect, specifically relating to views to and from the asset is considered low to possibly moderate. Significance of effect is considered to be low.
It is considered that the proposed development, particularly as regards increasing public access / availability of access to appreciate views towards the asset from the south may be considered to have a moderately beneficial effect.

10.6.3.3 **List entry No: 1027645: Grade II listed 17th century barn & cart shed, at Manor Farm, Church Lane, Eastergate**. NGR: SU94484 05123

Structure located within the curtilage of Manor Farm to the south west of the farmhouse main building. Possibly C17th. East wall is of red brick with a diaper pattern of grey headers. The remainder is face with flints and may be later period construction. There are stone steps up to the entrance on the northern side. The western part of the building / structure forms the cart-shed with the lower part open and weather-boarded above. Corrugated roof [later addition] to the whole.

Walkover notes / observations: The Grade II listed 17th century barn & cart shed sits in the south eastern corner of the open farm yard / barnyard complex that lies to the immediate south of Church Lane. The barn 'defines' the southern edge of the open 'historic' farmyard complex with all farm buildings and associated infrastructure, to the immediate west and east, being mid to late C20th. The modern agglomeration of barns and modern buildings form a distinct visual barrier to open farm land to the west and south and the proposed development site.

Heritage significance, magnitude and significance of effect of the proposed development: The asset is considered to be have a high heritage significance. Magnitude of effect is considered to be negligible. Significance of effect negligible.

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10.6.3.4 **List entry: 1233525: Granary / outbuilding at Manor Farm to the north west of the farmhouse, Church Lane, Eastergate**. [Formerly listed as Outhouse with Manor Farmhouse] C17th timber framed building with redbrick infilling standing on steddle-stones. Half-hipped tiled roof.

Walkover notes / observations. The Grade II granary building sits within the northern part of the 'historic' open farm yard area that lies to the south of Church Lane. It's location and design and build characteristics link it to the Manor farmhouse that lies immediately to the east.

Heritage significance, magnitude and significance of effect of proposed development: The asset is considered to have a high heritage significance. Magnitude of effect is considered to be negligible. Significance of effect negligible.

10.6.3.5 **List entry: 1353881: Grade II listed Eastergate House, Church Lane, Eastergate, a late 18th or early 19th century house**.

C16th timber-framed building of half H-plan with infilling of redbrick, plaster and flint. Roof tiled. Two storey structure with three windows. Modern [late C19th / C20th] part added to west end of south wing.

Walkover notes / observations: At time of walkover no clear access to the grounds / garden of Eastergate House was possible. No view of the north, west or south elevations was possible. From air photographs only it may be noted that the eastern garden area of Eastergate House extends to a discreet garden area adjoins an open paddock / pasture area that extends eastwards for approximately 100metres in turn bordering an open arable field.

Heritage significance, magnitude and significance of effect of proposed development: The asset is considered to be of high heritage significance. Magnitude of effect is considered to be negligible. Significance of effect negligible.

10.6.3.6 **List entry 1353882: Grade II: The Old House, Church Lane**. C18th two storey 2 windows Faced with square knapped flints with red brick dressings and quoins. Hipped thatched roof. Casement windows.

10.6.3.7 **List entry 1276546: Grade II: The Wilkes Head Inn**. c. 1763. Two storeys and attic. Three windows. Two Hipped dormers. Red brick. Stringcourse. Tile roof. Casement windows. Doorway with flat hood on brackets and door of six fielded panels.

Walkover notes / observations: Both the Old House and Wilkes Head lie at the extreme north west of the conservation area. They have limited views towards the proposed development site area [from upper floors only]. The C20th Eastergate primary school building complex lies immediately to the south of these buildings.

Heritage significance, magnitude and significance of effect of proposed development: The assets are considered to have a high heritage significance. Magnitude of effect is considered to be negligible. Significance of effect negligible.

Table 10.4: Assessment of Effect During Operation, During Construction and Post Construction

Asset	Heritage Significance	Magnitude of Effect	Significance of Effect
The Square Eastergate Conservation Area			
The Long House Nyton Road	Local significance; Moderate to Low Heritage significance	Negligible / none	Negligible / none
Argyll House, Nyton Road	Local significance; Moderate to Low Heritage significance	Negligible / none	Negligible / none
Eastergate Memorial	High heritage significance	Negligible / none	Negligible / none
Shelley House and the Elm Tree Stores, Church Lane	High heritage significance	Negligible	Negligible
The White House, Church Lane	High heritage significance	Negligible	Negligible
Old Farm Cottage, Church Lane	High heritage significance	Negligible	Negligible
Flint House, Church Lane	High heritage significance	Negligible	Negligible
Malthouse Cottages, 1-3 Church Lane	High heritage significance	Low / Negligible	Negligible
Merryend	High heritage significance	Low / Negligible	Negligible
The Church Lane Eastergate Conservation Area			
Parish Church of St George, Church Lane, Eastergate	High to Very High heritage significance	Moderate (esp views from the asset to the south and south-west)	Moderate Beneficial (not significant) (The Proposed Development will increase public access and availability of access to appreciate views of the asset)
17th Century barn and cart shed, Manor Farm, Church Lane, Eastergate	High heritage significance	Negligible	Negligible
Granary / outbuilding at Manor Farm to the north	High heritage significance	Negligible	Negligible

Asset	Heritage Significance	Magnitude of Effect	Significance of Effect
west of the farmhouse, Church Lane, Eastergate			
Eastergate House, Church Lane, Eastergate	High heritage significance	Negligible	Negligible
The Old House, Church Lane			
The Wilkes Head Inn	High heritage significance	Negligible	Negligible

10.6.4 Assessment of Impacts

10.6.4.1 The most significant built heritage assets are contained within two 'Conservation Areas' all of which lie outside the proposed Site boundary though at potential risk of effect from the Proposed Development. It is considered that the 'more urban' character The Square, Eastergate Conservation Area will remain unaffected by the development proposal.

10.6.4.2 Within the Church Lane Conservation Area, The Grade II* listed parish church of St George at Eastergate is situated close to the north western boundary of the Site. Some modification to the setting of this asset is anticipated though it is considered the most significant and valued views to and from the asset will be mitigated by the maintenance of extensive views to the south by the landscaping strategy detailed within the application with extensive views to and from the area, particularly from and to the south being largely preserved with public access of views towards, particularly St George's' Church, being maintained and possibly enhanced. Note: The assessment of impact should also be considered against proposed landscaping, site layout presented within application BN/11/22/OUT where public access to allow views from open ground to the south of St George's Church are enhanced.

10.6.4.3 The Grade II listed granary/outbuilding, barn and cart shed at Manor Farm, Eastergate and the Manor Farmhouse itself are similarly located to the north east of the Site. All of these buildings are situated within a farmstead complex and will be largely screened off from potential development on the Site, so the potential impact on the setting of these respective buildings will be low. Similar considerations may apply to the setting of the Grade II listed Old House, Church Lane, which will also be screened from potential development on the Site, so the potential impact on the setting of this building will also be low. The same consideration would also apply to the setting of the Grade II listed Thatched Cottage, Barnham Road. This building is situated well away from the Site, so there will be no impact from the Proposed Development here on the setting of this building.

10.6.4.4 Both the Square Eastergate and Church Lane Barnham Conservation Areas lie at some significant distance from the Site boundary and it is considered that there will be nil impact to the fabric of any designated and non-designated built assets within these Conservation Areas.

10.6.4.5 No significant residual effects are anticipated during the construction or operational periods and post construction in respect of the historic built environment are anticipated.

10.6.5 Built assets reviewed within study area though external to reviewed Conservation Areas.

10.6.5.1 Chichester Arundel Canal (14 MWS5754)

A significant feature located outside and to the south of the Site is the line of the now derelict Chichester Arundel Canal (HER MWS5754). This east west orientated liner feature is predominantly filled in and only partially visible. The line of the Portsmouth to Arundel canal is afforded special significance within the Arun District Council Local Plan.

At present the canal route exist only as a variable largely ephemeral feature recognised predominantly from the historic cartographic record. Some elements of the original structure / forming are present though visible only as localised topographic anomalies.

Note: A review of the heritage significance of the Chichester Arundel Canal, based on visual assessment would suggest the significance is nil though as included and receiving special mention within the local plan this may be elevated to low. Its significance is considered based primarily on its presence as an historic feature recorded within the cartographic record.

10.6.5.2 The site of the former 19th century Headhone Farm, which is shown on the First Edition Ordnance site map occurs to the east of the present Headhone Farm [HER MWS8025]. The farmstead shifted to the west in the late 19th century. This later Headhone Farm site has been identified as an historic farmstead of late 19th century origin [HER MWS11289]. This farmstead is set around a regular 'U'-shaped courtyard with additional detached elements. The farmhouse is detached and set away from the yard. The site was in an isolated location and is extant.

Effects are anticipated or predicted to be nil during the construction period or post construction on this heritage feature.

10.6.5.3 At the mainline railway which extends through Woodgate is the site of Woodgate Railway Station [HER MWS5682]. The building survives at this location as a single storey building and dates to the construction of this railway in c1846. Nearby is a former railway crossing keepers' cottage also constructed at about the same time.

Effects are anticipated or predicted to be nil during the construction period or post construction on this heritage feature.

10.6.5.4 The Grade II Milliards Manor Farmhouse [List entry 1027707] is located on the east side of Westergate Street [A29] at SU 93888 04942 to the approximately 80m to the west of the proposed site boundary. The building is

a two storey C18th building with stuccoed elevations under a tiled roof. Modern, C20th residential development lie between this building and the western site boundary.

Effects are anticipated or predicted to be nil or negligible during the construction period or post construction on this heritage feature.

10.6.5.5 The Grade II Timbers [List entry 1027706 is located on Westergate Street [A29] at SU 93871 04984 to the north of Oaks Close and approximately 80m from the north west corner of the proposed site boundary. The building is two story C16th cottage with flint infilling with thatched roof with two eyebrow windows. Modern, C20th residential development lie between this building and the north western site boundary.

Effects are anticipated or predicted to be nil during the construction period or post construction on this heritage feature.

10.6.5.6 The Grade II Old Manor House [List entry 1027705 is located to the west of the [A29] at SU 93819 05132 to the north of The Cornfields and south of Oliver's Meadow approximately 200m from the north west corner of the proposed site boundary. Dense mixed residential development [modern] lie in between the Old Manor House and the north west corner of the site. The building is C17th two storeys with four casement windows with ground floor façade faces with red brick dressing and quoins, above red brick and grey headers. The roof is tiled.

Effects are anticipated or predicted to be nil during the construction period or post construction on this heritage feature

10.6.6 Archaeology Baseline Conditions

Summary of Recorded archaeology within the search area.

10.6.6.1 The accompanying Archaeological Desk-Based Assessment has identified widely scattered, very limited and fragmented archaeological activity and finds from the Bronze Age period. Within the area surrounding the assessment site, this has comprised a hoard consisting of eight celts and a palstave axe which were found during the excavations for a railway cutting on the Bognor railway branch line in the 19th century and a Bronze Age urn found off Eastergate Lane in 1954 to the north of the assessment site. It is considered that the potential for Bronze Age archaeological activity and finds to be made on the proposed development site is low to possibly moderate.

10.6.6.2 No archaeological activity or finds from the Iron Age period have been made within the study site area. To the immediate north-east, an archaeological evaluation in 2010 at Barnham Manor identified a boundary ditch which yielded two residual sherds of Iron Age pottery. Given this very limited evidence, the potential for Iron Age archaeological activity and finds to be made on this assessment site is low to possibly moderate.

10.6.6.3 An archaeological evaluation on Church Lane, Eastergate in 2000 and just outside the area of the assessment site located fragments of worked and burnt flint of prehistoric date. This similarly represents very limited and fragmentary evidence of archaeological activity and finds and so it is considered that the potential for general prehistoric archaeological activity and finds to be made on this assessment site is also low.

10.6.6.4 There is some evidence for archaeological activity and finds from the Roman period which have been made within the area of the assessment site. This consists of the site of a possible villa, which has been plotted from prior aerial photographic analysis to the north-west of New Barn, approximately 350metres from the central eastern boundary of the application site. A large assemblage of pottery, fragments of roof tile, oyster shell and animal bone have also been found at this location, supporting this interpretation. To the north-east of the assessment site, an archaeological evaluation in 2010 at Barnham Manor identified a boundary ditch of Roman date. An archaeological evaluation on Church Lane, Eastergate in 2000 and just outside the area of the assessment site found a fragment of Roman roof tile. However, this still represents scattered, fragmented and limited evidence of such activity and finds, so this potential is also considered to be **moderate**.

10.6.6.5 No evidence for archaeological activity and finds from the Anglo-Saxon period have been made within the area of the assessment site; though settlements such as Eastergate and Barnham appear to have had Anglo-Saxon origins from place name evidence. Despite this, it is considered that the potential for archaeological activity and finds from the Anglo-Saxon period to be made on this assessment site is **low**.

10.6.6.6 There is similarly very limited, widely scattered and fragmentary evidence for medieval archaeological activity and finds here also. Within the area of the assessment site, this has comprised sherds of medieval pottery that were found on the surface of a ploughed field in 1952 to the north-west of New Barn and the site of a chapel at Lidsey to the south-west.

10.6.6.7 The site of a second medieval chapel is situated to the south east of the assessment site at Sack Lane, Lidsey. An archaeological evaluation on Church Lane, Eastergate in 2000 and just outside the area of the assessment site located medieval boundary ditches which produced sherds of 11th-13th century pottery. It is thus similarly considered that the potential for archaeological activity and finds from the medieval period to be made on this assessment site is low to possibly moderate.

10.6.6.8 To the east of the present Headhone Farm, and within the area of the assessment site is the site of a former 19th century farmstead which is shown on the map of 1880 also known as Headhone Farm, a precursor of the present farm. To the north-east and also within the area of the assessment site is the site of a 20th century brickfield at West Barnham. Within the northern portion of the assessment site, is the site of a second 19th century farmstead at Follyfoot Farm. At Woodgate, and to the immediate west of the assessment site is the site of a former brickworks.

10.6.6.9 Three recent [2022/23] excavations/site investigations undertaken by DAS Ltd within the study area. were not at time of review logged with the county SMR [see Figure 9 of the submitted DBA].

An investigation undertaken in relation to planning application AL.129/21/OUT, at land off Lidsey Road, Woodgate, Aldingbourne [site centre located at approximately SU 9350 0390] recorded only remnants of land drains dated to c. late C19th / early C 20th. At this site archaeological trial trenching did not identify any significant archaeological activity or finds.

An investigation undertaken in relation to planning application BN/153/20/PL , at land at the Bowereis, Barnham Road, Eastergate [site centred at approximately SU 94917 05113] recorded only The archaeological features that were identified were either of modern 20th century origin comprising possible ditches and land drains or were features such as brick foundations and water pipes that were associated with the former nursery that had stood on this site.

An investigation undertaken in relation to planning application BN/135/20/PL, at The Boweries, Barnham Road, Eastergate, [site centre located at approximately SUSU 050 051]] recorded a deposit sequence consisted of a topsoil horizon and an underlying natural horizon of brickearth which was consistent over the whole site. It is however, worthy of note that there was a moderate-frequent density of fragments of prehistoric burnt flint within the makeup of the underlying natural horizon of brickearth indication possible bronze age or iron age activity.

10.6.6.10 The aerial photographic analysis undertaken for this study identified evidence for the earthwork cultivation remains of ridge and furrow, also of probable post-medieval date. These were similarly in isolated locations and were highly fragmented and scattered in nature. This is reflected in the highly intensive nature of the farming activity which has taken place within the area of the assessment site for the past century. Given all of these aforementioned factors, the potential for post-medieval and early modern archaeological activity and finds to be made on this assessment site is also considered to be low to possibly moderate

10.6.6.11 A geophysical survey [Magnetometry survey; see Appendix 5 of the submitted DBA and requested at consultation / scoping opinion stage] was undertake over available sub-site areas during first week June 2023. The results indicate the presence of a group of anomalies in the centre of the site that include a possible rectilinear feature although the origin is uncertain Within the southern part of the site a small quantity of weakly positive linear features is recorded though these lack a clearly defined morphology. Results in summary suggest moderate to low potential over the surveyed site area that would require testing by a probable phase of post determination investigation. The precise scope and detail of investigation to be determined after consultation with the LPA's archaeological planning officer.

10.6.6.12 NOTE AS REGARDS SITE POTENTIAL: Previous archaeological investigations undertaken by Development Archaeology Services Limited and others on the Lower Sussex Coastal Plain have yielded unexpected

discoveries of archaeological activity from the later prehistoric periods (from the Bronze Age and Iron Age periods) through to the Romano-British period. Although there is no direct evidence to suggest this, it is possible that similar such unexpected archaeological activity and finds may be encountered on this assessment site, despite the low archaeological potential identified from these periods by this study. This factor will be strong and overriding consideration in framing potential mitigation.

10.6.7 Archaeology: Future Baseline [during and post construction]

10.6.7.1 It is considered highly probable that given the assessment of archaeological potential as detailed in the submitted DBA and referred to above that archaeological site investigation will be stipulated 'by Condition' within all areas where ground impact associated with the development is predicted to occur, this to include foundation runs, service installations, landscaped areas and main and service roadways.

10.6.7.2 It is advised that investigation is likely to be required post determination though in advance of construction. The precise details of investigation methodology [remote sensing or intrusive investigation by trail trenching etc. to be detailed in a 'Written Scheme of Investigation' [a WSI] for investigation that will be prepared in response to and to address any imposed Condition.

10.6.7.3 It is anticipated that investigation will be phased and undertaken in advance of each 'build / construction' phase. Review of the results of site investigation undertaken, at each phase within the proposed development area will be reviewed. NOTE: Assessment of results will influence scope of future investigations both within the proposed development site and any future proximal development area.

10.6.7.4 Should significant and minimally regionally significant archaeology be anticipated to be present within any part of the current development area, then this scenario is likely to attract a pre-determination investigation requirement and, pending consideration of results either full area excavation or specific site areas may be excluded from being considered as available for development as significant remains may be deemed worthy of full protection and 'preserved in situ'

10.6.8 Potential Effects

10.6.8.1 During Construction: As referred to with reference to 'Future baseline' it is anticipated that each proposed development site area where ground impact [estimated at deeper than c. 20 cms bgl] will occur will require an archaeological survey to confirm presence / absence and significance, if present, of any below ground archaeological resource. It is anticipated that this requirement will be Conditioned.

Details of any investigation method to be confirmed after consultation with ADC's archaeology officer. The initial investigation phase 'an evaluation' will be required pre-build or any associated construction ground works where impact to depths of greater than c. 15cms bgl. is anticipated.

The results of the evaluation will be reviewed and subject to results may require an additional 'second phase' of investigation 'an excavation'.

NOTE: Until site areas are 'cleared / signed off' by the LPA's archaeological advisor no ground impact associated with construction phases should be permitted.

As a result of this required 'phased' approach to archaeological mitigation, within the proposed development site area, it is strongly advised that the required archaeological works are scheduled to be completed well in advance of any scheduled construction start date within any 'sub-site' area. There should be close and early consultation between the landowners, appointed build contractors and appointed archaeological contractor to ensure mutually acceptable schedules are devised.

10.6.8.2 Potential effects during operation: Should recommendations as detailed above be followed then no potential effects during operation are anticipated. However, should 'separation' of archaeological investigation and construction works not be possible then early consultation between the appointed archaeological contractor and appointed construction contractor should take place to ensure mutually satisfactory operational arrangements are put in place.

The only circumstance where archaeological presence may be required during any construction operation is if a 'Archaeological Watching Brief' is required. Again, consultation between the appointed archaeological contractor and appointed construction contractor should take place to ensure mutually satisfactory operational arrangements are put in place.

10.6.9 Residual Effects

During Construction. None anticipated

During Operation. None anticipated.

10.6.10 Consideration of the Strategic Allocation

10.6.10.1 Review of strategic allocation applications:

10.6.10.2 The following current / pending applications a have been considered:

- Application: WSCC/052/20 [A29 realignment]
- Barratts [land north of Barnham Road] c. 600 units.
- Boweries [EG/22//19/OUT] 28 units [DAS Survey completed under Condition]
- Warwick Nursery. 44 units [[DAS Survey completed under Condition]
- BEW: BN/11/22/OUT Land at Barnham, Eastergate and Westergate [BEW Parcel SC1] Southern Consortium [CC Projects, Ashmarden Ltd and Hanbury PM Ltd]

10.6.11 It is anticipated that the above applications, with the possible exception of WSCC/052/20, will if approved, be subject to an archaeological condition requiring archaeological investigation. The results of any investigation, if available prior to archaeological investigation works undertaken in association construction works associated with the proposed development site, will require review.

10.6.12 The results of any investigation outside and proximal to the development site area will inform and enhance any predictive model that has been constructed for investigation of the proposed development site.

10.7 Likely Significant Environmental Effects During Construction

10.7.1 **Built Heritage**: None anticipated

10.7.2 **Archaeology**: The groundworks associated with any proposed development such as the excavation of foundations and services along with ground reduction associated with the construction of new access roads and the cut and fill of associated landscaping can directly impact upon any buried archaeological potential.

The impact of development on low archaeological potential is considered to be **low** and conversely the potential impact of development on the identified moderate and high archaeological potential will be high based on the currently available data.

It is anticipated that mitigation, in the form of additional phases of investigation, will be undertaken in response to any Condition placed on any forthcoming permission.

10.8 Likely Significant Environmental Effects Post Construction

10.8.1 **Built Heritage**: None anticipated

10.8.2 **Archaeology**: None anticipated [Though note the additional information gathered at any investigation phase will enhance existing predictive models regarding archaeological potential within adjacent site areas].

10.9 Mitigation

10.9.1 **Built Heritage**: None anticipated/required.

10.9.2 **Archaeology**: It is anticipated that any required archaeological mitigation will be detailed in the Written Scheme of Investigation [WSI] that will be submitted to address any imposed archaeological condition associated with any forthcoming permission.

10.9.3 The review of available data undertaken in this desk-based assessment suggests ground works associated with the proposed development, such as the excavation of foundations and services and the construction of new access roads / landscaping etc., may directly impact on any buried archaeological resource within the site area. It is anticipated that mitigation in the form of archaeological investigation will be completed in advance of construction.

10.9.4 It is suggested that the indicated level of archaeological resource within the proposed development area should not be viewed as an overriding constraint to development. It is advised that a program of investigation, post determination, though undertaken in advance of development, at each phase, should be implemented. This may be secured by imposition of an appropriate Condition/s.

10.9.5 The precise details of mitigation to be undertaken defined after consultation between the Environment and Heritage Team of the relevant planning authority [Arun District Council] and the applicant / applicant agent.

10.9.6 In consultation with the Arun District Council it is suggested that any phased investigation program might incorporate an element of local community involvement in accordance with any existing heritage 'outreach' initiative followed by the heritage / planning authority.

10.10 Residual Effects

10.10.1 **Built Heritage**: It is considered that there will be a potential impact, though assessed as being potentially beneficial, regarding 'setting' from proposed development at the northern end of this assessment site on the setting of the Grade II* listed parish church of St George at Eastergate. The substantial site buffer areas, along the eastern boundary and within the central area of the site are, subject to review of any landscaping proposals within these areas, to be considered as probably at low risk from any development.

10.10.2 Any cumulative residual effects regarding setting should be made with regard to landscaping / land use proposals associated with pending applications listed below and specifically; BEW: BN/11/22/OUT. and WSCC/052/20 [A29 realignment].

10.10.3 Some modification to the setting of this asset is anticipated though it is considered the most significant and valued views to and from the asset will be mitigated by the maintenance of extensive views to the south by the landscaping strategy detailed within the application with extensive views to and from the area, particularly from and to the south being largely preserved with public access of views towards, particularly St George's' Church, being maintained and possibly enhanced.

10.10.4 **Archaeology**: No significant effects anticipated

10.11 Cumulative Effects

10.11.1 **Built Heritage**: No Significant effects anticipated

10.11.2 **Archaeology**: No Significant effects anticipated

10.12 Summary

10.12.1 It is suggested on archaeological or built heritage grounds there should be no reason for refusal of the forthcoming application.

10.12.2 It is anticipated a review of the submitted DBA [to include review of results of the already undertaken geophysical survey for this et [DAS / Arch Surveys 2023, see Appendix 5 of the DBA] will result in a standard Condition for site investigation being applied to any permission that may be forthcoming.

10.12.3 Subsequently protocols to address any imposed Condition will follow current Sussex archaeological standards for site investigation and reporting.

10.12.4 Necessarily the results of archaeological investigation, undertaken in advance of any development will enhance the existing data base for archaeology within the site area / site region and allow construction of more accurate predictive models for similar sites to be made.

10.12.5 Consideration has been given to potential impact of the proposed development to the two Conservation Areas, and other built assets, located within and surrounding the application site.

10.12.6 The Eastergate Conservation Area has a generally urban character with a close-knit grouping of buildings of various styles and ages fronting the main roads reflecting the historic development of a village at a road junction. The proposed development will have no impact on the fabric or setting of any built asset within The Square Conservation Area and there will be nil impact to the settings of any built asset within The Square Conservation Area.

10.12.7 The Church Lane Conservation Area will retain the characteristics of a rural agricultural settlement based on the manor House [C16th] St Georges Church [Norman] and farm buildings. The attractiveness of individual buildings and their grouping a variety of brick and flint walling and boundary hedges contribute to the special character of reviewed conservation areas. The substantial and significant provision for 'buffer zone' landscaping contained with the application will protect and maintain and protect these characteristics.

10.12.8 Review of Strategic Allocation Applications [see 6.2.19] suggests significant predicted development within the gross site area of the application site. It is considered that the substantial provision for buffer corridor areas to the east of the application site will allow for and maintain extensive and protected 'open views', and potentially enhance public access to appreciate these views, from and towards the Church Lane Conservation Area.

10.13 References

10.13.1 A list of references is provided below:

- British Geological Survey, (1984), Chichester & Bognor, Solid & Drift, 1:50,000 scale map sheet nos. 317/332.
- Extract from the First Edition 25 inch to one-mile scale Ordnance Survey (O.S.) map of 1880, map sheet no. Sussex 62.
- Composite extracts from the Second Edition six inch to one-mile scale Ordnance Survey (O.S.) maps of 1899, map sheet nos. Sussex 62NW, 62NE, 62SE & 62SW.
- Composite extracts from the Third Second Edition six inch to one-mile scale Ordnance Survey (O.S.) maps of 1913-1914, map sheet nos. Sussex 62NW, 62NE, 62SE & 62SW.
- Composite extracts from the Provisional Edition six inch to one-mile scale Ordnance Survey (O.S.) maps of 1937-1950, map sheet nos. Sussex 62NW, 62NE, 62SE & 62SW.
- Composite extracts from the 1:10,560 scale Ordnance Survey (O.S.) maps of 1961-1963, map sheet nos. SU 90 SSE, SU 90 SW, SU 90 NE & SU 90 NW.
- Gover, J., (1975), Sussex Place Names.
- Hudson, T., Bags, A., Warne, H., (1997), The Victoria County History of Sussex: Vol. 5 Part 1: Arundel Rape, South-Western Part including Arundel.
- Mawer, A., Stenton, F., Gover, J., (2006), The Place Names of Sussex, Vols. VI & VII. English Place Name Society.
- Mawer, A., Stenton, F., Gover, J., (2001), The Place Names of Sussex, Part 1: The Rapes of Chichester, Arundel & Bramber. Society of English Place Names Vols. VI & VII.
- Morris, J., (ed.), (1976), Domesday Book: Sussex.
- Ordnance Survey, (2008), 1:25,000 scale map, Arundel & Pulborough, Worthing & Bognor Regis, Explorer Sheet No. 121.
- Poulton-Smith, A., (2012), West Sussex Place Names.
- Soil Survey of England & Wales, (1983), Soils of South East England, map sheet no. 6, 1:250,000 scale.
- Ancient Monuments and Archaeological Areas Act, 1979
- National Planning Policy Framework, 2023
- Planning (Listed Buildings and Conservation Areas) Act, 1990
- Arun Local Plan 2011 to 2031 (adopted July 2018)
- Sussex Archaeological Standards for Archaeological Investigations (Revised; 2019)
- CIfA (2019) Code of Conduct, Reading: Chartered Institute for Archaeologists

- CIfA (2020) Standard and Guidance for Historic Environment Desk-Based Assessment, Reading: Chartered Institute for Archaeologists
- Historic England (2008) Conservation Principles; Policy and Guidance for the Sustainable Management of the Historic Environment
- Historic England (2015) Managing Significance in Decision-Taking in the Historic Environment: Historic Environment Good Practice Advice in Planning Note 2
- Historic England (2017) The Setting of Heritage Assets: Historic Environment Good Practice Advice in Planning Note 3 (Second Edition)

10.13.2 Legislation and Policy

- Ancient Monuments and Archaeological Areas Act, 1979
- National Planning Policy Framework, 2023
- Planning (Listed Buildings and Conservation Areas) Act, 1990
- Arun Local Plan 2011 to 2031
- The Arun Local Plan covers the period 2011-2031 for the area of Arun District (excluding the area covered by the South Downs National Park Authority) and was adopted on the 18th of July 2018.

10.13.3 Best Practice and Guidance

- Sussex Archaeological Standards for Archaeological Investigations [Revised; 2019]
- CIfA (2019) Code of Conduct, Reading: Chartered Institute for Archaeologists
- CIfA (2020) Standard and Guidance for Historic Environment Desk-Based
- Assessment, Reading: Chartered Institute for Archaeologists
- Historic England (2008) Conservation Principles; Policy and Guidance for the
- Sustainable Management of the Historic Environment
- Historic England (2015) Managing Significance in Decision-Taking in the Historic
- Environment: Historic Environment Good Practice Advice in Planning Note 2
- Historic England (2017) The Setting of Heritage Assets: Historic Environment Good
- Practice Advice in Planning Note 3 (Second Edition)

10.14 Abbreviations & Definitions

10.14.1 Abbreviations

DAS: Development Archaeology Service Ltd.

DBA: Desk Based Assessment

ADC: Arun District Council

bgl. Below Ground Level.

WSI: Written Scheme of Investigation

LPA: Local Planning Authority

PA - Palaeolithic

NE - Neolithic

ME - Mesolithic

BA - Bronze Age

IA - Iron Age

RO - Roman

EM - Anglo-Saxon

MD - Medieval

PM - Post-medieval

MO - Modern

Un – Uncertain

10.14.2 Definitions

The time periods referenced in the text are as follows:

Prehistoric

Palaeolithic: 500,000 - 10,000 BC

Mesolithic: 10,000 – 4,000 BC

Neolithic: 4,000 – 2,500 BC

Bronze Age: 2,500 - 800 BC

Iron Age: 800 BC – AD 43

Roman: 43 – 410

Early Medieval and Saxon: 410 - 1066

Medieval: 1066 – 1540

Post Medieval: 1540 - 1901

Modern: 1901 – present

11. Water Environment, Flood Risk and Drainage

11.1 Introduction

11.2 Background

11.3 Water Environment Policy Context

11.4 Water Environment Assessment Methodology

11.5 Baseline

11.6 Likely Significant Environmental Effects During Construction

11.7 Likely Significant Environmental Effects Post Construction

11.8 Mitigation

11.9 Residual Effects

11.10 Cumulative Effects

11.11 Summary

11.12 References

11.13 Glossary

11 Water Environment, Flood Risk & Drainage

11.1 Introduction

11.1.1 This chapter has been written by WSP UK Limited, a practice of professional engineers and scientists who are in particular specialists in the field of foul, surface water drainage and flood risk from all sources of flooding. In preparing this chapter by a specialist with more than 30 years of relevant experience, he has ensured consistency with the hydraulic modelling report and Flood Risk Assessment for the proposed development.

11.1.2 This chapter assesses the likely significant impacts of the proposed development on the environment regarding foul requirements, surface water drainage and flood risk, during the construction and operational phases. It also describes the methods used to assess the impacts; the baseline conditions currently existing at the site and in the surrounding area; the mitigation measures required to prevent, reduce or offset any significant adverse effects; and the likely residual impacts after these measures are adopted. This chapter is accompanied by a Flood Risk Assessment, that is included at Appendix 11.1.

11.1.3 Supporting information for the assessment has been obtained from the following documents:

- Environmental Impact Assessment Screening and Scoping Report for Land East of Westergate, West Sussex prepared by Luken Beck dated June 2022.
- Land East of Westergate West Sussex, Pre-Application Planning Statement dated June 2022.
- Proposed development plans drawings number CALA230719-GB1PP-01 Rev P1, CALA230719-AMSHPP-01 Rev P1, CALA230719-SHPP-01 Rev P1 and CALA230719-DPDPP-01 Rev P2 prepared by Thrive Architects dated 31st July 2023.
- Arun District Council - Scoping request - Land East of Westergate Aldingbourne (Ref: AL/98/22/EIS, dated 21st November 2022)
- Main Investigation Report completed by Soils Limited Ref:19522/MIR dated September 2021
- Ground Gas Risk Assessment completed by Soils Limited Ref:19522/GRA dated June 2022
- Groundwater monitoring report by Bingham Hall Associates dated June 2017
- Infoworks Aldingbourne Model CaVID data and report from the Environment Agency dated 2015
- Southern Water Drainage and Wastewater Management Plan (May 2023)

11.2 Background

11.2.1 Introduction

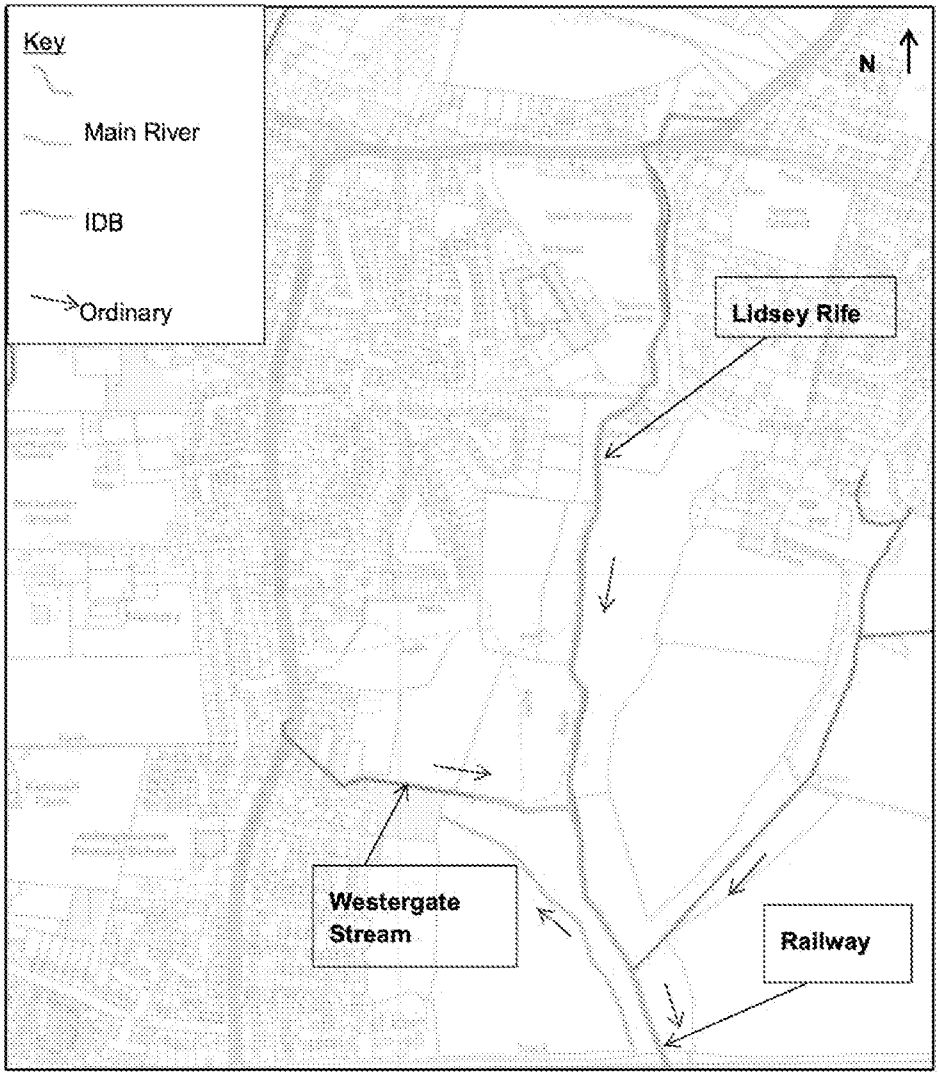
11.2.1.1 The chapter provides a review of baseline conditions within the vicinity of the proposed development and identifies receptors sensitive to changes to foul, surface water drainage and flood risk due to the construction

and/or operation of the Proposed Development. It evaluates the Proposed Development's likely impact on foul requirements, surface water drainage and flooding which may occur during the construction and/or operational phases, identifies the methodology to be applied to the EIA along with potential measures to reduce/mitigate any drainage and flood risk effects.

11.2.2 *The Site*

11.2.2.1 The Environmental Impact Assessment Screening and Scoping Report for the site prepared by Luken Beck dated June 2022, states 'the site (approx. 18.77ha) comprises agricultural and improved grassland to the east of Westergate. The site has defined boundaries with the 'west coast way' main railway line forming the southern boundary, the Lidsey Rife watercourse forming the eastern boundary and the settlements of Westergate and Eastergate forming the western and northern boundaries. A tributary of the Lidsey Rife (defined in the FRA as the Westergate Stream) crosses the middle of the site running east-west with a wet woodland located adjacent to the Westergate settlement boundary.

Figure 11.1 Local Watercourses



11.2.2.2 The FRA Indicates that the relevant sources of flooding to the site are fluvial flood risk, surface water flood risk, residual fluvial flood risk and residual foul flood risk.

11.2.3 The Scheme

11.2.3.1 The appraisal of constraints and opportunities and the various inputs within the design team has led to the development of a coherent development framework for the site layout. This layout addresses the constraints in terms of foul requirements, surface water drainage and flood risk. Key elements are summarised as follows:

- A foul drainage strategy that accommodates the existing north-south foul sewer and provides routes for diversion of the two connecting sewers through the development;
- A surface water drainage strategy which attenuates development runoff to greenfield runoff rates;
- Integration of shallow and long basins for the attenuation of development runoff, within the natural landscape and avoidance of buried storage structures below ground;
- Application of the principle of avoidance of the residential plots from all relevant sources of flood risk to ensure that the development is safe and does not increase flood risk elsewhere;
- Application of the Sequential Approach within the site, so that more vulnerable uses are placed in the areas at lowest risk;
- Applying a more extreme climate change scenario for the development, which is applied to critical infrastructure (the Higher climate change scenario);
- Ensuring safe access and egress during flood events;
- Retention of field ditches were possible and setting up of a regular maintenance regime.

11.2.4 Potential Cumulative Effects

11.2.4.1 The potential for cumulative effects with projects highlighted within the Scoping Opinion Response received from consultees are assessed in the following sections.

11.2.5 Scoping Opinion Responses

11.2.5.1 As part of issuing the Scoping Opinion, consultation responses from the Environment Agency, WSCC, Arun District Council and Southern Water were received, and which are relevant to the subject of this assessment. The comments are summarised in Table 11.1.

Table 11.1: Summary of Consultation

Summary of Issue Raised	Summary response and reference to ES Chapter
Environment Agency	
Development should be steered away from flood zones 2/3 and development within the flood plain will require compensation. Any changes in ground levels within Flood Zones 2/3 will also require compensatory storage. Development located within 8m of a main river will require a Flood Risk Activity Permit, which will include all headwall and pipes.	Development has been steered away from flood zones 2/3. The 100 year plus climate change flood levels and extent have been used as the indicator for the requirement of compensation storage, which is more relevant than Flood Zones 2 and 3.
WSCC (Lead Local Flood Authority)	
Where field boundary ditches not shown on OS mapping are present, these should be maintained and highlighted in future plans.	Field boundary ditches have been identified in draft maintenance plan in the FRA.
Southern Water	
Southern Water's current sewerage records show that there are public foul and surface water sewers within the proposed development site/s. Certain restrictions apply in relation to developing or planting near these sewers which will need to be adhered to or the appropriate consents gained. Capacity assessments will also be required to ensure that the existing sewer network can accommodate the proposed development flows. Where surface water is being considered for discharge to the network, the hierarchy under part 3 of the Building Regulations must be followed. PLEISDEC (ODB1107).	Public foul and surface water sewers have been identified within the site and the restrictions to the development have been considered. Diversions of two existing foul sewers are proposed). Pre-development capacity assessments have taken place and Southern Water has advised that capacity exists at the Lidsey WTW for development foul flows and that capacity for up to 50 homes is available at a connection to the existing on-site sewers. Southern Water will need to carry out capacity improvement works to support the remainder of the development. Development surface water runoff will be discharged to the nearby watercourses and not to the pipe network system.
Arun District Council	

Due to the size of the development and to protect the premises from the impact of sewage flooding, an assessment is required to ascertain an appropriate point of connection to the foul and surface water sewerage network. The contents of Policy W DM1(3) should be fulfilled as part of a full Drainage Impact Assessment which will detail the capacity of the Waste Water Treatment Works (WWTW), in combination with other committed, anticipated and phased development. There are numerous other watercourses (ditches/culverts) within the site which are not mentioned within the EIA report. These will need to be suitably accommodated within the development layout, and de-culverting will be required where possible. Improvement to these watercourses will also be a requirement. The hierarchy for sustainable drainage must be following, with infiltration fully investigated. Winter infiltration testing and winter groundwater monitoring must be undertaken, and early discussion with ADC drainage officers to discuss the extent is encouraged. It is suggested that drainage is considered early in the process, giving due consideration to the location and design of surface water drainage features to achieve necessary capacity, water quality, and ease of maintenance.	Residual impact of foul flood risk is investigated as part of the FRA. In relation to the connection to the foul network (there will not be connection to the surface water system), an initial assessment has identified that limited capacity is available on the site for up to 50 homes and that capacity at the Lidsey WTW exists or will be made available through planned Southern Water works. In terms of the full Drainage Impact Assessment this concludes that capacity is either already available or can be provided in a phased delivery by Southern Water to enable the development. Field boundary ditches have been identified in draft maintenance plan in the FRA. The hierarchy for sustainable drainage has been followed and sufficient winter infiltration testing has been undertaken, as summarised in the FRA. Drainage has been considered as an integral part of the Masterplanning process, to ensure the necessary capacity, water quality and ease of maintenance are achieved. Ground raising is envisaged on the southern parcel in an area where ground levels are relatively high. The Drainage Strategy has been designed to ensure no impact on existing properties in terms of elevated groundwater levels and surface runoff implications. Treatment of surface water will be incorporated in the detailed planning application. Permeable paving is no longer the preferred option, and it will only be used to a smaller extent, in a shallow and tanked configuration. The surface runoff attenuation storage will be provided by long attenuation basins, which may incorporate reed beds or similar natural treatment systems.

Ground raising is discouraged, and where it is absolutely necessary, then due consideration must be given to the potential impacts on existing properties in terms of elevated groundwater levels and surface water run-off implications. Adequate treatment of surface water must be ensured prior to discharge, for which permeable paving is strongly encouraged to assist with this. It is advised that the applicant seeks further information on what is required within Arun District Council at https://www.arun.gov.uk/drainage-planning-consultations.	

11.3 Water Environment Policy Context

11.3.1 This Section summarises the relevant legislation, regulatory frameworks, national policy, local policy and designations and guidance relevant to foul, surface water drainage and flood risk.

11.3.2 Legislation

11.3.3 The following legislation relates to this Chapter:

- The Water Environment (Water Framework Directive) (England and Wales) Regulations (2017)
- The Flood Risk Regulations (2009)
- Flood and Water Management Act (2010)
- Land Drainage Act (1991)
- Water Industry Act (1991)
- Water Resources Act (1991)
- Environment Act (2021)

11.3.4 National Policy and Guidance

11.3.4.1 NPPF, 20 July 2021. The National Planning Policy Framework sets out strict tests to protect people and property from flooding which all local planning authorities are expected to follow. Where these tests are not met, new development should not be allowed. The main steps to be followed in addressing flood risk, start with assessing and then avoiding flood risk. The steps are designed to ensure that if there are lower risk sites

available, or a proposed development cannot be made safe throughout its lifetime without increasing flood risk elsewhere, it should not be permitted. Measures to avoid, control, manage and mitigate flood risk should also not increase flood risk elsewhere. The FRA for this proposed development is fully NPPF compliant.

11.3.4.2 Preparing a flood risk assessment: standing advice (Gov.UK, 8 Feb 2022). This document sets the Government expectations for Planning applicants and LPAs to make sure flood risk assessments (FRAs), contain the correct information and follow the standing advice. The FRA for this proposed development adheres to this Government standing advice.

11.3.4.3 Development and Flood Risk – Guidance for the Construction Industry (C624), CIRIA 2004. This book sets out practical guidance in assessing flood risk as part of the development process. It describes the mechanisms and impacts of flooding, whether caused by rivers, the sea, estuaries, groundwater, overland flow, artificial drainage systems or infrastructure failure. The guidance recommends a tiered approach to flood risk assessment and provides a simple-to-use toolkit to help practitioners complete the assessments. The FRA follows the practical guidance provided by this document.

11.3.4.4 Non-statutory technical standards for sustainable drainage systems, DEFRA 2015. This document sets out non-statutory technical standards for sustainable drainage systems. It provides guidance on: a) flood risk outside the development, b) peak flow control, c) volume control, d) flood risk within the development, e) structural integrity, and f) designing for maintenance. The FRA adheres to all the recommendations of this document.

11.3.4.5 The SuDS Manual (CIRIA C753), CIRIA 2015. The updated SuDS Manual incorporates the very latest research, industry practice and guidance. In delivering SuDS there is a requirement to meet the framework set out by the Government's 'non statutory technical standards' and the revised SuDS Manual complements these but goes further to support the cost-effective delivery of multiple benefits. The Surface Drainage Strategy takes account of this manual by identifying cost-effective SuDS measures.

11.3.4.6 Flood Risk Assessments, Climate Change Allowances guidance (May 2022). This live Government document advices when and how local planning authorities, developers and their agents should use climate change allowances in flood risk assessments.

11.3.4.7 Building Regulations Approved Document H, Ministry of Housing, Communities and Local Government (2015). This document provides guidance on how to meet the Building Regulations in relation to drainage and waste disposal. Part H contains guidance on foul and surface water drainage, and also refuse storage for dwellings.

11.3.4.8 A Green Future: Our 25 Year Plan to Improve the Environment (2018). This 25 Year Environment Plan sets out government action to help the natural world regain and retain good health. It aims to deliver cleaner air and water in our cities and rural landscapes, protect threatened species and provide richer wildlife habitats.

11.3.5 Local Policy and Guidance

11.3.5.1 SuDS design guidance for LLFAs of the South East of England, live (Sep 2013). This guidance outlines the process for integrating sustainable drainage systems (SuDS) into the master planning of large and small developments. Consideration of the movement of water and its interaction with space at the earliest stage of design is crucial to the success of SuDS and allows the developer to maximise wider benefits. This guidance complements existing guidance on SuDS design, maintenance and operation which should be used to inform detailed design and delivery of SuDS. The FRA includes early engagement with the statutory consultees and follows the general advice of this document.

11.3.5.2 Arun and Western Streams Catchment Flood Management Plan, 2009. The role of CFMPs is to establish flood risk management policies which will deliver sustainable flood risk management for the long term. It was produced through a wide consultation and appraisal process; however, it is only the first step towards an integrated approach to flood risk management. Policy 4 applies for the proposed development: Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change. This FRA uses a higher estimate of climate change predictions, in line with Policy 4 expectations.

11.3.5.3 West Sussex Local Flood Risk Management Strategy, 2013. The Flood and Water Management Act 2010 require county councils (Lead Local Flood Authorities) to lead the coordination of flood risk, with the production of a Local Flood Risk Management Strategy. The 2013 strategy by WSCC focuses on: a) the risks of flooding from surface water, groundwater and ordinary watercourses but also considers flooding from rivers and the seas and clarifies responsibilities for the management of these flood risk.

11.3.5.4 Lidsey Surface Water Management Plan, October 2014. This Surface Water Management Plan (SWMP) outlines the preferred surface water management strategy for the Lidsey wastewater drainage catchment. It describes flood risk from sewers, drains, ditches and watercourses (including main river watercourses) and ground water that occurs during or after heavy rainfall. The plan identifies priority areas and potential solutions for further assessment. The FRA reduces development runoff to greenfield rates to ensure that flood risk is not increased in downstream areas of surface water flood risk.

11.3.5.5 Arun Level 1 Strategic Flood Risk Assessment Update. This work was commissioned to update the Strategic Flood Risk Assessment for the District outside of the National Park. This was necessary to support planning decisions around Main Modifications to the Arun Local Plan 2011-2031 during the period of suspension during the examination process. The FRA complies with the requirements of the SFRA.

11.3.5.6 Arun Strategic Surface Water Management Strategy (SSWMS), Stage 1 and Stage 2 reports, July 2016. This document provided recommendations in relation to development drainage strategies in the Westergate area, including for the proposed development. The FRA is consistent with the recommendations of this document.

11.4 Water Environment Assessment Methodology

11.4.1 The qualitative assessment has been undertaken in general accordance with the principles as set out within the DMRB LA 113 – Road Drainage and the Water Environment Revision 1 and DMRB LA 104 – Environmental Assessment and Monitoring.

11.4.2 Although the DMRB is not directly applicable to the nature of the Proposed Development as it was developed to provide guidance for assessing potential effects that road projects may have on the water environment, it offers a general framework which can be used to provide a consistent assessment of the effects of development proposals on foul, surface water drainage and flood risk.

11.4.3 The significance of the effects will be determined based on the sensitivity of the receptor and the magnitude of change. The methodology which will be used to assess significance is in accordance with Table 11.2, Table 11.3 and Table 11.4 of this section. Overall, effects can be beneficial or adverse, and negligible or neutral, where applicable.

Table 11.2: Estimating the sensitivity of receptors and flood risk attributes

Sensitivity	Criteria	Typical examples	
Very High	Nationally significant attribute of high importance.	Surface water:	Watercourse having a WFD classification shown in a RBMP and Q95 ≥ 1. 0 m^3/s. Site protected/designated under EC or UK legislation (SAC, SPA, SSSI, Ramsar site, salmonid water)/Species protected by EC legislation LA 108
		Groundwater:	Principal aquifer providing a regionally important resource and/or supporting a site protected under EC and UK legislation LA 108. Groundwater locally supports GWDTE. SPZ1.
		Flood Risk:	Essential infrastructure or highly vulnerable development.
High	Locally significant attribute of high importance.	Surface water:	Watercourse having a WFD classification shown in a RBMP and Q95 <1.0m^3/s. Species protected under EC or UK legislation LA 108.
		Groundwater:	Principal aquifer providing locally important resource or supporting a river ecosystem. Groundwater supports a GWDTE.

			SPZ2.
		Flood Risk:	More vulnerable development.
Medium	Of moderate quality and rarity	Surface water:	Watercourses not having a WFD classification shown in a RBMP and Q9 5 >0.001m³/s.
		Groundwater:	Aquifer providing water for agricultural or industrial use with limited connection to surface water. SPZ3.
		Flood Risk:	Less vulnerable development.
Low	Lower quality	Surface water:	Watercourses not having a WFD classification shown in a RBMP and Q9 5 ≤0.001m³/s.
		Groundwater:	Unproductive strata
		Flood Risk:	Water compatible development.

Table 11.3: Estimating the magnitude of an impact on an attribute

Magnitude	Criteria	Typical Examples
Major adverse	Results in loss of attribute and/or quality and integrity of the attribute	**Surface water (SW)** - Loss or extensive change to a fishery. Loss or pollution of regionally important public water supply. Loss or extensive change to a designated nature conservation site. Reduction in water body WFD[3] classification. **Groundwater (GW)** - Loss of, or extensive change to, an aquifer. Loss of regionally important water supply. Loss of, or extensive change to GWDTE or baseflow contribution to protected surface water bodies. Reduction in water body WFD classification. Loss or significant damage to major structures through subsidence or similar effects. **Flood Risk (FR)** Increase in peak flood level (> 100mm). Loss of flood storage.
Moderate adverse	Results in effect on integrity of attribute, or loss of part of attribute	(SW) Partial loss in productivity of a fishery. Degradation of regionally important public water supply or loss of major commercial/industrial/agricultural supplies. Contribution to reduction in waterbody WFD classification. (GW) Partial loss or change to an aquifer. Degradation of regionally important public water supply or loss of significant commercial/industrial/agricultural supplies. Partial loss of the integrity of GWDTE. Contribution to reduction in waterbody WFD classification. Damage to major structures through subsidence or similar effects or loss of minor structures.

[3] WFD – Water Framework Directive

Magnitude	Criteria	Typical Examples
		(FR) Increase in peak flood level (>50mm).
Minor adverse	Results in some measurable change in attributes, quality or vulnerability	(SW) Minor effects on water supplies. (GW) Minor effects on an aquifer, GWDTEs, abstractions and structures. (FR) Increase in peak flood level (> 10mm).
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity	(SW) No significant loss in quality, fishery productivity or biodiversity. (GW) No measurable impact upon an aquifer and/or groundwater. (FR) Negligible change to peak flood level (≤ +/- 10mm).
Minor beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring	(SW) Minor effects on water supplies or quality. (GW) Reductions in waterlogging and groundwater flooding. (FR) Creation of flood storage and decrease in peak flood level (>10mm).
Moderate beneficial	Results in moderate improvement of attribute quality	(SW) Contribution to improvement in water body WFD classification. Enhanced productivity of a fishery. Reduced effluent to receiving river. (GW) Contribution to improvement in water body WFD classification. Improvement in water body catchment abstraction management Strategy (CAMS) (or equivalent) classification. Support to significant improvements in damaged GWDTE. (FR) Creation of flood storage and decrease in peak flood level1 (> 50mm).
Major beneficial	Results in major improvement of attribute quality	(SW) Removal of existing polluting discharge or removing the likelihood of polluting discharges occurring to a watercourse. Improvement in water body WFD classification. (GW) Removal of existing polluting discharge to an aquifer or removing the likelihood of polluting discharges occurring. Recharge of an aquifer. Improvement in water body WFD classification. (FR) Creation of flood storage and decrease in peak flood level (> 100mm).

11.4.4 Determining Significance

11.4.4.1 The effects significance is determined by combining the predicted magnitude of impact with the assigned sensitivity of the receptor.

Table 11.4: Matrix to support determining the significant effect

		Sensitivity			
		Very High	High	Medium	Low
Magnitude of change (or impact)	Major	Major	Moderate to Major	Minor to Moderate	Negligible
	Moderate	Moderate to Major	Moderate	Minor	Negligible
	Minor	Minor to Moderate	Minor	Negligible to Minor	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

11.4.4.2 For the EIA, effects that are assessed as Moderate or greater are generally assessed as significant.

11.4.4.3 The following terms have been used to define the level of the effects identified and these can be 'beneficial' or 'adverse':

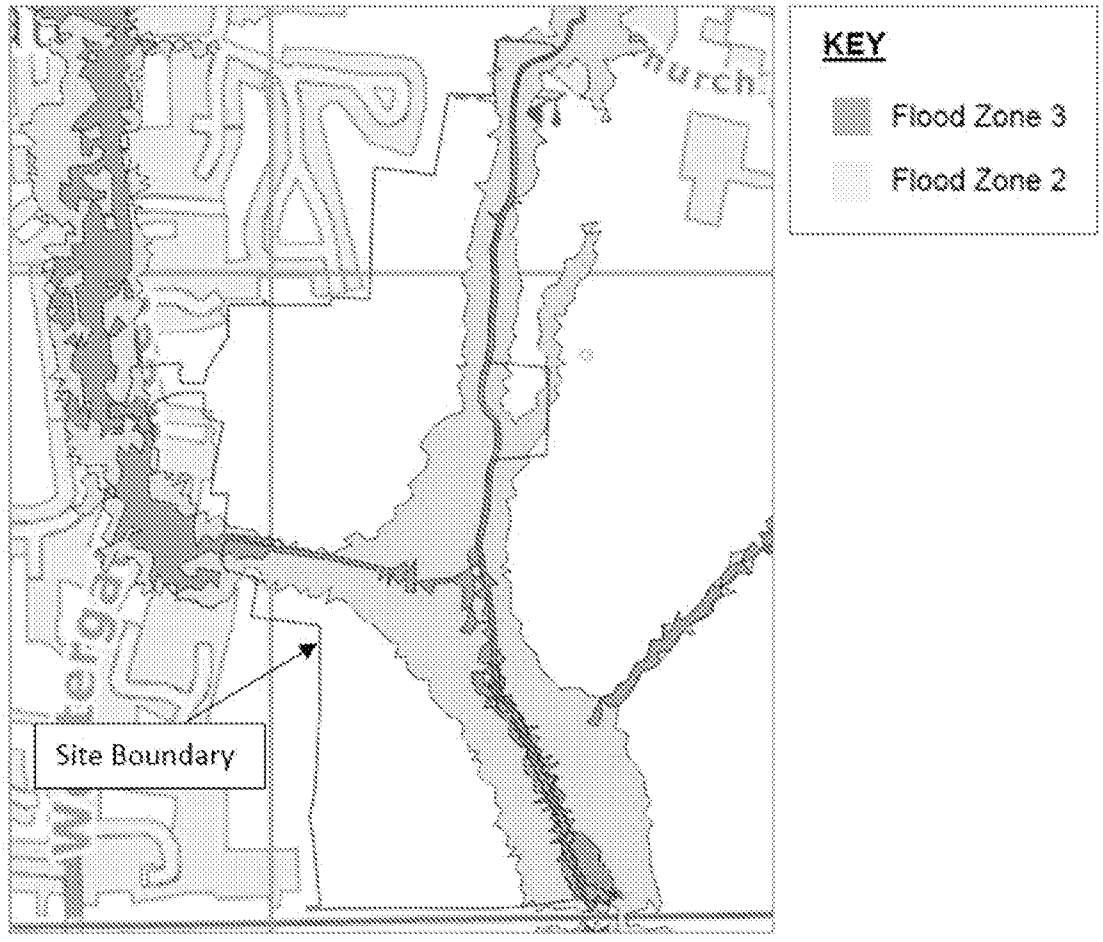
- Major effect: Where the Proposed Scheme is likely to cause a considerable change from the baseline conditions and the receptor has limited adaptability, tolerance or recoverability or is of the highest sensitivity;
- Moderate effect: Where the Proposed Scheme is likely to cause either a considerable 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;
- Minor effect: Where the Proposed Scheme 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 and / or can recover from the change; and
- Negligible: Where the Proposed Scheme 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.

11.5 Baseline

11.5.1 The Lidsey Rife is a main river and a tributary stream (the Westergate Stream) Is an ordinary watercourse. The Westergate Stream crosses the middle of the site running east-west with a wet woodland located adjacent to the Westergate settlement boundary. Several field ditches are present within the existing site, which serve the current agricultural and improved grassland uses.

11.5.2 The site topography comprises a level field system, elevated above shallow valley areas and areas of flood plain, which are shown on the Environment Agency flood risk map as following the Lidsey Rife and the Westergate Stream. Most of the site falls within Flood Zone 1 and a sequential approach towards the distribution of residential development on the site has been followed to ensure flood risks are minimised.

Figure 11.2: Flood Zone Map



11.5.3 The British Geological Survey (BGS) 1:50,000 map for Chichester/Bognor (sheet 317/332) indicates the existing site lies on bedrock of the London Clay Formation. This is largely masked by superficial deposits of Head (Gravel, Sand Silt & Clay) in the northern part and River Terrace Deposits (Sand, Silt & Clay) in the southern part, of the

existing site. The river valley of the Lidsey Rife comprises of Alluvium (Clay, Silt, Sand & Gravel) and Raised Beach Deposits (Sand and Gravel).

11.5.4 The superficial deposits are designated as Secondary Aquifers (i.e., permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers). Groundwater within these deposits will be perched upon the Unproductive London Clay Formation (i.e., low permeability layers with negligible significance for water supply or river base flow) which is known to be more than 100m thick beneath the existing site.

11.5.5 An existing Southern Water foul sewer crosses the site from north to south draining towards the Lidsey Wastewater Treatment Works (WTW). Two further foul sewers drain across the site from west to east connecting existing built development to the north-south sewer. Southern Water has identified moderately significant or significant risks to 8 of 14 planning objectives for the Lidsey WTW catchment in its Drainage and Wastewater Management Plan (DWMP). As a result, an investment strategy has been identified to improve the wastewater system in this catchment.

11.5.6 Summary of receptors and their sensitivity

11.5.6.1 The following receptors have been identified as sensitive (based on the criteria provided in Table 4.2) to potential changes in drainage and flood risk during the construction and/or operation of the proposed development:

- adjacent and downstream properties (high sensitivity);
- the Lidsey Rife (high sensitivity as it has moderate status with Q95 less than 1m^3/s);
- the Westergate Stream (medium sensitivity as it does not have a WFD classification and Q9 5 >0.001m^3/s); and
- the aquifer beneath (medium sensitivity as it is not a principal aquifer however it is a local resource linked to the local watercourses); and
- the capacity of the existing foul system (very high sensitivity as it can be considered as essential infrastructure).

11.5.6.2 The FRA Indicates that the relevant sources of flooding to the site are fluvial flood risk, surface water flood risk, residual fluvial flood risk and residual foul flood risk.

11.5.6.3 A list of all potential sources of flood risk and their relevance for this study is provided in Table 11.5.

Table 11.5: Potential sources of flood risk

Source of flood risk	Relevance and level of risk	Comment
Fluvial flood risk	Yes, high **	The existing site is within Flood Zones 2 and 3.
Coastal flood risk	No	Although the lowest level of the existing site is 1.7m AOD there is no coastal flood risk. There are defences in place at Bognor Regis and the Beachy Head to Selsey Bill Shoreline Management Plan (SMP) indicates that these defences will be maintained in the future.
Tidal flood risk	No	
Surface water flood risk from overland flows	Yes, high	Shallow flooding is anticipated from this source based on our modelling undertaken for the area.
Groundwater flood risk	No	The assessment of groundwater flood risk confirms that the existing site is not at risk from groundwater flooding, however it is acknowledged that in winter periods, this is near the ground surface.
Foul flood risk	No	The WSCC SWMP does only indicate flood risk originated solely from foul sewers, within or in the vicinity of the existing site.
Residual fluvial flood risk	Yes, high	The residual flood risk from this source is from partial or full blockages of culverts along the Lidsey Rife and the Westergate Stream, mainly the railway culvert located at the downstream (south-east corner) of the existing site.
Residual coastal and tidal flood risk	No	It is anticipated that a breach in the defences (or overtopping for an extreme event) would not result in flooding of the existing site, as this is located many km upstream from the coast.
Residual surface water flood risk	No	There is no residual flood risk from this source as the existing site does not benefit from defences from surface water flood risk.
Residual groundwater flood risk	No	There is no residual flood risk from this source as there are no pumping systems which keep groundwater levels artificially low.
Residual foul flood risk	Yes, high	There is indication that groundwater intrusion into the foul drains results in manholes overflowing within the existing site.

**a risk is considered high if its probability is greater or equal to 1% in a given year.

11.6 Effects During Construction

11.6.1 Considering current information regarding the Proposed Development and the results of the baseline review, the following likely environmental effects are identified (significant effects are shown in red boxes).

Table 11.6: Likely Significant Effects (without mitigation construction phase)

Receptor	Sensitivity	Potential Impact	Magnitude (pre-mitigation)	Significant effect
Possible flood risk to adjacent and downstream properties	High	Short Term Increase in Flood Risk due to Construction Activities	Major adverse (more than 100mm increase in flood risk)	Negative moderate to major
Lidsey Rife	High	Potential Effects on the Water Quality of Water Resources, due to Accidental Leaks and Spillages and sedimentation	Moderate adverse (reduction in WDF status)	Negative moderate
Westergate Stream and on-site field ditches	Low to Medium	Potential Effects on the Water Quality of Water Resources, due to Accidental Leaks and Spillages	Minor adverse (measurable change in attributes)	Negative negligible to minor
Secondary (undifferentiated) aquifer	Medium	Short Term Alterations to Groundwater Flow and Quality	Minor adverse (measurable change in attributes)	Negative negligible to minor
Existing foul or drainage system	Very high	Affecting the structural integrity of the foul or drainage system	Major adverse (more than 100mm increase in flood risk)	Negative major

11.7 Effects Post Construction

11.7.1 Considering current information regarding the Proposed Development and the results of the baseline review, the following likely environmental effects are identified (significant effects are shown in red boxes):

Table 11.7: Likely Significant Effects (without mitigation operational phase)

Receptor	Sensitivity	Potential Impact	Magnitude (pre-mitigation)	Significant effect
Possible flood risk to adjacent and downstream properties	High	Increase in flood risk due to lack of maintenance or raising ground levels	Major adverse (more than 100mm increase in flood risk)	Negative moderate to major
Lidsey Rife	High	Increase in flood risk and potential pollution and scouring due to lack of maintenance	Moderate adverse (reduction in WDF status)	Negative moderate
Westergate Stream and on-site ditches	Medium	Increase in flood risk and potential pollution and scouring due to lack of maintenance	Minor adverse (measurable change in attributes)	Negative negligible to minor
Secondary (undifferentiated) aquifer	Medium	Potential pollution and increase in groundwater levels due to lack of maintenance	Minor adverse (measurable change in attributes)	Negative negligible to minor
Existing foul or drainage system	Very high	Development goes ahead without increasing the capacity of the system	Major adverse (more than 100mm increase in flood risk)	Negative major

11.8 Mitigation

11.8.1 This section lists the various mitigation measures that will be incorporated within Proposed Development to address relevant potential effects during the construction and operation phases.

11.8.2 Construction Phase

11.8.2.1 Best practice recommendations for the prevention of contamination will be outlined in more detail in a Construction Environmental Management Plan (CEMP) and agreed with relevant statutory consultees prior to commencement of construction works. This will include measures to comply with relevant legislation and guidance, and best practice measures in line with the Considerate Contractors Scheme and Site handbook for the construction of SuDS (CIRIA C698) (tertiary mitigation).

11.8.2.2 Generic measures that will be included are as follows:

- Awareness training will be provided to construction workers on the sources / risks of flooding;
- Signing up to the Environment Agency's flood warning system to receive up to date flood warnings. In addition, the weather forecast should be checked daily, and works should be postponed in time of severe rainfall events to mitigate potential risk of flooding to construction workers;
- No materials or site cabins should be stored / located in the areas indicated to be at risk of fluvial or surface water flooding;
- Relevant safe working procedures should be applied for any operations near the existing watercourses to minimise flooding risks;
- Installation of temporary drainage strategy during construction, incorporating attenuation features which may remain as part of the operational surface water drainage system (e.g., settling ponds). The temporary strategy would be defined and managed and take account of industry best practice, relevant guidance and standards, including British Standard 8582:2013;
- Sub-surface flow paths will be assessed prior to construction, in accordance with British Standard 8533:2017;
- Suitable dewatering techniques will be used if required, in consultation with the Environment Agency, and associated permits will be obtained;
- Any additional land drainage or culverts within the site are to be mapped and the source identified to maintain the local area drainage;
- Any raw effluent will be stored in sealed compartments and transferred off-site to receive the appropriate level of treatment, including sludge treatment should it be required;
- Use of wheel washing;
- A Pollution Control Plan will be developed prior to construction occurring, this will identify pollution pathways / watercourses and access points / pollution trapping locations so that should a pollution event occur a rapid response is possible to prevent further contamination of the water environment;
- Management of construction pollution using inspection points and plant spill kits to limit migration. Appropriate storage measures are to be provided (e.g., bunded storage of oils); and
- An erosion prevention and sediment control plan will be prepared and implemented to reduce the quantity of sediment entrained in runoff and to prevent hydro-morphological changes to surface water features such as watercourses, existing ponds and existing sewers. This will include measures such as settlement lagoons and/or silt filters.

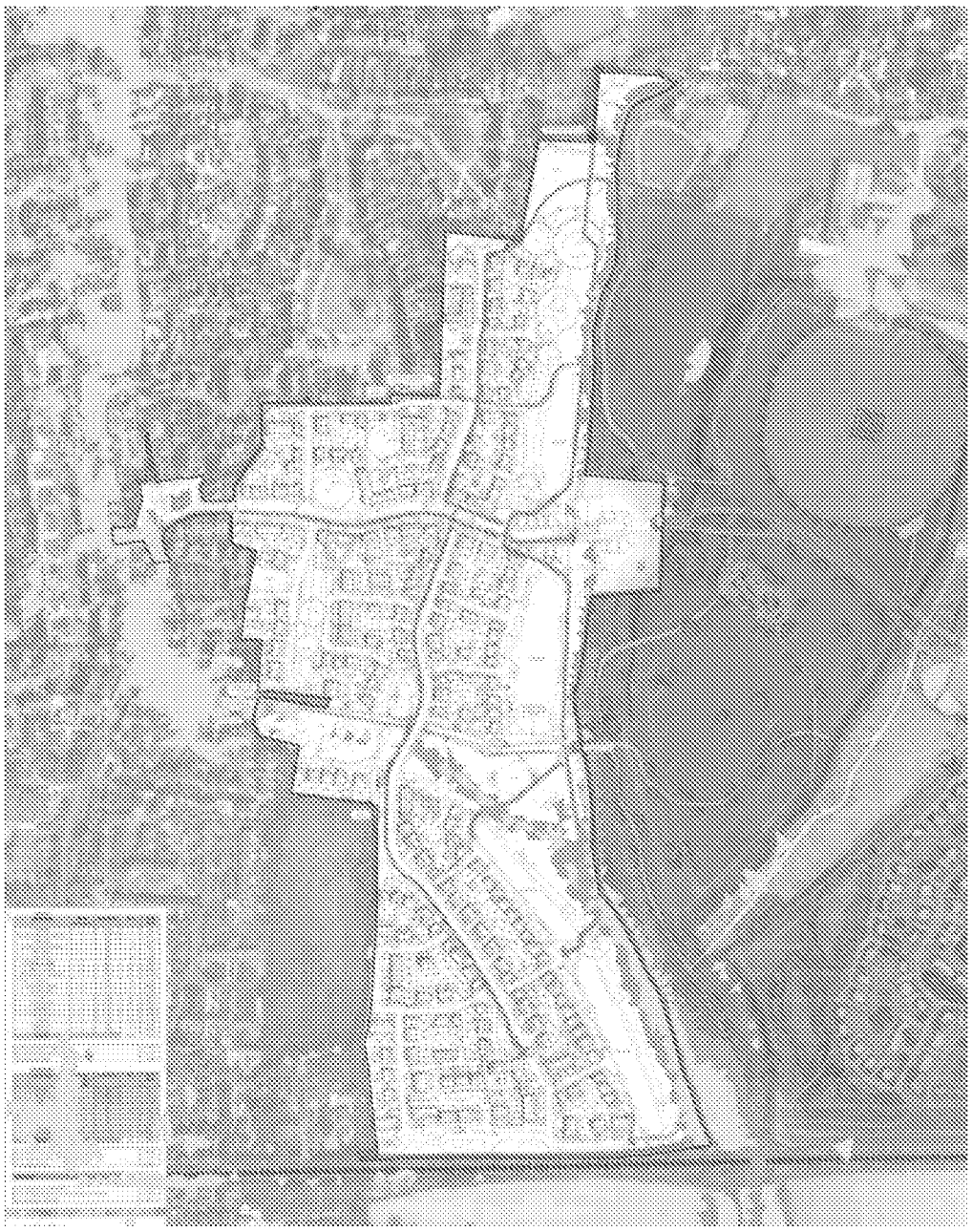
11.8.2.3 Prior to construction, further site-specific investigations will be undertaken which will include water sampling and testing. If contamination is identified, a detailed risk assessment will be undertaken, which may include in-situ/ex-situ remediation in consultation with the Environment Agency and associated permits will be obtained.

11.8.3 Operational Phase

11.8.3.1 Mitigation measures that have been embedded the design and included as part of the operational stage assessment (primary mitigation) are outlined below:

- Locating the development footprint outside Flood Zone 3 and the 1 in 100 year plus climate change (with 36% increases in flows) flood extents
- Implementation of a new drainage system prepared in accordance with latest national, regional and local standards and guidance;
- Preparation and implementation of an operational adoption and maintenance plan for the new drainage system throughout the lifetime of the development.
- Existing watercourses will be protected or carefully diverted where necessary, and / or enhanced as part of the drainage strategy. Appropriate easements / buffers will be incorporated into the design; and
- Finished floor levels will be set a minimum of 150 mm above external ground levels.

Figure 11.8:Flood Extents for the 1 in 100 year flood event with and without climate change



11.9 Residual Effects

Construction Phase

11.9.1 Increased pollution of surface water and groundwater features

11.9.1.1 During the construction stage, there would be several activities which could reduce surface water quality due to potential accidental spillages of hydrocarbons and oils and usage of hazardous materials. These activities include site clearance; excavations; foundation installation (piling); ground remediation (where required); installation of and service diversions / installations; and materials handling, storage, stockpiling, spillage and

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disposal. Runoff from site compounds may contain pollutants and spillages of hydrocarbons, chemicals, fuel, oils and unset cement which can be toxic to aquatic species and affect the quality of watercourses and groundwaters.

11.9.1.2 The above construction activities are likely to be located close to the Lidsey Rife and the Westergate Stream and the on-site field drainage ditches. Unmitigated, this could lead to pollutants from construction activities, including leaks and spills, being washed into these surface water features. In addition, the groundwater beneath may also be at risk.

11.9.1.3 A temporary drainage solution would be implemented during the construction stage. Appropriate interceptors would be incorporated in the on-site drainage systems. In addition, spill containment equipment would be stored on-site. Where permanent drainage components are used during the construction stage, all silt and debris build-up and captured hydrocarbons and oils will be removed, and the permanent components fully reinstated on completion of construction activities.

11.9.2 Increased sediment of surface water features due to surface erosion

11.9.2.1 During the construction phase, there would be several activities which could reduce surface water quality with respect to physical contamination. These include site clearance, excavations, localised ground remediation (if required), and materials handling, storage stockpiling, spillage and disposal. In addition, during periods of heavy rainfall, vehicle movements associated with construction activities resulting in damage to soil structure may generate increased sediment within surface run-off.

11.9.2.2 Runoff with high sediment load can have direct adverse effects on adjacent water bodies through increasing turbidity (thus, reducing light penetration and plant growth), and by smothering vegetation and bed substrates which can impact on invertebrate and fish communities through the destruction of feeding areas, refuges and breeding/spawning areas). Indirect adverse effects can also be associated with suspended sediments that have inorganic or organic contaminants (e.g., heavy metal and pesticides, respectively).

11.9.2.3 The effects of increased sedimentation in construction runoff would reduce shortly after completion of the works when exposed areas of earth are resurfaced, reseeded or replanted.

11.9.3 Increased flood risk associated with temporary works within fluvial and surface water flood zones

11.9.3.1 Construction activities at the proposed development have the potential to increase flooding from various sources. As flood flow routes into or across the study area would follow defined and controlled pathways, construction activities, and in particular earthworks that involve extensive storage of materials or level changes, may lead to pathways for overland flood routes changing and potentially impacting downstream receptors. In addition, compaction can lead to increases in rates / volumes of surface water run-off, as well as an increase in impermeable areas leading to a greater risk of peak flows from the Proposed Development.

11.9.3.2 A temporary drainage strategy will be implemented during the construction stage. Surface water discharge from the study area will be controlled and attenuated, as far as possible, as part of the temporary drainage. The CEMP will also incorporate measures, such as flood risk awareness training for construction workers. No materials should be stored in the areas indicated to be at risk of fluvial or surface water flooding.

11.9.3.3 The potential flood risk would be dependent upon the type, nature and depth of the flood event. However, overall, there is a relatively low risk of a significant flood event occurring during the construction stage.

11.9.3.4 Specific measures that will mitigate the significant effects identified in Table 11.6 are as follows:

- The short-Term Increase in flood risk due to construction activities will be mitigated by maintaining the capacity of the ditches and watercourses;
- The potential effect on the water quality of the Lidsey Rife, due to accidental leaks and spillages and sedimentation, will be mitigated following the generic measures identified above;
- The potential effect on the structural integrity of the existing foul or drainage system will be mitigated by locating all assets on-site and ensuring that these are fully updated and reviewed regularly in a construction drawing.

Table 11.6: Likely significant effects (with mitigation construction phase)

Receptor	Sensitivity	Potential Impact	Magnitude (post mitigation)	Significant effect
Possible flood risk to adjacent and downstream properties	High	Short Term Increase in Flood Risk due to Construction Activities. Increases less than 50mm.	Minor adverse	Negative minor
Lidsey Rife	High	Potential Effects on the Water Quality of Water Resources, due to Accidental Leaks and Spillages and sedimentation	Minor adverse (the probability is reduced however not fully)	Negative minor
Westergate Stream and on-site field ditches	Low to Medium	Potential Effects on the Water Quality of Water Resources, due to Accidental Leaks and Spillages	Minor adverse (measurable change in attributes)	Negative negligible to minor
Secondary (undifferentiated) aquifer	Medium	Short Term Alterations to Groundwater Flow and Quality	Minor adverse (measurable change in attributes)	Negative negligible to minor
Existing foul or drainage system	Very high	Affecting the structural integrity of the foul or drainage system	Negligible	Negligible

Operational Phase

11.9.4 Increased pollution of surface water and groundwater features

11.9.4.1 Polluted surface water runoff containing silts and hydrocarbons that may migrate or be discharges to surface water features or groundwater resources via the new road surfaces and highway drainage systems.

11.9.4.2 During the operational phase, untreated routine surface runoff from impermeable areas and accidental spillages could be mobilised into the surface water drainage system, and this contaminated surface water could be discharged to the surface water or groundwater receptors via the proposed drainage system.

11.9.4.3 Due to the residential nature of the development, spillages would likely be generally minor in extent and volume. The quality of surface water runoff generated by residential development is generally reasonable as much of it will arise from falling on roofs and hardstanding areas. The greatest risk lies with the possibility of hydrocarbon spillages from the movement and parking of vehicles and from residents disposing of chemicals into the drainage system.

11.9.4.4 Inherent mitigation measures will be implemented. The application of the SuDS and drainage designs will include filtration and water quality treatment stages. End of system discharges will be limited, and the widespread distribution of SuDS features will limit the generation of significant surface water flows entering the watercourses carrying pollutants.

11.9.4.5 Increases flood risk to the Proposed Development including people and property beyond the scheme

11.9.4.6 Once the Proposed Scheme is complete, the introduction of new impermeable areas could, if not mitigated, also intercept and displace the overland flow routes beginning off-site, posing an increased flood risk. Flooding events, if significant enough, have the potential to harm future site users (e.g., residents and visitors), particularly if they are in ground floor areas within the Proposed Scheme.

11.9.4.7 As stated above, inherent mitigation measures will be implemented to the development to ensure it is safe from flooding for its lifetime and will not result in any increase in flood risk. Finished floor levels should be raised to at least 150 mm above ground levels. Surface water runoff will be restricted to greenfield rates.

11.9.4.8 Specific measures that will mitigate the significant effects identified in Table 11.7 are as follows:

- The potential increase in flood risk to adjacent and downstream properties will be mitigated by having a maintenance plan that will be implemented throughout the life of the development and by raising ground levels on the development where there is no increase in flood risk to adjacent properties.

- The potential Increase in flood risk and pollution and scouring due to lack of maintenance of the Lidsey Rife will be mitigated by having a maintenance plan which will be implemented through the life of the development.
- The potential increase in flood risk of the foul system will be fully mitigated by ensuring the capacity of the foul system is increased to serve the development.

Table 11.9: Likely Significant Effects (with mitigation operational phase)

Receptor	Sensitivity	Potential Impact	Magnitude (post-mitigation)	Significant effect
Possible flood risk to adjacent and downstream properties	High	Increase in flood risk due to lack of maintenance or raising ground levels. Maintenance plan in place and raising of the ground not affecting nearby properties.	Minor adverse (the probability is reduced but not entirely)	Negative minor
Lidsey Rife	High	Increase in flood risk and potential pollution and scouring due to lack of maintenance. Maintenance plan in place.	Minor adverse (the probability is reduced but not entirely)	Negative minor
Westergate Stream and on-site ditches	Medium	Increase in flood risk and potential pollution and scouring due to lack of maintenance. Maintenance plan in place.	Negligible to minor adverse (the probability is reduced but not entirely)	Negative negligible to minor
Secondary (undifferentiated) aquifer	Medium	Potential pollution and increase in groundwater levels due to lack of maintenance	Negligible to minor adverse (the probability is reduced but not entirely)	Negative negligible to minor
Existing foul or drainage system	Very high	Development goes ahead without increasing the capacity of the system. This will not take place as it will be a condition to the development.	Negligible	Negative negligible

11.10 Cumulative Effects

11.10.1 Cumulative effects associated with hydrology and flood risk during construction are associated with the generation of sediments and increased suspended sediments being released to the water environment, spillage and leakage of oils, fuels and wet cement. Measures exist to manage and control these effects and reduce the magnitude and significance of impact to a minimum, as set out in this Chapter. These measures should also be adopted at other local construction sites and likely at different times. Therefore, the cumulative effect is negligible to minor.

11.10.2 Other committed development site will include the necessary mitigation (drainage infrastructure and flood mitigation measures) to ensure that flood risk to and from the developments is not increased to an unacceptable level. Based on this assumption, and in accordance with NPPF Planning Policy Guidance, the cumulative effects of the Proposed Development in combination with other committed developments are negligible to minor.

11.11 Summary

11.11.1 This assessment has been undertaken to determine the potential effects of the Proposed Development on the water and flood risk.

11.11.2 The potential effects that were identified during the construction phase were:

- Increased flood risk associated with temporary works within fluvial and surface water flood zones;
- Increased pollution of surface water and groundwater features;
- Increased sediment of surface water features due to surface erosion; and
- Affecting the integrity of the existing drainage and foul system.

11.11.3 The potential effects that were identified during the operational phase were:

- Increases flood risk to the Proposed Development including people and property beyond the scheme;
- Polluted surface water runoff containing silts and hydrocarbons that may migrate or be discharges to surface water features or groundwater resources via the new road surfaces and highway drainage systems; and
- Effect on the current limited capacity of the foul system.

11.11.4 The temporary drainage solution will be put in at the construction phase as a mitigation measure to manage/control the flows off site, the risk of flooding and pollution events during construction.

11.11.5 A Construction Environmental Management Plan (CEMP) will also be in place during the construction phase as an additional mitigation measure both chemical and physical contaminants entering the surface water and groundwater bodies.

11.11.6 At the operation phase, a Drainage Strategy will be put into place as part of the inherent design to ensure that there are no detrimental effects from flood risk or degradation of receiving waterbodies. The general principles applied for the Proposed Development will be to control surface water run-off using suitable Sustainable Drainage Systems (SuDS) in accordance with relevant policy and guidance.

11.11.7 As outlined in the drainage strategy, all development has been placed outside Flood Zone 3 and the 1 in 100-year plus 36% (increases in flows) for climate change, to ensure that the development does not increase the risk of fluvial flooding on site or downstream. Floor levels should be set a minimum of 150mm above finished external levels to minimise the risk of water intrusion, thereby increasing resilience in line with standard building regulations.

11.11.8 Following the implementation of appropriate mitigation measures, the Proposed Development will not result in any adverse significant residual effects on the water environment.

11.12 References

11.12.1 A list of Water Environment reference below:

- CIRIA (2015) The SuDS Manual (C753). Available at: http://www.scotsnet.org.uk/documents/NRDG/CIRIA-report-C753-the-SuDS-manual-v6.pdf
- Department of Levelling Up, Housing and Communities and Ministry of Housing Communities & Local Government (2022), Flood Risk and Coastal Change. Available at: https://www.gov.uk/guidance/flood-risk-and-coastal-change
- Department for Environment, Food and Rural Affairs (2015) Sustainable Drainage Systems. Non-statutory technical standards for sustainable drainage systems. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf
- Environment Act (2021), c.30. Available at:
- https://www.legislation.gov.uk/ukpga/2021/30/contents/enacted
- Environment Agency (2022) Flood risk assessments: climate change allowances. Available at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances
- Environment Agency (2012) River Ex Catchment Flood Management Plan. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/294033/Exe_Catchment_Flood_Management_Plan.pdf

- Environment Agency (2022) South West river basin district flood risk management plan 2021 to 2027. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1122760/South-West-FRMP-2021-2027.pdf
- Flood and Water Management Act (2010), c.29. Available at: https://www.legislation.gov.uk/ukpga/2010/29/contents
- The Flood Risk Regulations (2009), No. 3042. Available at: https://www.legislation.gov.uk/uksi/2009/3042/contents/made
- HM Government (2018) A Green Future: Our 25 Year Plan to Improve the Environment. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/693158/25-year-environment-plan.pdf
- Land Drainage Act (1991), c.59. Available at: https://www.legislation.gov.uk/ukpga/1991/59/contents
- Local Resilience Forum (2028) Multi Agency Flood Framework. Available at: https://www.dcisprepared.org.uk/media/2158/multi-agency-flood-framework-lrfdcios-20160615-v24.pdf
- Ministry of Housing Communities & Local Government (2010) Drainage and waste disposal: Approved Document H. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/442889/BR_PDF_AD_H_2015.pdf
- Ministry of Housing Communities & Local Government (2021) National Planning Policy Framework. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf
- Standards for Highways (2020) LA 113 – Road drainage and the water environment. Available at: https://www.standardsforhighways.co.uk/tses/attachments/d6388f5f-2694-4986-ac46-b17b62c21727?inline=true
- The Water Environment (Water Framework Directive) (England and Wales) Regulations (2017), No. 407. Available at: https://www.legislation.gov.uk/uksi/2017/407/contents/made
- Water Industry Act (1991), c.56. Available at: https://www.legislation.gov.uk/ukpga/1991/56/contents
- Water Resources Act (1991), c.57. Available at: https://www.legislation.gov.uk/ukpga/1991/57/contents

11.13 Glossary

11.13.1 A glossary of Water Environment terms is below:

FRA	Flood Risk Assessment
NPPF	National Planning Policy Framework
PPG	Planning practice guidance
CIRIA	Construction industry research and information association
DEFRA	Department Environment Food & Rural Affairs
SuDS	Sustainable Drainage Systems
LLFA	Lead Local Flood Authority
SMP	Shoreline Management Plan
WSCC	West Sussex County Council
PFRA	Preliminary Flood Risk Assessment
SSWMS	Strategic Surface Water Management Strategy
SWMP	Surface Water Management Plan
LiDAR	Light Detection and Ranging
BGS	British Geological Survey
IDB	Internal Drainage Board
NEAP	Neighbourhood area of play
LEAP	Local equipped area of play
LAP	Local area of play
uFMfSW	Updated Flood Maps for Surface Water
AEP	Annual Exceedance Probability
ADC	Arun District Council

12. Socio-Economics

12.1 Introduction

12.2 Background

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12 Socio-Economics

12.1 Introduction

12.1.1 This chapter has been written by Nexus Analytics and Research. The section is informed and supported by a Health Impact Assessment which is provided in Chapter 16.

12.1.2 This Section is written by Fiona Bruce, Research Analyst at Nexus Planning with two-years' experience.

12.2 Background

12.2.1 The National Planning Policy Framework (NPPF) establishes that building a strong, competitive economy is central to delivering sustainable development. Undertaking an economic impact assessment clearly sets out the economic benefits of development in terms of jobs and investment during the construction and completion stages. This can support planning applications as well as assisting funding and project decisions, with projects ranging from small residential schemes through to major mixed used regeneration.

12.2.2 Socio-economic impact assessments identify the degree of significance and spatial impact of a development on lifestyles and services and set out ways to maximise, minimise or mitigate these. These can help stakeholders understand the wider impacts of development and are often completed as a part of EIAs.

12.2.3 The Site

12.2.3.1 Land East of Westergate, Westergate ("The Site") is located to the eastern border of Westergate, West Sussex. It is located in the north-west of Arun District, near the border with Chichester District.

12.2.4 The Scheme

12.2.4.1 The Proposed Development is a hybrid application including the following:

- Full planning application for western section of East/West Link Road with new access, road bridge and associated works;
- Outline planning application with all matters reserved for up to 400 no. dwellings with access and associated works.

12.2.4.2 The Proposed Development forms part of the wider Barnham/Eastergate/Westergate allocation as outlined in Chapter 4.

12.2.5 Potential Cumulative Effects

12.2.5.1 The potential for cumulative effects with projects highlighted within the Scoping Opinion Response received from Arun District Council dated 21st November 2022 is assessed within section 12.11 of this chapter.

12.3 Chapter Structure

12.3.1 The Chapter is set out as follows:

- Section 12.4 of this chapter will first discuss the policies relating to socio-economics in a development context, at both national and local levels.
- Section 12.5 will then outline the methodology used to define the assessment areas and assessment criteria.
- Section 12.6 sets out the existing socio-economic conditions of the relevant assessment zones to understand the baseline position.
- Section 12.7 considers the initial impacts of the Proposed Development on the relevant receptors during the construction phase of development.
- Section 12.8 considers the initial impacts of the Proposed Development on the relevant receptors during the post-construction phase of development.
- Section 12.9 outlines the mitigation measures which can be taken to reduce or enhance the initial impacts of the Proposed Development.
- Section 12.10 concludes the residual effects of the Proposed Development, following the implementation of these mitigation measures.
- Section 12.11 discusses the effects of the Proposed Development when considered cumulatively with other developments in the local area.

12.4 Socio-Economics Policy Context

National Planning Policy Framework

12.4.1 The Government published the updated National Planning Policy Framework ("the Framework") in September 2023. It sets out the Government's planning policies for England and how these are expected to be applied. The policies contained within the Framework are material considerations which local planning authorities should take into account.

12.4.2 The purpose of the planning system is to contribute to the achievement of sustainable development and so that sustainable development is pursued in a positive way, at the heart of the Framework is a presumption in favour of sustainable development.

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12.4.3 Achieving sustainable development means the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives).

Adopted Arun Local Plan 2011-2031 (2018)

12.4.4 The Arun Local Plan 2011-2031 was adopted in July 2018, and outlines the spatial vision, objectives and strategy of growth for the District over this period.

12.4.5 Housing delivery is one of the strategic objectives of the Local Plan, and Policy H SP1 outlines that over the period 2011-2031, at least 20,000 new homes will be delivered across the District. 11 strategic housing sites have been identified to help deliver this.

12.4.6 Policy H SP1 SD5 relates to the Barnham/Eastergate/Westergate allocation, of which the Site forms a part of. The policy allows for 2,300 new dwellings, which makes it the second largest allocation in the District.

12.5 Socio-Economics Assessment Methodology

Assessment Methodology

12.5.1 Whilst there is currently no specific Government guidance or regulations on the preferred method of assessing wider socio-economic impacts associated with major development, this assessment has been undertaken using our experience of schemes elsewhere and drawing on relevant guidelines, including the HCA Additionality Guide (this guidance was withdrawn in May 2022, but has not yet been replaced and is still regarded as being up to date).

12.5.2 Baseline socioeconomic conditions have been established through the interpretation of nationally recognised research and survey information such as:

- Census 2021
- Index of Multiple Deprivation 2019
- HM Land Registry
- Business Register and Employment

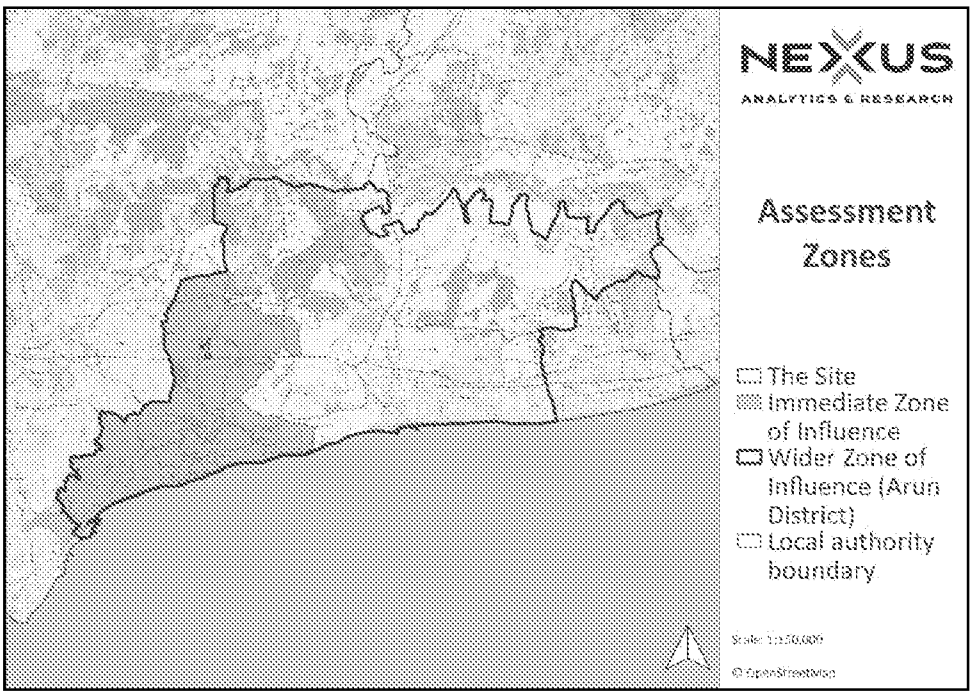
12.5.3 The assessment of impacts will be considered in relation to the relevant assessment zones, identified in **Figure 12.1.**

12.5.4 The Immediate Zone of Influence is defined as the area most likely to be impacted by the Proposed Development. In this case, it has been identified as nine Middle Layer Super Output Areas (MSOAs) which cover the settlements of Westergate, Eastergate and Barnham, in addition to the built-up area of Bognor Regis, to the south of the Site.

12.5.5 The Wider Zone of Influence has been identified as Arun District.

12.5.6 The extent of the Immediate and Wider Zones of Influence in relation to the Site can be seen in Figure 12.1.

Figure 12.1: Assessment Zones



12.5.7 In addition to the immediate and Wider Zones, the baseline assessment will also make reference to regional (South East) and national (England) averages.

Consultations

12.5.8 The scope of the socio-economics chapter has been agreed in consultation with Arun District Council, as outlined in their Scoping Opinion.

Limitations

12.5.9 Some data used in the baseline section is not available at granular levels, such as LSOAs and MSOAs. In these cases, we have reverted to using data at a district wide level.

12.5.10 Census 2021 results inform a significant part of the baseline section. This data was collected during Covid-19 and as such, some results may be influenced by this context.

Significance Criteria and Receptors

12.5.11 The significance of the potential socio-economic impacts associated with the Proposed Development has been assessed using professional judgment and the standard significance criteria set out in Chapter 2.

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12.5.12 Impacts will be assessed in terms of their sensitivity, magnitude, significance, type, spatial extent, and duration.

12.5.13 In relying on professional judgment, the assessment process aims to be objective and quantify the impacts where possible. However, given the nature of the assessment some of the effects of the Proposed Development can only be evaluated on a qualitative basis.

12.5.14 The following are identified as receptors and considered to be part of the EIA process:

- 12.6.1 - Population;
- 12.6.2 – Age Structure;
- 12.6.3 - Deprivation;
- 12.6.4- Employment and the labour market;
- 12.6.5 - Earnings;
- 12.6.6 - Unemployment;
- 12.6.7 - Travel to work;
- 12.6.8 – Qualifications and Skills;
- 12.6.9 - Housing;
- 12.6.10 - Health and education facilities; and
- 12.6.11 - Social and Recreational Facilities

12.6 Baseline

12.6.1 Population

12.6.1.1 The population of the Immediate Zone, the Wider Zone and England over the period 2011-2031 can be seen in Table 12.1.

12.6.1.2 At the time of the 2021 Census, the Immediate Zone was reported to have a population of 82,560, an increase of 7,775 from the 2011 Census. This represents an increase of 10.3%, which is similar to that of the Wider Zone, but significantly higher than the increase seen in England over the same time period (6.6%).

12.6.1.3 Population growth over the period to 2031 is expected to slow across all assessment areas. In the Immediate Zone, there is projected to be an increase of 5.5%; this is slightly lower than in the Wider Zone, but slightly higher than in England.

Table 12.1: Population Change, 2011-2031

	Immediate Zone		Wider Zone		England	
	Population	Increase (%)	Population	Increase (%)	Population	Increase (%)
2011	74,785	-	149,518	-	53,012,456	-
2021	82,560	10.4%	164,889	10.3%	56,490,048	6.6%
2031	87,139	5.5%	175,901	6.7%	58,978,025	4.4%

Source: Census 2011, Census 2021 and Experian Population Projections

12.6.2 Age Structure

12.6.2.1 Table 12.2 below illustrates the age profile of the Immediate Zone in comparison to the Wider Zone and England. The age profile is broadly similar to that of the Wider Zone. However, the Immediate Zone has a smaller population of under 20s (19.0%) in comparison to England (23.0%) and a larger proportion of over 60s (34.2%) in comparison to England (24.2%).

Table 12.2: Age Structure

	Immediate Zone	Wider Zone	England
0 to 4	4.3%	4.4%	5.4%
5 to 9	4.9%	5.0%	5.9%
10 to 14	5.1%	5.0%	6.0%
15 to 19	4.7%	4.6%	5.7%
20 to 24	4.9%	4.5%	6.0%
25 to 29	5.4%	5.1%	6.6%
30 to 34	5.8%	5.6%	7.0%
35 to 39	5.6%	5.4%	6.7%
40 to 44	5.4%	5.3%	6.3%
45 to 49	5.8%	5.7%	6.4%
50 to 54	6.9%	6.9%	6.9%
55 to 59	7.2%	7.2%	6.7%
60 to 64	6.6%	6.7%	5.8%
65 to 69	6.3%	6.5%	4.9%
70 to 74	7.4%	7.6%	5.0%
75 to 79	5.7%	5.9%	3.6%
80 to 84	4.0%	4.1%	2.5%
85+	4.2%	4.3%	2.4%

Source: Census 2021

12.6.3 Deprivation

Index of Multiple Deprivation

12.6.3.1 The Index of Multiple Deprivation (IMD) is a measure of multiple deprivation for small areas. The indices of deprivation are determined by seven domains, being:

- Income (which measures the proportion of the population experiencing deprivation relating to low income).
- Employment (which measures the proportion of the working age population in an area involuntarily excluded from the labour market).
- Education, skills and training (which measures the lack of attainment and skills in the local population)
- Health and disability (which measures the risk of premature death and the impairment of quality of life through poor physical or mental health).
- Crime (which measures the risk of personal and material victimisation at a local level).
- Barriers to Housing and Services (which measures the physical and financial accessibility of housing and local services).
- Living Environment (which measures the quality of the local environment)

12.6.3.2 According to the IMD 2019, of the 317 local authorities in England (where 1 is the most deprived and 317 is the least deprived), Arun District is ranked 149th, which means it is around the national average in terms of deprivation levels.

12.6.3.3 On a more localised basis, the area surrounding the Site is less deprived than the District average. The Site is located primarily in the LSOAs of Arun 003C and Arun 003D. As seen in Table 12.3, both LSOAs score within the top 50% least deprived LSOAs nationally, although deprivation levels are slightly higher in Arun 003D. In Arun 003D, the domains with the highest deprivation levels are Barriers to Housing and Services and Living Environment.

Table 12.3: IMD Deciles

Data	Arun 003C	Arun 003D
IMD	9	6
Income	8	6
Employment	8	6
Education, Skills and Training	7	6
Health	6	6
Crime	8	8
Barriers to Housing and Services	7	4
Living Environment	8	4

Source: Index of Multiple Deprivation (2019)

Life Expectancy

12.6.3.4 The average life expectancy at birth for males and females across each assessment area can be seen in the Table 12.4. Life expectancies for males in the Wider Zone are similar to that of England, although they are slightly below that of the South East region. Life expectancies for females in the Wider Zone are slightly higher than in England, though slightly below that of regional averages.

Table 12.4: Average Life Expectancy at birth, 2009-2010 to 2015-2018

Location	2009-2010		2010-2012		2012-2014		2014-2016		2015-2018	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Wider Zone	79.1	83.1	79.6	83.4	79.7	83.7	79.7	83.5	79.7	83.5
South East	79.5	83.3	80.2	83.7	80.4	83.9	80.6	84.0	80.7	84.1
England	78.4	82.3	79.1	82.9	79.4	83.1	79.5	83.1	79.6	83.2

Source: Life expectancy at birth and age 65 by sex, ONS (2019)

12.6.4 Employment and the labour market

12.6.4.1 Table 12.5 displays the occupations of the economically active within the Immediate Zone. In comparison to England, there is a greater proportion of people employed in skilled trades occupations, process, plant and machine operatives and elementary occupations. Conversely, there is a smaller proportion of people employed as managers, directors and senior officials, professional occupations and associate professional and technical occupations.

Table 12.5: Employment by Occupation

Occupations	Immediate Zone	Wider Zone	England
Managers, directors and senior officials	12.7%	13.3%	12.9%
Professional occupations	13.5%	14.4%	20.3%
Associate professional and technical occupations	10.7%	11.7%	13.3%
Administrative and secretarial occupations	9.3%	9.3%	9.3%
Skilled trades occupations	12.9%	12.6%	10.2%
Caring, leisure and other service occupations	11.6%	11.7%	9.3%
Sales and customer service occupations	8.1%	8.0%	7.5%
Process, plant and machine operatives	8.6%	7.5%	6.9%
Elementary occupations	12.5%	11.4%	10.5%

Source: Census 2021

12.6.5 Earnings

12.6.5.1 Table 12.6 demonstrates the weekly gross pay for both full time and part time workers in the Wider Zone, the South East and England. As seen, wages for both full time and part time workers in the Wider Zone are significantly lower than in the South East and England.

Table 12.6: Weekly Gross Pay (2022)

Weekly gross pay	Wider Zone	South East	England
Full time workers	£546.6	£685.3	£645.8
Part time workers	£196.1	£231.2	£228.0

Source: Annual Survey of Hours and Earnings, ONS (2022)

12.6.6 Unemployment

12.6.6.1 Unemployment rates across the Wider Zone, the South East and England can be seen in Table 12.7. Unemployment is slightly higher in the Wider Zone than in the South East region but lower than in England. Like the South East and England, the Wider Zone has experienced a trend wherein unemployment increased significantly in 2020, before declining until 2023.

Table 12.7: JSA Claimant Count, 2019-2023

Month	Wider Zone	South East	England
May 2019	2.0%	1.8%	2.6%
May 2020	6.2%	5.3%	6.4%
May 2021	5.1%	4.7%	5.9%
May 2022	3.0%	2.9%	3.8%
May 2023	3.0%	2.8%	3.7%

Source: Claimant Count by sex and age, ONS (2023)

12.6.7 Travel to work

Method of Travel to Work

12.6.7.1 As seen in Table 12.8, the most popular method of travelling to work in the Immediate Zone is by private vehicle (62.8%). Although this is comparable to that of the Wider Zone (60.6%), it is significantly higher than the rate in England (49.6%). There are fewer people who travel to work by public transport (3.9%) and fewer people who work mainly from home (22.1%) when compared to the national average.

Table 12.8: Method of travel to work

Method	Immediate Zone	Wider Zone	England
Work mainly from home	22.1%	24.7%	31.5%
Public Transport – rail, tram, train, bus, minibus or coach	3.9%	3.5%	8.2%
Private Vehicle – Taxi, Motorcycle, scooter, moped, driver or passenger in car or van	62.8%	60.6%	49.6%
Active Transport – Bicycle or on foot	10.1%	10.1%	9.7%
Other method of travel to work	1.2%	1.1%	1.0%

Source: Census 2021

Distance Travelled to Work

12.6.7.2 Table 12.9 demonstrates commuting patterns in the Immediate Zone. There is a greater proportion of people in the Immediate Zone who travel less than 10km to work (42.3%) when compared to the Wider Zone (38.0%) and England (35.4%).

Table 12.9: Distance travelled to work

Distance travelled to work	Immediate Zone	Wider Zone	England
Less than 10km	42.3%	38.0%	35.4%
10km to less than 30km	12.5%	14.8%	14.4%
30km and over	5.1%	5.1%	4.3%
Works mainly from home	22.1%	24.7%	31.5%
Other	18.1%	17.4%	14.5%

Source: Census 2021

12.6.8 Qualifications and skills

12.6.8.1 The highest qualifications achieved by those over 16 across the different assessment zones can be seen in Table 12.10. The proportion of people with no formal qualifications is slightly higher in the Immediate Zone (20.7%) when compared to the Wider Zone (19.7%) and England (18.1%). Conversely, the proportion of residents with Level 4 qualifications and above is considerably lower in the Immediate Zone (25.6%) when compared to England (33.9%).

Table 12.10: Highest qualification

Highest qualification	Immediate Zone	Wider Zone	England
No qualifications	20.7%	19.7%	18.1%
Level 1, 2 or 3 qualifications	43.4%	44.0%	39.9%
Apprenticeship	6.8%	6.5%	5.3%
Level 4 qualifications and above	25.6%	26.4%	33.9%
Other qualifications	3.5%	3.3%	2.8%

Source: Census 2021

12.6.9 Housing

Dwelling Size

12.6.9.1 Average dwelling size in the Immediate Zone is slightly smaller in the Immediate Zone when compared to the Wider Zone and England. There is a greater proportion of households living in 1- and 2-bed properties, and a smaller proportion of households living in properties with 3 or more bedrooms.

Table 12.11: Number of Bedrooms

Number of bedrooms	Immediate Zone	Wider Zone	England
1 bedroom	13.0%	11.8%	11.6%
2 bedrooms	31.2%	30.9%	27.3%
3 bedrooms	36.9%	38.4%	40.0%
4+ bedrooms	18.8%	19.0%	21.1%

Source: Census 2021

Housing Type

12.6.9.2 The most popular housing types in the Immediate Zone are broadly similar to that of the Wider Zone and England, although there are slightly fewer households living in houses and bungalows and slightly more households living in flats, maisonettes and apartments.

Table 12.12: Housing Type

Housing Type	Immediate Zone	Wider Zone	England
Whole house or bungalow	75.7%	77.6%	77.4%
Flat, maisonette or apartment	23.1%	21.0%	22.2%
A caravan or other mobile or temporary structure	1.2%	1.3%	0.4%

Source: Census 2021

Housing Tenure

12.6.9.3 Table 12.13displays the housing tenure of households across the assessment areas. Home ownership rates are significantly higher in the Immediate Zone (71.4%) than in England (62.3%). Although the proportions of people living in the private rented sector are broadly similar, there is a far smaller proportion of people in the Immediate Zone living in the social rented sector (8.9%) when compared to England (17.1%).

Table 12.13: Housing Tenure

Housing Tenure	Immediate Zone	Wider Zone	England
Owns outright	43.6%	44.3%	32.5%
Owns with a mortgage or loan or shared ownership	27.8%	28.1%	29.8%
Social rented	8.9%	9.3%	17.1%
Private rented or lives rent free	19.7%	18.3%	20.6%

Source: Census 2021

Housing Completions

12.6.9.4 The most recent Housing Delivery Test (HDT) for Arun District Council was published in January 2022. The HDT outlines the percentage of housing requirements which have been over the last three year period:

- November 2018: 91%
- November 2019: 68%
- November 2020: 61%
- November 2021: 65%

12.6.9.5 As such, it is evident that housing delivery in the District is particularly low.

House Prices and Affordability

12.6.9.6 Data on house prices is available from the UK House Price Index at a local authority level. In June 2022, the average house price in the Wider Zone was £361,347; this is significantly higher than the English national average of £303,557, but slightly below the South East average of £388,873.

12.6.9.7 The ONS provides data on housing affordability through its ratio of house price to workplace-based earnings. The Wider Zone has an affordability ratio of 12.6, which means residents must pay, on average, 12.6 times their salary for a house. This ratio has steadily increased year-on-year. In 2011, when the Local Plan period began, the ratio was 10.0, and as such there has been a 26% increase. In England, the affordability ratio is 8.3, and as such housing within the Wider Zone is considerably less affordable than national averages. This is likely due to a combination of higher than average house prices and lower than average earnings, as outlined in 12.6.5.

12.6.10 Health and education facilities

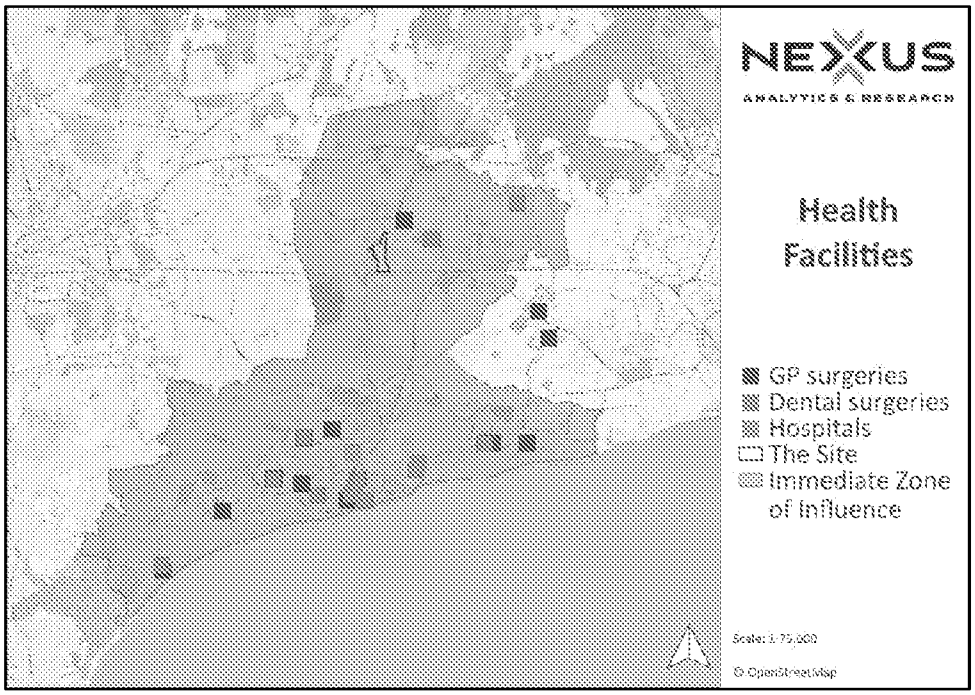
Health facilities

12.6.10.1 The Immediate Zone is well provided for in terms of health facilities, as seen in Figure 12.2.

12.6.10.2 The nearest hospital is Bognor Regis War Memorial Hospital, located around 5km from the Site. St Richards Hospital, located approximately 8km from the Site in Chichester, offers a wider range of facilities and services.

12.6.10.3 There are 14 dental surgeries located within the Immediate Zone. However, of the two practices located closest to the Site - Chantry House Dental Practice and Walberton Dental Surgery - neither are currently accepting new NHS patients.

Figure 12.2: Health Facilities



12.6.10.4 The Site falls within the catchment areas of four GP surgeries, as seen in the Table 12.14. The Croft Surgery and Meadowcroft Surgery are two separate surgeries but share patients and staff, and so capacity numbers have only been listed once. Based on NHS Healthy Urban Development Unit Model (HUDU Model) population size standards of 1,800 people to justify one General Practitioner, we can see that currently all surgeries are over-capacity. Across the surgeries there is a combined over-capacity of 8,717 patients, which equates to nearly 5 FTE (full-time equivalent) GPs.

Table 12.14: GP Surgery Capacities

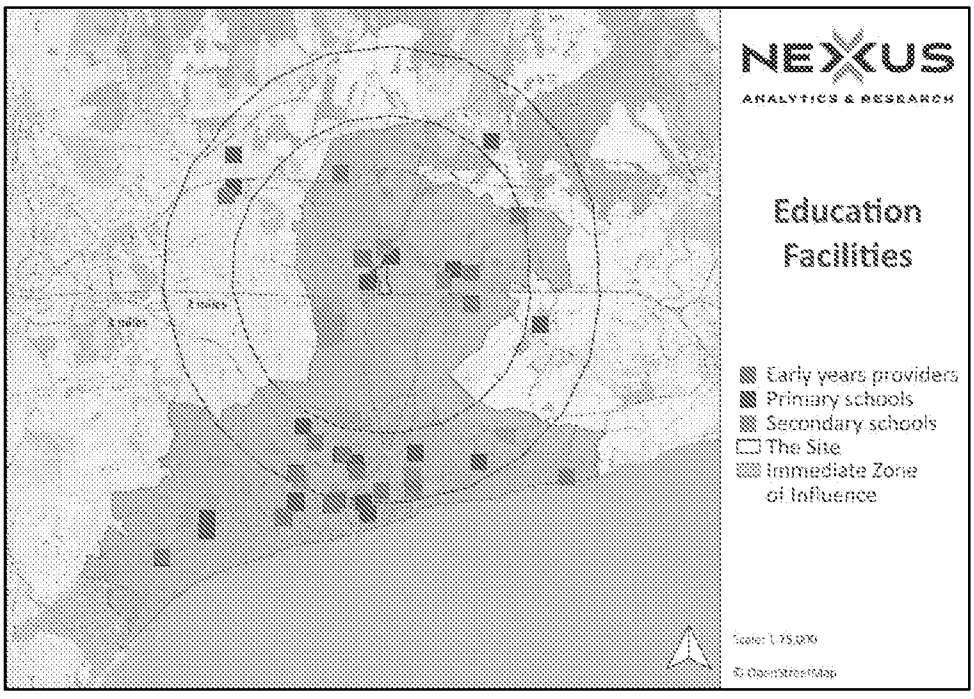
GP Name	CQC rating	No. of patients (July 2023)	No. of FTE GPs	Patient capacity	GP capacity
The Croft Surgery	Good	12,072	5.5	-2,172	-1.2
Tangmere Medical Centre	Good	7,448	1	-5,648	-3.1
Avisford Medical Group	Good	11,697	6	-897	-0.5
Meadowcroft Surgery	Good	-	-	-	-
Net		31,217	12.5	-8,717	-4.8

Source: Patients registered at a GP Practice, NHS (2023)

Education facilities

12.6.10.5 The Department for Education (DfE) accessibility standards are that schools should be within walking distance of the homes of the majority of its children. For children under 8 years the maximum walking distance is 2-miles and for children over 8 years 3-miles. In view of these standards, the education baseline applies a 2-mile and 3-mile accessibility buffer around the Site.

Figure 12.3: Education Facilities



12.6.10.6 Within a 2-mile radius of the Site, five facilities offering early years childcare have been identified, as listed in the table below. This includes two day nurseries, two pre-schools and one childminder, offering a level of variety to parents. Additionally, of the four nurseries which have had an inspection from Ofsted, all have received a grade of 'Good', suggesting the quality of childcare available is generally high. Recent and consistent capacity data at early years level is currently unavailable.

Table 12.15: Early Years Providers

Provider Name	Ofsted grade	Type of Provider
Hopscotch Pre-School	Good	Pre-School
Sarah Dominick Childminding	Good	Childminder
Seasons @ Aldingbourne Trust	Good	Day Nursery
Squirrel's Den Daycare	N/A	Day Nursery
Walberton Pre-School	Good	Pre-School

12.6.10.7 Within a 2-mile radius of the Site there are three primary schools, as seen in the Table 12.16. All three schools have achieved the grade of 'Good' at their latest Ofsted inspection.

12.6.10.8 Across the three schools there are a total of 735 school places with 708 enrolled pupils, resulting in a headroom of 27 pupils. There is some variation in capacity, however, with Barnham and Eastergate primary schools having some minor capacity, whereas Aldingbourne Primary School is already overcapacity.

Table 12.16: Primary School Capacity (2022)

School Name	School Places	Pupils on Roll	Headroom
Aldingbourne Primary School	210	213	-3
Barnham Primary School	315	294	+21
Eastergate CofE Primary School	210	201	+9
Total primary school capacity	735	708	27

Source: Planning School Places 2023, West Sussex County Council

12.6.10.9 West Sussex County Council's Planning School Places 2023 document also discusses the capacity of primary schools within the District.

12.6.10.10 The Site falls within the Barnham/Westergate primary planning area. The capacity across all primary schools in this area was reported to be 92%. School planning areas are considered to be at full capacity when the

capacity level exceeds 95%. Although this indicates the area currently has some capacity, the Council anticipates demand to increase and as such is exploring options to expand primary provision.

12.6.10.11 There are four secondary schools within a 3-mile radius of the Site; however two of these, Felpham Community College and the Regis School are located within Bognor Regis and are not considered to be within a walkable distance from the Site.

12.6.10.12 Details of the other two schools can be seen in the table below. As seen, there is existing capacity of 165 pupils at Ormiston Six Villages Academy but an overcapacity of 58 places at St Philip Howard Catholic School, resulting in a total capacity of 107 places.

12.6.10.13 However, the Planning School Places document indicates that the Barnham/Westergate secondary school planning area is already at 99% capacity, which exceeds the recommended 95% occupation level.

Table 12.17: Secondary School Capacity (2022)

School Name	School Places	Applicable roll	Headroom
Ormiston Six Villages Academy	823	658	+165
St Philip Howard Catholic School	900	958	-58
Total secondary school capacity	1,723	1,616	107

Source: Planning School Places 2023, West Sussex County Council

12.6.11 Social and Recreational Facilities

12.6.11.1 The Immediate Zone is an area of high recreational value. Bognor Regis, as a seaside resort, has many social and recreational facilities for both tourists and residents.

12.6.11.2 Furthermore, Bognor Regis town centre has many independent and national retailers, in addition to a variety of cafés, restaurants and pubs.

Open Spaces and Sports Facilities

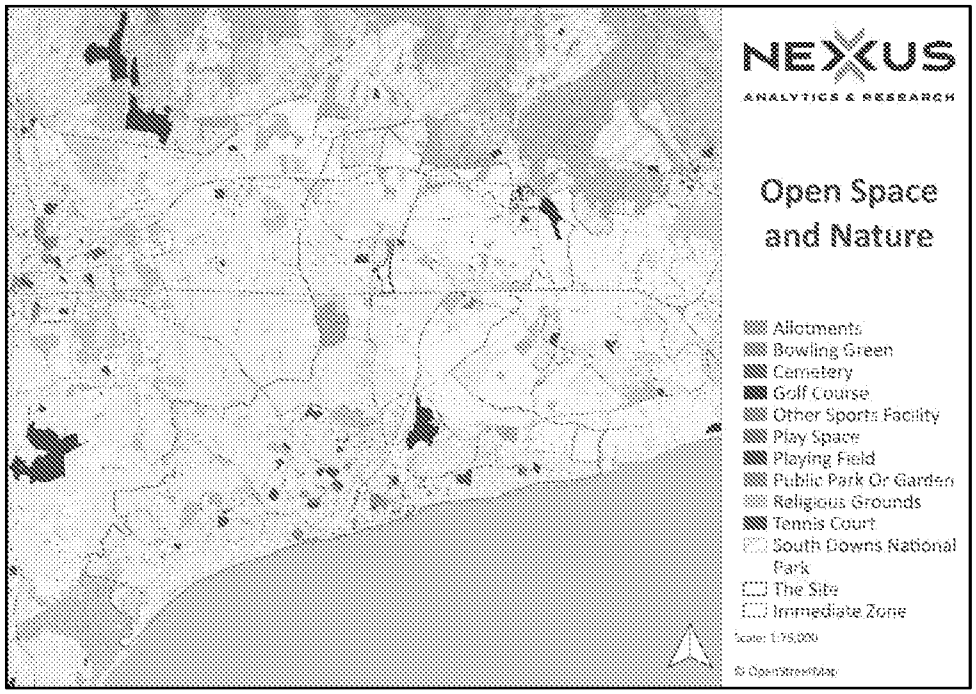
12.6.11.3 In Westergate itself, the Six Villages Sports Centre and Aldingbourne Community Sports Centre offer a range of sports facilities. Other playing fields and play spaces are available throughout the settlement.

12.6.11.4 In Bognor Regis there is a wider range of open spaces and sports facilities, as indicated in the figure below.

12.6.11.5 The Immediate Zone is also located on the border of the South Downs National Park, and is only 5km from the beach at Bognor Regis, and as such residents are able to benefit from these vast areas of natural open space.

12.6.11.6 Evidence from the Arun District Council Open Space Assessment Report also suggests that residents are generally satisfied with both the quantity and quality of open space available.

Figure 12.4: Open Space



Source: OS Greenspace

12.7 Likely Significant Environmental Effects During Construction

12.7.1 The following section sets out the environmental effects associated with the construction phase of the Proposed Development prior to any mitigation measures other than those measures embedded within the scheme.

12.7.2 For the purposes of economic modelling, we refer to the impacts on the Wider Zone of Influence and regional area of the South East. The build period is estimated to be approximately six and a half years.

12.7.3 Population

12.7.3.1 The total construction expenditure is estimated to provide around 547 person years of employment across the minimum six-year build period, which is equivalent to around 84 full-time jobs. The majority of these would be expected to be located on-site.

12.7.3.2 Although a limited number of short-term migrant workers may be attracted to the local area during the construction period, it is expected that the majority of construction jobs could be sourced from within the local workforce, as the local area has a relatively high proportion of people employed in the construction industry. The overall impact on population would therefore be considered negligible.

12.7.4 Deprivation

12.7.4.1 The construction phase is unlikely to have any discernible effect on the local health status in the Immediate Zone of Influence and the Wider Zone of Influence, with any impact due to injuries or accidents on-site. Modern average site accident rates are low and overall, it is considered that there would be no effect on health status. Given the good levels of health in the Wider Zone, the sensitivity of this receptor is considered low.

12.7.4.2 The construction phase is judged to have a negligible impact on deprivation in the local area.

12.7.5 Employment and the labour market

12.7.5.1 The Proposed Development is expected to support the local economy by creating temporary employment during the construction phase. There are two methods to calculate the number of construction jobs created.

12.7.5.2 First, construction employment can be derived as a product of construction costs, which are calculated to be £97.8m for the Proposed Development[4]. This figure incorporates both capital and labour costs for the development and associated infrastructure. We then apply the average turnover per worker in the construction sector from the Annual Business Survey (ABS) data on regional turnover, and Business Register and Employment Survey (BRES) data on employment in the South East region[5], to infrastructure and building costs which provides an indication of the employment anticipated to be generated by the construction of the development. This equates to 75 equivalent full time temporary construction jobs over the six-year build period.

12.7.5.3 The second method of calculating construction jobs assumes that 30% of construction costs will be spent on labour; this equates to £29.3m. Average South East construction labour wages in 2022 were £43,928[6]. Allowing for overheads[7], this would generate some 94 construction jobs per annum.

12.7.5.4 We then take a midpoint of the results from these two approaches. An estimated 84 construction jobs will be supported on-site over the build period.

12.7.5.5 Consideration is also given to net additional jobs which may be created during the construction phase. In our analysis we account for the following economic effects:

- Displacement – whether jobs created are detracting from other business/employers
- Substitution – whether jobs have been created without the Proposed Development in any case
- Leakage – the extent to which jobs are taken by those outside of the study area; and

[4] This is based on the cost assumption of £225 per sqf, as provided by the client

5 Derived from Annual Business Survey data (2021 results) on turnover and GVA in the construction sector, and Business Register and Employment Survey (2021 results)

6 Annual Survey of Hours and Earnings (ASHE) (2022) (12.19)

7 Derived from Savills, Residential Development Margin Research (2017)

- Multiplier effects – downstream business benefits through the supply chain (indirect) and benefits created through additional income expenditure of employees

12.7.5.6 Displacement: Unemployment levels are lower than national averages, so the labour market is considered to be relatively tight. Although the Proposed Development requires a fairly high number of construction workers, the Wider Zone has a relatively large construction workforce from which this labour can be sourced. Some level of displacement has therefore been accounted for.

12.7.5.7 Substitution: The jobs arising from the Proposed Development are not anticipated to substitute alternate activity.

12.7.5.8 Leakage: According to Census 2021 data, Arun has a construction workforce of 7,194 workers; the average annual requirement will be just over 1% of the workforce. As such, it is assumed that 95% of construction jobs will be supported from within Arun, with the other 5% supported by the wider South East region. Therefore, it is assumed there will be minimal leakage beyond the region.

12.7.5.9 Multiplier effects: 'The Additionality Guide Fourth Edition'[8] recommends a composite multiplier (indirect and induced effects) for average linkages of 1.1 at the local level and 1.5 at the regional level.

12.7.5.10 To determine the additionality of the Proposed Development the following formula is used (**Figure 12.5**):

Figure 12.5: Additionality Formula

$$AI = [GI \times (1-L) \times (1-Dp) \times (1-S) \times M] - [GI^* \times (1-L^*) \times (1-Dp^*) \times (1-S^*) \times M^*]$$

Where:

AI= Net additional impact
GI= Gross impact
L=Leakage
Dp= Displacement
S=Substitution
M=Multiplier
* denotes reference case and hence deadweight

Source: Additionality Guide Fourth Edition

12.7.5.11 Considering the above, the net additional jobs anticipated to be supported as a result of the Proposed Development within the local area is 488 person years of employment in construction related jobs across the six-year build period.

[8] Note that this guidance was withdrawn in May 2022, but has not yet been replaced and is still regarded as being up to date.

12.7.5.12 The Proposed Development is anticipated to support approximately 821 person years of employment in construction related jobs at the regional level.

12.7.5.13 Using the ONS Annual Business Survey Ratio of turnover to GVA (gross value added) in the South East for construction, and dividing the construction expenditure equally over the six-year build period (applying the HM Treasury's recommended discounting of 3.5% to present values[9]), the forecast construction expenditure is anticipated to generate a total of £33.7 GVA.

12.7.5.14 Overall, the construction expenditure, jobs generated on-site and additional jobs within the local area and region, alongside the associated additional GVA, are considered to have a minor-neutral beneficial impact on the employment receptor. Given that the proposed employment is a small proportion of the existing regional total, the sensitivity of this receptor is considered low.

12.7.6 Earnings

12.7.6.1 Increased construction employment would not be considered to materially alter the earning structure of the local area. Therefore, it is considered that the Proposed Development would have a negligible impact on this receptor. Given the relatively low wages in the local area, the sensitivity of this receptor is considered medium.

12.7.7 Unemployment

12.7.7.1 Unemployment in the Wider Zone is around 3.0% which is higher than that of the South East (2.8%), but lower than in England (3.7%). The provision of an estimated 84 direct FTE jobs at the level per annum over the construction period has the potential to have a minor-neutral beneficial effect in reducing unemployment if appropriate measures are included. Given that unemployment only affects a small number of persons in the Wider Zone, the sensitivity of this receptor is considered low.

12.7.8 Travel to work

12.7.8.1 The 547 construction jobs (person years of employment) or 84 FTE jobs supported during the construction phase are likely to have a limited short-term impact on travel to work methods and distances due to the likely travel requirements of construction employees from around the local area and wider South East region.

12.7.8.2 The Proposed Development is therefore considered to have a negligible impact on the receptor. The sensitivity of this receptor is considered low, however the transport assessment work will identify the final impact of construction traffic.

12.7.9 Qualifications and skills

12.7.9.1 There is potential for the training of local residents to be delivered as part of the Proposed Development scheme through contractors, working in partnership through local training providers including local colleges and universities. This would enable some training of local residents which would be encouraged through a

[9] Green Book Review, 2020

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Construction Partnership as noted in the mitigation section. With this in place, the overall effect on this receptor is considered to be minor-neutral beneficial. Given the relatively low qualification levels in the Wider Zone of Influence, the sensitivity of this receptor is considered medium.

12.7.10 Housing

12.7.10.1 The total construction workforce is estimated to be 84 FTE jobs per annum on-site. It is assumed the majority of the workforce will be sourced locally, and therefore this is unlikely to put significant pressure on the local private rented housing stock and process.

12.7.10.2 Considering the Site's connectivity to surrounding areas, and the levels of construction and development being undertaken in the local area, it is not expected that there will be any discernible impact on housing. Therefore the construction phase is anticipated to have negligible impact on the housing receptor.

12.7.11 Health and education facilities

12.7.11.1 The construction phase is unlikely to have any discernible effect on the local health status in the Local Area, with any impact due to injuries or accidents on-site. Modern average site accident rates are low. Overall the construction phase is considered to have negligible impact on health facilities. The sensitivity of this receptor is considered medium.

12.7.12 Social and recreational facilities

12.7.12.1 The construction phase is unlikely to have any significant effect on local recreational or social facilities. No facilities surrounding the Site or within the Immediate Zone are anticipated to be affected by the construction process. It is likely that construction workers employed on-site will utilise local centres and Bognor Regis town centre and therefore local centres may experience some additional retail trade. It is therefore considered that the Proposed Development will have a minor-neutral beneficial impact on this receptor. Given the range of facilities available in the Immediate Zone, the sensitivity of this receptor is considered low.

12.8 Likely Significant Environmental Effects Post Construction

12.8.1 The following section outlines the environmental effects of the Proposed Development in the post-construction phase.

12.8.2 There are a number of socio-economic and health benefits included in the planning application proposals as key features of the Proposed Development. These can be summarised as:

- Provision of up to 400 dwellings
- Open space; and
- Associated infrastructure

12.8.3 Population

12.8.3.1 The Proposed Development will generate a population increase of 920 residents following construction and operation. This is based upon an estimated ratio in the Wider Zone of 2.3 residents per dwelling from the 2021 Census.

12.8.3.2 In the Wider Zone of Influence (for which the population is 157,400), this would result in a population increase of 1.2%. However, this is assuming that all those occupying the Proposed Development be new movers into the Immediate Zone of Influence. Based on 2011 Census data, around 12% of movers within the Immediate Zone of Influence moved locally. As such, assuming 12% of new residents move locally, the overall population increase would be reduced by approximately 110 persons, for 810 total.

12.8.3.3 Given the wide range of housing types anticipated to be provided through the Proposed Development (from 1 bedroom flats to 4+ bedroom detached houses), it is expected that a range of new residents will populate it but particularly families and adults of working age. This diversity of housing is likely to help maintain the balance of population within the local area, supporting both ageing members of the population and the high proportion of young and working age residents.

12.8.3.4 The overall impact on this receptor is considered to be minor beneficial. The sensitivity of this receptor is considered to be low.

12.8.4 Deprivation

12.8.4.1 The health status within the Immediate and Wider Zones of Influence is slightly higher than regional and national levels. This trend would be expected to continue with in-migration of new residents.

12.8.4.2 Through the provision of housing, which has been identified as an issue in the Wider Zone, and the provision of public open space, accessible to both current and new residents, the Proposed Development can make material improvements to local deprivation levels.

12.8.4.3 Overall, the Proposed Development is considered to have a minor-neutral beneficial impact on this receptor. However, the sensitivity is low, considering the limited levels of deprivation in the local area.

12.8.5 Employment and the labour market

12.8.5.1 The Proposed Development itself does not include employment uses and as such it is not expected to generate any direct employment opportunities. However, it is expected that local spending by residents of the Proposed Development is likely to benefit the local economy and create demand for additional employment.

12.8.5.2 The 2018 Family Spending Survey establishes the average weekly expenditure in the South East region per household, including for retail and leisure goods expenditure components, which are likely to be spent in local

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businesses. According to the Arun District Retail Study, 42% of retail spend is retained within the local area. It is assumed that 40% of leisure spend is retained within the local area.

12.8.5.3 The 400 additional dwellings would spend around £1.6m on retail and £1.1m on leisure in the local area, after accounting for leakage and those moving locally within the area.

12.8.5.4 Using retail and leisure turnover per employee in the South East region and accounting for indirect taxation, the new resident expenditure could create demand for around 9 new retail jobs and 17 new leisure jobs in the local area.

12.8.5.5 Considering a regional average GVA per head of £32,443[10] over a standard 10-year period and applying the HM Treasury recommended present value discount of 3.5%, these forecast jobs are anticipated to generate a total GVA of £7.2m at the regional level.

12.8.5.6 In consideration of the 26 new jobs generated due to local residential spending, and the operational GVA of £7.2m, it is considered that the Proposed Development will have a minor-neutral beneficial effect on employment. The sensitivity of this receptor is considered to be low.

12.8.5.7 It is recognised that the wider strategic allocation does include employment uses; the implications of this are discussed in 12.11.7.

12.8.6 Earnings

12.8.6.1 The baseline findings demonstrate that earnings for full-time workers in the Wider Zone are below average. Given the scale of Proposed Development and the likely residents that will be attracted to the area, it is unlikely that earnings will change as a result of this development.

12.8.6.2 Overall, the impact on this receptor is considered to be negligible and the receptor sensitivity medium.

12.8.7 Unemployment

12.8.7.1 The percentage of those claiming for jobseeker's allowance in the Wider Zone is lower than national trends. Generation of 26 additional jobs through local residential spending is likely to have a positive impact on the issue of unemployment locally.

12.8.7.2 Overall, the impact on this receptor is considered to be minor-neutral beneficial, and the receptor sensitivity is low.

[10] Regional gross value added (balanced) per head and income components, UK: 1998-2021

12.8.8 Travel to work

12.8.8.1 It can be reasonably assumed that the additional incoming population will follow similar travel and commuting patterns to the current population structure. The Site is within a walking distance from Westergate, Eastergate and Barnham, and a cycling distance from Bognor Regis.

12.8.8.2 The 26 additional jobs generated as part of residential spending are likely to be sourced from residents within the Local Area. Overall, the impact on this receptor is negligible and the sensitivity is low.

12.8.9 Qualifications and skills

12.8.9.1 It is considered that the new resident population is unlikely to have any significant impact on the overall qualification and skill level of the local area.

12.8.9.2 Overall the Proposed Development is considered to have a negligible effect on this receptor. Sensitivity is considered to be medium.

12.8.10 Housing

12.8.10.1 The Proposed Development will help meet housing demand across Arun. By constructing up to 400 new dwellings across the six-year build period (or approximately 67 dwellings per year), the Proposed Development would contribute to the Wider Zone of Influence's total annual housing requirement.

12.8.10.2 Overall the Proposed Development is considered to have a moderate beneficial effect on this medium sensitivity receptor.

12.8.11 Health and education facilities

12.8.11.1 As outlined in the baseline findings, GP surgeries in the local area are already over-capacity and as such are unlikely to be able to accommodate any additional demand arising from the Proposed Development. Assuming that all new residents will register with a local GP, this will add demand for 920 additional places at GP surgeries.

12.8.11.2 The baseline findings indicate that there is marginal capacity at local primary and secondary schools. West Sussex County Council's Section 106: Planning obligations guidance outlines the methodology used to calculate additional education demand generated by new housing developments. Excluding one-bed properties and affordable units, the Council assumes a pupil yield figure of 0.25 for primary education level and 0.18 for secondary education level.

12.8.11.3 Applying these figures to the 322 eligible dwellings in the Proposed Development, therefore, we can calculate that there is likely to be additional demand for 81 primary school places and 58 secondary school places.

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12.8.11.4 There is currently a capacity of 107 secondary school places in the local area, so it is expected that this will be able to accommodate these additional 58 places. However, primary schools only have a capacity of 27 places, and as such it is unclear whether they can accommodate the additional 81 primary school places required.

12.8.11.5 Although the Proposed Development is likely to put further stress on local health and education infrastructure, it is understood that the Proposed Development is expected to make financial contributions towards a new early years facility, a new primary school, a new secondary school and a new community centre (which may include healthcare uses).

12.8.11.6 As such, by providing financial contributions, it is considered that the Proposed Development will have a negligible impact on the medium sensitivity receptor of health and educational facilities.

12.8.12 Social and recreational facilities

12.8.12.1 In terms of recreational space, the Proposed Development includes 7.48ha of publicly accessible open space. This provision also includes play spaces to be used by local residents.

12.8.12.2 The Proposed Development is also expected to make financial contributions towards a community centre, a sports hub and outdoor sports facilities.

12.8.12.3 Overall, the recreational and retail facilities provided by the Proposed Development will benefit the new and existing neighbouring residential populations in the local area and it is considered that the Proposed Development will have a minor beneficial effect on this low sensitivity receptor.

12.9 Mitigation

12.9.1 In addition to the integrated mitigation measures, in order to avoid, prevent, reduce or offset identified adverse impacts and maximise beneficial outcomes on socioeconomic and human health receptors by phase, the following mitigation measures are proposed.

12.9.2 Construction Phase

- Setting up a Construction Partnership agreement between the local authority, local training providers, Job Centre Plus and the construction contractors to assist in ensuring local people, both unemployed or young people getting ready to leave school, are appropriately skilled and well placed to take advantage of construction opportunities.

- Many contractors have their own programmes that involve taking local young people and unemployed residents into work and training. These should be explored and co-ordinated with relevant providers at the earliest opportunity.

12.9.3 Operational Phase

- Establish and implement a Residential Travel Plan to encourage sustainable modes of travel.

12.10 Residual Effects

12.10.1 The residual effects of the Proposed Development are the projected impacts of the proposal on each receptor following the implementation of mitigation and enhancement measures. In the majority of receptors, no mitigation measures are proposed and as such their residual effects are anticipated to be the same as those discussed in 12.7 and 12.8.

12.10.2 However, for those receptors in which mitigation measures have been proposed, their residual effects are listed below.

Construction Phase

12.10.3 Employment and the labour market

12.10.3.1 The Proposed Development is expected to have a minor-neutral beneficial impact on the employment and the labour market receptor due to the provision of jobs on-site. Through the establishment of a Construction Partnership agreement, and the establishment of a programme which hires local young people and unemployed residents, the Proposed Development can further enhance its impact. The impact in this case is still considered to be minor-neutral beneficial.

12.10.4 Earnings

12.10.4.1 By introducing a Construction Partnership Agreement and other programmes to promote the hiring of young and unemployed residents, the Proposed Development can further influence its effect on the receptor of earnings. However, given that salaries of associated jobs are likely to be in-keeping with averages, the residual impact is still considered to be negligible.

12.10.5 Unemployment

12.10.5.1 The Proposed Development is expected to have a minor beneficial impact on the unemployment receptor due to the provision of jobs on-site. By establishing a programme which hires unemployed residents, the Proposed Development can further enhance this impact. However, given that unemployment rates are already below average and the sensitivity of the receptor is low, the residual impact is still considered to be minor-neutral beneficial.

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12.10.6 Qualifications and skills

12.10.6.1 The Proposed Development is considered to have a minor-neutral beneficial impact on the receptor of qualifications and skills. Through the implementation of a Construction Partnership Agreement, the Proposed Development could provide training for construction workers and improve skill levels. The residual effect is still considered to be minor-neutral beneficial.

Operational Phase

12.10.7 Travel to work

12.10.7.1 The impact of the Proposed Development on the receptor of travel to work is judged to be negligible. Through implementing a Residential Travel Plan, the Proposed Development can encourage residents to use sustainable modes of transport. However, considering the low sensitivity of the receptor, the residual effect on this receptor is still expected to be negligible.

12.11 Cumulative Effects

12.11.1 A number of developments have been identified in terms of relevance to assessing cumulative impact, as determined through the scoping report and discussions with the Council. This section considers the cumulative socioeconomic impacts of the Proposed Development when assessed alongside the schemes identified in the

12.11.2 Table 12.18 below.

Table 12.18: Cumulative Effects

	Site Address	Reference	Application	Status
1	Land to the North of Eastergate and North-West of Barnham, PO22 0DF	WSCC/052/20	Construction of a single carriageway with shared cycleway / footway, roundabouts, road markings, traffic signals, bus stops, provision of hard and soft landscaping, construction of a substation building, installation of a noise barrier, and other associated works.	Approved, 30th June 2021
2	Land North of Barnham Road and East of Fontwell Avenue Eastergate	BN/195/22/PL	Hybrid application: 1)- Full planning application for the demolition of existing dwelling and outbuildings and the construction of residential dwellings, public open space including recreation space and associated infrastructure and works to be constructed in 5 distinct areas (A-E) each one independent from the other and 2)-Outline application with all matters reserved other than means of access for a care home. This application falls within Strategic Site HD5, CIL Zone 1 and 2 (Zero Rated) and may affect the setting of listed	Application for 551 dwellings, submitted 13th January 2023

			buildings. This application is subject to an Environmental Statement.	
3	Barnham, Eastergate, Westergate BEW Parcel SC1 Barnham	BN/11/22/OUT	Outline application with all matters reserved (except for the A29 Realignment) for the demolition of existing structures and mixed use development to provide up to 1,250 residential dwellings (Use Class C3), Care Home/Senior Living Accommodation (Use Class C2/C3), flexible retail and community floorspace (Use Classes E/F2/Sui Generis), a Primary School plus open space, landscaping, 4drainage and all other associated ancillary works; and realignment of the A29 and early connection to existing A29 including construction of a new road carriageway, junctions and associated infrastructure. This application also lies within the parish of Aldingbourne, affects the setting of listed buildings, affects the character & appearance of the Eastergate Church Lane Conservation Area and affects a Public Right of Way. This application is the subject of an Environmental Statement.	Submitted, 4th February 2022
4	Woodgate Centre, Oak Tree Lane, Woodgate, PO20 3GU	AL/107/21/PL	Demolition of the Woodgate Centre buildings (including 3 No. residential dwellings) & the construction of 180 No. residential dwellings with the creation of new vehicular access with footways and cycleways, ancillary road infrastructure, emergency access arrangements, associated parking, public open space, including children's play space, landscape planting, surface water attenuation & drainage & other associated infrastructure. This site in in Cil Zone H SP2, BEW Strategic Site and is not CIL Liable.	Submitted, 16th August 2021 and resolution to grant approved at Committee on 30th November 2022 subject to S106
5	Boweries Barnham Road Eastergate PO20 3RT	BN/135/20/PL	Construction of 30 no. dwellings, new access, public open space, landscaping and associated works (submission following EG/22/19/OUT). This site is a Strategic Site in SP2 (Zero Rated).	Approved, 30th July 2021
6	Warwick Nursery Barnham Road Eastergate Barnham PO203RT	BN/153/20/PL	44 No. dwellings & associated infrastructure. This site falls within the BEW Strategic Site, CIL Zone 1 (Zero Rated).	Approved, 10th December 2021
7	Land at former Eastergate Fruit	EG/71/14/OUT	Outline for the erection of 60 residential dwellings with new vehicular access, open space and other ancillary works.	Approved, 3rd February 2015

	Farm, Eastergate, PO20 3RP	EG/6/18/RES	Approval of reserved matters following outline consent EG/71/14/OUT for the erection of 60 No. dwellings with new vehicular access, open space & ancillary works.	Approved, 25th May 2018
8	Land south and west of Barnside and east of Pond, Hook Lane	AL/8/16/OUT	Outline application with all matters reserved for a residential development of up to 14No. dwellings and associated works including access, landscaping and open space. This application is a departure from the development plan.	Allowed at appeal, 3rd May 2018
		AL/33/19/RES	Approval of reserved matters following the consent of AL/8/16/OUT (APP/C3810/W/16/3155330) for the erection of 14 No. dwellings with associated access, parking, landscape and open space.	Approved, 15th July 2019
9	Land at Nyton Road and Northfields Lane, Westergate and Land off Fontwell Lane, Eastergate	AL/61/13/OUT	Outline application with some matters reserved for the demolition of existing glasshouses, residential bungalow, stables and various outbuildings and residential development of up to 268 dwellings including 30% affordable housing (incorporating 60 senior living units), with associated access, public open space and landscaping, This is a Departure from the Development Plan.	Allowed at appeal, 23rd February 2015
		AL/102/17/RES	Application for approval of Reserved Matters following outline application AL/61/13/OUT for the demolition of existing glasshouses, residential bungalow, stables and various outbuildings and residential development of 268 dwellings including 30% affordable housing (incorporating 60 senior living units), with associated access, public open space and landscaping.	Approved, 24th January 2018
10	Wings Nursery	AL/32/19/OUT	Outline application with some matters reserved for the erection of 55 No. dwellings, access arrangements, sustainable drainage measures, public open space landscaping and all other associated works (resubmission following AL/115/17/OUT). This application is a Departure from the Development Plan.	Approved, 3rd October 2020
11	Land North of Lee's Yard, Lidsey Road, Woodgate, PO20 3SU	AL/21/20/OUT	Outline application with some matters reserved for the erection of 38 No. dwellings consisting of 5 No. 4-bed houses, 14 No. 3-bed houses & 19 No. 2-bed houses, with communal work hub and associated car parking & landscaping (resubmission following AL/57/18/OUT). This	Approved, 22nd October 2020

			application is a Departure form the Development Plan.	
12	Land West of Fontwell Avenue, Eastergate	BN/50/20/PL	Demolition of existing structure on-site and erection of 42 No. dwellings with access, parking, landscaping & associated works. This application is a Departure from the Development Plan.	Approved, 11th December 2020
13	Land South of Barnham Station, Barnham	BN/142/20/OUT	Outline planning application with all matters reserved, other than principal means of access, for up to 200 No. dwellings, with access taken from Marshall Close, associated infrastructure and landscaping and demolition of existing buildings. his application is a Departure from the Development Plan, may affect the setting of listed buildings, may affect the Church Lane, Barnham Conservation Area & affects a Public Right of Way.	Allowed at appeal, 5th January 2022
		BN/147/22/RES	Approval of reserved matters following BN/149/22/PL for 200 dwellings respect of appearance, landscaping, layout and scale. This application may affect the setting of listed buildings, may affect the Church Lane, Barnham Conservation Area & affects a Public Right of Way.	Submitted, 4th November 2022 and decision deferred at Committee on 28th June 2023
14	Land at Bayards, Level Mare Lane, Eastergate, PO20 3RZ	AL/113/21/OUT	Outline application with all matters reserved, apart from access, for up to 69 No dwellings with access, parking, landscaping & associated works. This application is a Departure from the Development Plan.	Approved 25th May 2022
		AL/96/22/RES	Approval of reserved matters following outline consent AL/113/21/OUT for 67 No houses. This application is a Departure from the Development Plan and is in CIL Zone 3 and is CIL Liable as new dwellings.	Approved, 30th November 2022
15	Land adjacent to Woodgate Nurseries, Lidsey Road, Aldingbourne, PO20 3SU	AL/129/21/OUT	Outline planning application with all matters reserved (except access) for residential development with up to 95no. dwellings (Use Class C3), informal and formal public open space, landscaping, drainage and other associated works. This application is a Departure from the Development Plan	Approved, 22nd August 2022

12.11.3 Given the number and diverse scope of the cumulative sites in the local area, the table below has been produced to identify and summarise the indicative population and employment impacts.

12.11.4 Each proposal will specify its own details at the point of application and the figures below set out the impacts based upon a reasonable assessment of the information available at this time. Population has been determined utilising the average household size of the Wider Zone of Influence, which is 2.3 persons per dwelling, as per the previous sections of this chapter, or as otherwise set out in the Table 12.19.

Table 12.19: Cumulative Sites population and employment forecasts

Site	Dwelling Number	Population Forecast	Employment Forecast	Notes
The Site	400	920	N/A	Population forecast assumes 2.3 people per household. No employment floorspace proposed.
1	N/A	N/A	N/A	No new dwellings or employment floorspace proposed.
2	551	1,267	38	Population forecast assumes 2.3 people per household. The number of beds proposed at the care home is currently unknown. Employment forecast is based on assumption that the average care home in England employs 38 staff[11].
3	920	2,472	113	Population and employment forecast taken from Environmental Statement.
4	180	414	N/A	Population forecast assumes 2.3 people per household. No employment floorspace proposed.
5	30	69	N/A	Population forecast assumes 2.3 people per household. No employment floorspace proposed.
6	44	101	N/A	Population forecast assumes 2.3 people per household. No employment floorspace proposed.
7	60	138	N/A	Population forecast assumes 2.3 people per household. No employment floorspace proposed.
8	14	32	N/A	Population forecast assumes 2.3 people per household. No employment floorspace proposed.
9	268	538	3	Population forecast assumes 2.3 people per household for market and affordable dwellings, and 1 person per extra living unit. Employment forecast based on assumption that a 45-unit extra care

[11] Care home stats: number of settings, population & workforce (2022)

				development directly employs 2.3 FTE staff[12].
10	55	127	N/A	Population forecast assumes 2.3 people per household. No employment floorspace proposed.
11	38	87	N/A	Population forecast assumes 2.3 people per household. No employment floorspace proposed.
12	42	97	N/A	Population forecast assumes 2.3 people per household. No employment floorspace proposed.
13	200	460	N/A	Population forecast assumes 2.3 people per household. No employment floorspace proposed.
14	67	154	N/A	Population forecast assumes 2.3 people per household. No employment floorspace proposed.
15	95	219	N/A	Population forecast assumes 2.3 people per household. No employment floorspace proposed.
Total	**2,964**	**7,095**	**151**	

12.11.5 Population

12.11.5.1 Including the Site, the cumulative sites will yield a total of 2,964 dwellings, if all sites were to come forward, or 7,095 residents, based upon application data (where available) or an estimated ratio of 2.3 residents per dwelling.

12.11.5.2 It will be essential that that individual developments contribute to local infrastructure through local mitigation and supporting strategic requirements. Assuming this is the case, the cumulative impact on this receptor is anticipated to be moderate beneficial.

12.11.6 Deprivation

12.11.6.1 It is unlikely that the cumulative developments will have a significant impact on deprivation in the Immediate Zone. However, by providing an additional 151 jobs, they are likely to improve the employment domain.

12.11.6.2 Cumulatively, the developments will also provide a care home, an extra care scheme, a primary school, retail and community floorspace and open space, all of which are expected to improve deprivation levels across multiple domains.

12.11.6.3 As such, the cumulative developments are expected to have a minor beneficial impact on deprivation in the Wider Zone.

[12] Homes for Later Living (2021)

12.11.7 Employment and the labour market

12.11.7.1 As above, the cumulative developments are expected to generate an additional 151 employment opportunities, and as such are considered to have a minor beneficial impact on this receptor.

12.11.8 Earnings

12.11.8.1 The cumulative sites will provide employment opportunities across a number of different industries and levels. Given the below average wage levels in the Wider Zone, the cumulative sites could have a minor beneficial impact on the earnings receptor.

12.11.9 Unemployment

12.11.9.1 The provision of 151 jobs will contribute to the reduction of unemployment levels in the Immediate and Wider Zone, resulting in a minor beneficial impact in the Wider Zone.

12.11.10 Qualifications and skills

12.11.10.1 The local area has a below average set of skills and qualifications. The provision of appropriate investment and development in the education system has the potential to improve education levels, and will be addressed by each site individually. As a viable location for employment and housing growth, it is likely that in migration of new population to the local area will reflect the existing skills levels. The cumulative impact on this receptor is judged to be moderate-minor beneficial.

12.11.11 Travel to work

12.11.11.1 Given the location of the Proposed Development and the cumulative sites being within close proximity to Bognor Regis and associated road network, it is anticipated that patterns of travel are unlikely to change. The cumulative effects is therefore considered to be negligible.

12.11.12 Housing

12.11.12.1 The delivery of some 2,964 dwellings in the local area has the potential to contribute significantly to the housing and affordable housing supply needed in the Wider Zone, in addition to helping to reduce high average house prices in the area. As such, it is considered to have a moderate beneficial impact on this receptor.

12.11.13 Health and education facilities

12.11.13.1 Each individual site will make appropriate contributions to support local education and health facilities. In addition, the cumulative sites will also provide a new primary school, which will support any additional primary school demand generated by housing development.

12.11.13.2 The local centre provided within the Barnham/Eastergate/Westergate strategic allocation will include medical and health services to accommodate the needs of the growing population associated with the cumulative sites. The cumulative impact is therefore expected to be moderate beneficial.

12.11.14 Social and recreational facilities

12.11.14.1 The cumulative sites are expected to provide new retail and community floorspace with flexible uses, and large areas of new open space to be used by local residents. The cumulative impact, therefore, is considered to be minor beneficial.

12.12 Summary

12.12.1 This chapter has evaluated the likely impacts of the Proposed Development on the existing socio-economic conditions in the local area.

12.12.2 A baseline assessment of existing socio-economic conditions in the Immediate and Wider Zones identified the sensitivity of relevant receptors.

12.12.3 An impact assessment was then carried out to identify the initial impacts of the Proposed Development against each receptor during both construction and operational phases, without the implementation of mitigation measures. This exercise identified that the Proposed Development had either a beneficial or negligible impact against all receptors but one. In the receptor of health and education facilities, it was identified that there was likely to be a permanent minor adverse impact during the operational phase, as existing health and education infrastructure is unlikely to accommodate increased demand generated by the Proposed Development.

12.12.4 Following this, recommendations were made to incorporate mitigation measures that could prevent, reduce, compensate and enhance the impact of the Proposed Development against each receptor.

12.12.5 The residual impacts, therefore, consider the likely impact of the Proposed Development against each receptor, after the implementation of any mitigation and enhancement measures. After this process, it is judged that the Proposed Development will have either a beneficial or negligible impact against each receptor, during both the construction and operational phase.

12.12.6 The residual impacts of the Proposed Development are summarised in the Table 12.20.

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Table 12.20: Summary of Impacts

Receptor	Sensitivity	Impact	Mitigation / enhancement	Residual impacts
Construction phase				
Population	Low	Negligible	None proposed	Negligible
Deprivation	Low	Negligible	None proposed	Negligible
Employment and the labour market	Low	Temporary minor-neutral beneficial	Establishment of a Construction Partnership agreement Establishment of a programme which hires local young people and unemployed residents	Temporary minor-neutral beneficial
Earnings	Medium	Negligible	Establishment of a Construction Partnership agreement Establishment of a programme which hires local young people and unemployed residents	Negligible
Unemployment	Low	Temporary minor-neutral beneficial	Establishment of a Construction Partnership agreement Establishment of a programme which hires local young people and unemployed residents	Temporary minor-neutral beneficial
Qualifications and skills	Medium	Temporary minor-neutral beneficial	Establishment of a Construction Partnership agreement	Temporary minor-neutral beneficial
Travel to work	Low	Negligible	None proposed	Negligible
Housing	Medium	Negligible	None proposed	Negligible
Health and education facilities	Medium	Negligible	None proposed	Negligible

Social and recreational facilities	Low	Temporary minor-neutral beneficial	None proposed	Temporary minor-neutral beneficial
Operational phase				
Population	Low	Permanent minor beneficial	None proposed	Permanent minor beneficial
Deprivation	Low	Permanent minor-neutral beneficial	None proposed	Permanent minor-neutral beneficial
Employment and the labour market	Low	Permanent minor-neutral beneficial	None proposed	Permanent minor-neutral beneficial
Earnings	Medium	Negligible	None proposed	Negligible
Unemployment	Low	Permanent minor-neutral beneficial	None proposed	Permanent minor-neutral beneficial
Qualifications and skills	Medium	Negligible	None proposed	Negligible
Travel to work	Low	Negligible	Establish Residential Travel Plan	Negligible
Housing	Medium	Permanent moderate beneficial	None proposed	Permanent moderate beneficial
Health and education facilities	Medium	Negligible	Make financial contributions to new primary schools, to fund places at a new secondary school, and towards the new community hub	Negligible
Social and recreational facilities	Low	Permanent minor beneficial	Make financial contributions towards the new community hub	Permanent minor beneficial

12.13 References

12.13.1 A list of references is provided below:

- Additionality Guide Fourth Edition, Homes & Communities Agency (2014)
- Adopted Arun Local Plan 2011-2031, Arun District Council (2018)
- Annual Business Survey 2021 results, Office for National Statistics (2023)
- Annual Survey of Hours and Earnings 2022 results, Office for National Statistics (2023)
- Annual Survey of Hours and Earnings, Office for National Statistics (2022)
- Arun District Council Open Space Assessment Report, Knight, Kavanagh & Page (2016)
- Arun District Retail Study, DPDS (2013)
- Arun Housing Delivery Test Result 2021, Arun District Council (2022)
- Business Register and Employment Survey 2021 results, Office for National Statistics (2022)
- Care home stats: number of settings, population & workforce, carehome.co.uk (2022)
- Census 2011, Office for National Statistics (2011)
- Census 2021, Office for National Statistics (2021)
- Claimant count by sex and age, Office for National Statistics (2023)
- Green Book Review 2020: Findings and response, HM Treasury (2020)
- Homes for Later Living, WPI Economics (2021)
- House price to workplace-based earning ratio, Office for National Statistics (2023)
- Household expenditure by countries and regions, financial year ending 2016 to financial year ending 2018, Office for National Statistics (2019)
- Index of Multiple Deprivation, Ministry of Housing, Communities & Local Government (2019)
- Life expectancy at birth and age 65 by sex, Office for National Statistics (2019)
- National Planning Policy Framework, Department for Levelling Up, Housing and Communities (2023)
- Patients registered at a GP practice (July 2023), National Health Service (2023)
- Planning School Places 2023, West Sussex County Council (2023)
- Population projections, Experian (2023)
- Regional gross value added (balanced) per head and income components, UK: 1998-2021, Office for National Statistics (2023)
- Section 106: Planning obligations, West Sussex County Council (2023)
- Travel to school for children of compulsory school age, Department for Education (2023)
- UK House Price Index Dataset, HM Land Registry (2023)

12.14 Glossary

12.14.1 A glossary of terms is provided below:

- ABS - Annual Business Survey
- ASHE - Annual Survey of Hours and Earnings
- BRES - Business Register and Employment Survey
- CQC - Care Quality Commission
- DfE - Department for Education
- FTE - Full-Time Equivalent
- GVA - Gross Value Added
- HDT - Housing Delivery Test
- IMD - Index of Multiple Deprivation
- LSOA - Lower Layer Super Output Area
- MSOA - Middle Layer Super Output Area
- NHS HUDU - NHS Healthy Urban Development Unit
- NPPF - National Planning Policy Framework
- MSOA - Middle Layer Super Output Area
- ONS - Office for National Statistics

13. Ground Conditions and Contamination

13.1 Introduction
13.2 Background
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13 Ground Conditions and Contamination

13.1 Introduction

13.1.1 This chapter has been written by Soils Limited. practice of professional engineers and scientists who are specialists in the field of geotechnical and geo-environmental engineering. In preparing this chapter, they have consulted previous project reporting: a Preliminary Investigation Report ref:19522/PIR and Main Investigation Report ref:19522/MIR completed by Soils Limited dated September 2021 and Ground Gas Risk Assessment ref:19522/GRA completed by Soils Limited dated June 2022 which are provided in full in Appendix 13.3.

13.1.2 This chapter assesses the likely significant impacts of the proposed development on the environment with regard to ground conditions during the construction and operational phases. It also describes the methods used to assess the impacts; the baseline conditions currently existing at the site and in the surrounding area; the mitigation measures required to prevent, reduce or offset any significant adverse effects; and the likely residual impacts after these measures have been adopted.

13.1.3 Supporting information for the assessment has been obtained from the following documents:

- Environmental Impact Assessment Screening and Scoping Report for Land East of Westergate, West Sussex prepared by Luken Beck dated June 2022.
- Land East of Westergate West Sussex, Pre-Application Planning Statement dated June 2022.
- Proposed development plans drawings number CALA230719-GB1PP-01 Rev P1, CALA230719-AMSHPP-01 Rev P1, CALA230719-SHPP-01 Rev P1 and CALA230719-DPDPP-01 Rev P2 prepared by Thrive Architects dated 31st July 2023.
- Arun District Council - Scoping request - Land East of Westergate Aldingbourne (Ref: AL/98/22/EIS, dated 21st November 2022)
- British Geological Survey (BGS) - geology, hydrogeology, mines and quarries, radon risk and borehole records
- Ordnance Survey (OS) - historical mapping
- National Library of Scotland – historical mapping
- Magic Map Application (DEFRA) – hydrogeology, hydrology and environmental information
- Preliminary Investigation Report completed by Soils Limited Ref:19522/PIR dated September 2021
- Main Investigation Report completed by Soils Limited Ref:19522/MIR dated September 2021
- Ground Gas Risk Assessment completed by Soils Limited Ref:19522/GRA dated June 2022

13.2 Background

13.2.1 This chapter identifies baseline conditions with reference to soils, geology and potential ground contamination from previous land uses on, adjacent and within the vicinity of the site and describes how they may be affected by the development. It sets out in detail the impacts and assesses potential effects on geology and soils arising from the construction and operation of the proposed development.

13.3 The Site

13.3.1 The Environmental Impact Assessment Screening and Scoping Report for the site prepared by Luken Beck dated June 2022, states 'the site' (approx. 19.35ha) comprises agricultural and improved grassland to the east of Westergate. The site has defined boundaries with the 'west coast way' main railway line forming the southern boundary, the Lidsey Rife watercourse forming the eastern boundary and the settlements of Westergate and Eastergate forming the western and northern boundaries.

13.3.2 The open land is predominantly a mix of arable farmland. Hedgerows define the field boundaries and scattered trees are located in the northern part of the site. A tributary stream crosses the middle of the site running east-west with a wet woodland located adjacent to the Westergate settlement boundary. Public footpaths cross the site with access taken through the medium-density residential areas to the West (Pine Close, Orchard Gardens, Woodgate Park, Elmcroft Place and Old School Place) and to the north (St Richard Road). Existing vehicle access is taken from the A29 via an access road running parallel to the railway line.

13.3.3 The site topography comprises a level field system, elevated above shallow valley areas and areas of functional flood plain, which are shown on the Environment Agency flood risk map as following the Lidsey Rife and the tributary crossing the site. The majority of the site falls within Flood Zone 1 and a sequential approach towards the distribution of residential development on the site would be followed to ensure flood risks are minimised.

13.3.4 The site is not located within an area designated as of landscape sensitivity or of international or national ecological importance. It is not designated as, or within the setting of, a Building Conservation Area or Scheduled Ancient Monument. The South Downs National Park is located 2 miles to the north. A single statutory site for nature conservation (Brooks Local Nature Reserve) is located within 2 km of the site (approx. 1.65km to the southwest). There are also two non-statutory sites of Nature Conservation Importance (SNCI) within 2km of the site, comprising Fontwell Racecourse (0.82km to the northwest) and Slindon Bottom (located 1.27km to the north).'

13.4 The Scheme

13.4.1 According to the reference documents, our understanding is that the development proposals consist of a hybrid planning application. This application includes a detailed plan for the site access from Pine Close, an east-west link road, and a bridge over the Lidsey Rife. Additionally, there is an outline proposal for up to 400 residential dwellings with related infrastructure.

13.5 Potential Cumulative Effects

13.5.1 The potential for cumulative effects with projects highlighted within the Scoping Opinion Response received from Arun District Council dated 21st November 2022 are assessed in the following sections.

13.5.2 As part of issuing the Scoping Opinion, a consultation response from Arun District Council's Environmental Health Officer was received and which is relevant to the subject of this assessment. The comments are summarised in

13.5.3 Table 13.1.

Table 13.1: Summary of Consultations

Summary of Matter Raised	Reference in ES Chapter
Arun District Council	
The Local Planning Authority has come to the conclusion that the main issues requiring to be addressed in relation to the proposal relate to: **6. GROUND CONDITIONS, CONTAMINATION AND SOILS** 6.1 "Environmental Health has commented that due to the sites southern boundary being adjacent to the railway line, ground contamination may be present. Therefore, it is recommended to scope this in, including appropriate action and remediation where necessary."	The comments with regard to the Railway line present at the southern boundary of the site have been noted in (Baseline section). The comments with regard to the potential impacts of the contamination on the water environment and human health and the potential for mitigation have been noted throughout the assessment.

13.6 Chapter Structure

13.6.1 These assessments mentioned in the introduction of this chapter have been reviewed by Soils Limited, particularly with regard to human health, the environment and the proposed structures.

13.6.2 Specifically, this chapter considers the impacts on:

- Site Designation
- Geology, Hydrogeology and Hydrology
- Soils
- Contaminated Land

13.6.3 This chapter provides a summary of the relevant regulatory and policy framework for the purposes of geology and soil assessment. It describes the consultations undertaken in the course of the iterative design of the proposed development and the undertaking of this Geology and Soils assessment. The methods used to assess the impacts are described, together with the baseline conditions currently existing at the site and surrounding environs. The potential direct and indirect impacts of the construction and operational phases of the development arising from the ground conditions at the site are identified and assessed. Consideration is also given to the mitigation measures required to prevent, reduce or offset the impacts and the resulting residual impacts.

13.6.4 Conclusions are reached regarding the predicted significance of effects in relation to geology and soils during the construction and operational stages of the proposed development. An assessment is then made in respect of each predicted effect as to whether or not it is likely a significant effect for the purposes of the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 2017 ("EIA Regulations").

13.7 Policy Context

13.7.1 The assessment of potential effects on the geological and hydrogeological characteristics of the site has been assessed in context with national legislation, as well as with planning policies.

13.7.2 Legislative Context

13.7.2.1 The primary legislation for the identification of contaminated land in the UK, intended to be used for regulation of existing land uses, is set down in Part IIA of The Environmental Protection Act (1990), (as amended by The Contaminated Land (England) (Amendment) Regulations 2012).

13.7.2.2 Part IIA covers the potential for harm to be caused to human health, property, the wider environment and controlled waters by substances on or in the land. The legal test is one of 'significance' and this is determined by the relevant technical specialists using risk assessment techniques. The same legal definitions of contamination set out in the Act are also used under the UK planning regime to determine the fitness for the purpose of a proposed development in terms of environmental health.

13.7.2.3 Contaminated Land is defined in Part IIA of The Environmental Protection Act (1990) as:

> *"any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on, or under the land that:*
>
> *(a) significant harm is being caused or there is a significant possibility of such harm being caused; or*
>
> *(b) pollution of controlled waters is being, or is likely to be caused".*

13.7.2.4 The Water Resources Act (WRA) 1991 (as amended) regulates water resources in the United Kingdom, including issues in relation to water quality and pollution and flood defence. The European Union (EU) Water Framework Directive (WFD) 2000/60/EC4 sets out a number of objectives with respect to the protection and improvement of the quality of surface waters and groundwater.

13.7.2.5 The following regulations define clean water fit for drinking and are also used in the assessment of the potential for contamination of Controlled Waters: The Water Supply (Water Quality) Regulations (2018); Groundwater (England and Wales) Regulations (2009); and Private Water Supply Regulations (2016).

13.7.2.6 The Waste Management (England and Wales) Regulations 2011 Part 1 objective is to protect the environment and human health by preventing or reducing the adverse impacts of the generation and management of waste.

13.7.2.7 The Building Act (1984) as amended by the Deregulation Act (2015) and the Building Regulations (2010) are the two key legislative drivers when considering design aspects of development in terms of the engineering properties of the ground materials and the presence of ground gas.

13.7.3 Further Guidance and References

13.7.3.1 The Environment Agency (EA) guidance (Land contamination: risk management, 2020) states how to assess if there is unacceptable contamination risk and decide on suitable options to manage the risk and implement remediation if needed. The guidance outlines a tiered, conceptual risk assessment approach for the assessment of contaminated land. This guidance has been followed throughout this chapter to provide a technical framework to assist in the understanding of any contamination issues on site and how they are managed.

13.7.3.2 CIRIA publication C552 (2001) 'Contaminated Land: A guide to Good Practice' outlines the current state of good practice when working on contaminated or potentially contaminated land.

13.7.3.3 CIRIA publication C532 (2001) 'Control of Water Pollution from Construction Sites: Guidance for Consultants and Contractors' goes into detail with regard to sources of water on construction sites, pollutants and

pathways, in addition to providing guidance on planning for the type and location of suitable control measures.

13.7.3.4 Current regulatory guidance for the statistical assessment of environmental data within a contaminated land context is detailed within the CIEH and CL:AIRE joint publication titled 'Guidance on Comparing Soil Concentration Data with a Critical Concentration' (2008).

13.7.3.5 British Standard BS10175+A2 (2017) 'Investigation of potentially contaminated sites, code of practice' has been followed throughout this chapter and should be a point of reference during all works conducted on the site as should BS5930:2020 'Code of practice for site investigation'.

13.7.3.6 A report on ground gas for the site has been prepared for the site by Soils Limited ref:19552/GRA. The background and methodology for investigation, assessment and characterisation of ground gas risks to proposed developments are outlined in the following main guidance documents:

- CIRIA Report C665 (2007) 'Assessing risks posed by hazardous ground gases to buildings revised);
- NHBC (March 2007) 'Guidance on the evaluation of development proposals on sites where methane and carbon dioxide are present'
- BS8485:2015+A1:2019 'Code of Practice for the characterisation and remediation from ground gas in affected developments';
- BS8576:2013 'Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs); and
- Wilson S., Card C. and Haines S. (2009) 'Ground Gas Handbook)
- Radon is referred to in UK national building regulation guidance. Building Research Establishment (BRE) Report 211 (2015) 'Radon: Guidance on protective measures for new buildings, extensions, conversions and refurbishment provides guidance for reducing the risk of building occupants being exposed to it.

13.7.4 National Planning Policy

National Planning Policy Framework (NPPF)

13.7.4.1 Chapter 15 of the National Planning Policy Framework (NPPF), published in September 2023 relates to Conserving and Enhancing the Natural Environment. Section 170 of the framework states *"The planning policies and decisions should contribute to and enhance the natural and local environment by protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan), …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*

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relevant information such as river basin management plans; and remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate."

13.7.4.2 Paragraph 184 states *"Planning policies and decisions should also ensure that the site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation); after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part II A of the Environmental Protection Act 1990; and adequate site investigation information, prepared by a competent person, is available to inform these assessments".*

13.7.4.3 Paragraph 185 states *"Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rest with the developer and/or landowner".*

13.7.4.4 In addition, Paragraph 122 states *"Planning policies and decisions should...give substantial weight to the value of using suitable brownfield land within settlements for homes and other identified needs, and support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land...".*

13.8 Assessment Methodology

Assessment and Evaluation of Effects

13.8.1 Assessment Criteria and Impact Assessment Methodology

13.8.1.1 Potential effects of the presence of contaminated soil at the site have been identified and evaluated using the Source-Pathway-Receptor model in accordance with current guidance and from this, potential pollutant linkages have been identified. The potential harm to occur (as defined in Part IIA of the Environmental Protection Act 1990 exists only when the three components of the model are satisfied:

- Source: the presence of a contaminant or pollutant source;
- Pathway: the linkage between the source and the receptor; and
- Receptor: the presence of the identified feature that may be harmed.

13.8.1.2 For the linkages that have been identified, a potential effect has been assumed and for these, the assessment has sought to identify the significance of the effect and whether the effect is beneficial or adverse and permanent or temporary.

13.8.1.3 To assess the impacts of the proposed development on human health, ground and groundwater, a 'matrix approach' has been used, which is based on the characteristics of the impact (magnitude and nature) and the sensitivity of the receptor.

13.8.1.4 The assessment of potential and residual effects has been undertaken qualitatively using professional judgement.

13.8.2 Sensitivity of the Receptor

13.8.2.1 The sensitivity of the receptor is largely determined by its quality, rarity and scale, refers to its importance and may include a statutory designation or local designation and is generally determined as "Very High", "High", "Medium" or "Low".

13.8.2.2 The criteria set out in Table 13.2 have been taken into account in the consideration of sensitivity for the proposed project.

Table 13.2: Criteria to Determine Sensitivity of Receptors

Receptor Sensitivity	Definition	Typical Examples
Very high	Human health receptors. The feature is of a very high environmental value, quality or rarity on a regional or national scale. Receptor is highly vulnerable to impacts that may arise from the project and recoverability is long-term or not possible.	• Site residents, play area users • Principal Aquifer provides potable water • Source Protection Zone 1 • Nationally important geological features • Designated Site of Special Scientific Interest (SSSI)
High	Human health receptors The feature is of high environmental value, quality or rarity on a regional scale. Receptor is generally vulnerable to impacts that may arise from the project and recoverability is slow and/or costly.	• Construction and maintenance workers • Aquifer providing water for agricultural or industrial use • Aquifer supporting river ecosystem • Regionally important geological features
Medium	Human health receptors The feature is of a medium environmental value, quality or rarity on a regional scale or important at a local scale. Receptor is somewhat vulnerable to impacts that may arise from	• Site visitors (landscaped areas) and off-site receptors • Not in a Source Protection Zone • Aquifer with limited connection to surface water • Locally important geological features

	the project and has moderate to high levels of recoverability.	
Low	Human health receptors The feature is of low environmental value, quality or rarity on a local scale. The receptor is not generally vulnerable to impacts that may arise from the project and/or has high recoverability.	• Hard surface end users (i.e. industrial site, car park) • Unproductive groundwater strata • No important geological features • Previously disturbed land • Contaminated land

13.8.3 Magnitude of Impact

13.8.3.1 The magnitude of a potential effect on the baseline conditions is independent of the sensitivity of the feature. The magnitude considers the scale of the potential change to the baseline conditions as a result of the proposed development taking into account its geographical scale (i.e. local, regional or national level), duration (i.e. the magnitude may be moderated by the effects being temporary rather than permanent, short term rather than long term) and whether the effect is direct or indirect, reversible or irreversible.

13.8.3.2 This assessment of magnitude also takes into account design mitigation and any further mitigation identified within this ES. As a result of this, the magnitude of the change prior to and after the implementation of appropriate mitigation methods has been stated. Magnitude has been defined within this chapter as "Substantial", "Moderate", "Slight" and "Negligible", where an impact of substantial magnitude is far greater than one of negligible magnitude. Criteria for effect magnitude are described in Table 13.3.

Table 13.3: Criteria to Determine the Magnitude of Effect

Magnitude of Impact	Criteria	Typical Examples
Substantial	Short-term (acute) risk to human health is likely to result in "significant harm" as defined by the EPA 1990, Part IIA. The impact is of the extended temporal or physical extent and of long-term duration. Total loss or major alteration to key features of the baseline conditions such that post-construction character/ composition of baseline	• Concentrations are high enough to cause acute effects, i.e. significant harm is likely to arise from an identified hazard at the site without appropriate remedial action • Construction activities result in a major pollution release • The development introduces a new large-scale source of pollution or a number of new pollutant pathways

Magnitude of Impact	Criteria	Typical Examples
	condition will be fundamentally changed. Likely to cause failure to meet statutory objectives and/or breaches of legislation.	• Soil contamination resulting in a 'contaminated land' designation under Part IIA • Pollution of potable sources of water abstraction. • Loss of, or extensive change, to an aquifer • Loss of, or extensive change, to nationally important geological features
Moderate	Long-term (chronic) damage to human health ("significant harm" as defined in DETR, 2000). The impact is of moderate temporal or physical extent and of medium-term duration. Loss or alteration to one or more key features of the baseline conditions such that post-construction character/composition of baseline condition will be materially changed.	• Concentrations exceed soil guideline values of unacceptable intake or contact close to the surface at the site, i.e. it is possible that without appropriate remedial action harm could arise to a designated receptor but it is relatively unlikely that any such harm would be severe and if any harm were to occur, it is likely that such harm would be relatively mild • Construction activities result in a moderate pollution risk • The development introduces a new moderate-scale source of pollution and a new pollutant pathway • Concentration of a contaminant exceeding the assessment criteria • Partial loss or change to an aquifer • Permanent loss of, regionally important geological features, or substantial changes to nationally important geological features.

Magnitude of Impact	Criteria	Typical Examples
Slight	The impact is of a limited temporal or physical extent and of short-term duration. Results in a minor shift away from baseline conditions. Changes arising from the alteration will be detectable but not material; the underlying character/composition of the baseline condition will be similar to the predevelopment situation.	• No significant harm, but maybe aesthetic/olfactory impacts • Typical construction-related pollutant releases • Temporary pathway during construction activities only • Soil contamination exists but the concentrations would not be considered significant or there is a low likelihood of serious pollution • Measurable effect on aquifer but of limited size or proportion, which does not lead to a reduction in the aquifer status • Minor loss of, or minor change, to locally important geological features.
Negligible	A very slight change from baseline conditions. Change is barely distinguishable approximately to a "no change" situation. The physical extent of the impact is negligible and of short-term duration.	• No measurable effects on human health • No foreseeable change in the quality of any type of aquifer and/or its use as a resource • Risk assessment suggests negligible/low risk to human health or controlled waters. • No measurable effect on groundwater. • No measurable effect on geological features.

13.8.4 Assessment of Significance

13.8.4.1 Once the above receptor sensitivity and magnitude of effect have been considered, the significance of the potential effect can be determined using the matrix presented in Table 13.4. The combination of the sensitivity and magnitude of potential effect provides a matrix categorisation of significance ("Major", "Intermediate", "Minor" and "Negligible").

13.8.4.2 All effects considered within this assessment are deemed to be negative unless stated otherwise.

Table 13.4: Significance of Effects Matrix

Significance of Effect	Sensitivity of Receptor			
Magnitude	Very High	High	Medium	Low
Substantial	Major	Major	Intermediate	Minor
Moderate	Major	Intermediate	Minor	Negligible
Slight	Intermediate	Intermediate	Minor	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

13.8.5 Limitations and Assumptions

13.8.5.1 This chapter is based upon a study of available documented information and data from a variety of publicly available sources and communications with relevant authorities, together with borehole survey data and previous site investigations undertaken on the proposed development site and in the immediate vicinity. It is noted that the existing soil and groundwater conditions on-site assessed in the baseline study are based on site investigation data undertaken by Soils Limited ref: 19522/MIR dated September 2021 (see Appendix 12.1).

13.8.5.2 Where data is limited or absent, professional judgement has been employed in the assessment of ground and groundwater conditions within the development site and has been based on a worst-case scenario.

13.8.5.3 The assessment of the likely effects is based on the assumption that best-practice construction techniques and operation protocols will be employed.

13.9 Baseline

13.9.1 In order to assess the likely significant effects of the proposed development on the current condition of the soils and groundwater beneath the site, it is necessary to develop an understanding of the prevailing baseline conditions.

13.9.2 Soils, geology and hydrogeology play an important role in determining the environmental character of an area. The development of an area can have both a direct and indirect effect on geology and hydrogeology. Existing

soil conditions, particularly ground and groundwater contamination, can impose constraints on the development. In addition, new contaminants can be introduced into the ground and groundwater, both in the short-term during construction and in the long term from the intended use.

13.9.3 The baseline condition assessment at the site has been established on a review of available environmental, geological and historic information relating to the site and has involved a review of the following sources of baseline data:

- Historical Maps;
- Hydrogeological and hydrological data;
- BGS historical records and background soil data;
- Groundwater abstractions;
- Geotechnical parameters;
- Flood risk;
- UXO risk;
- Industrial, commercial, agricultural and other sensitive land uses; and
- Radon risk and other potential gas risks

13.9.4 Site Conditions

13.9.4.1 A description of current site conditions based on publicly available aerial photography and site visits undertaken as part of the wider EIA process is presented in Table 13.5 and Table 13.6.

Table 13.5: Site Conditions

Section	Description
Background	The site (approx. 18.77ha) comprises agricultural and improved grassland to the east of Westergate. The site has defined boundaries with the 'west coast way' main railway line forming the southern boundary, the Lidsey Rife watercourse forming the eastern boundary and the settlements of Westergate and Eastergate forming the western and northern boundaries at approximate National Grid Reference SU 94045 04652.
Site Topography	Generally, the site is flat but undulating overall with slight local dips (<5°) towards water courses and overall to the S and E, with an average height of 7m.AOD with localised ground depressions/mounds.
Site Layout and Activity/Operations	The open land is predominantly a mix of arable farmland. Hedgerows define the field boundaries and scattered trees are located in the northern part of the site. A tributary stream crosses the middle of the site running east-west with a wet woodland located adjacent to the Westergate settlement boundary. Public footpaths cross the site with access taken through the medium-density residential areas to the West (Orchard Gardens, Woodgate Park, Elmcroft Place

	and Old School Place). Existing vehicle access is taken from the A29 via an access road running parallel to the railway line.
Building Structure(s)	No structures were noted
Surface cover	Grass and crops
Vegetation	Semi-mature/mature trees and hedgerows along the boundaries
Drainage	According to 19522/PIR completed by Soils Limited, no evidence of man-made drainage, assumed to be water courses by surface or sub-surface flow through superficial deposits.
Potential Contamination Sources	Some minor fly-tipping at the entrance from St Richards Road (NW)

13.9.5 The Surrounding Area

13.9.5.1 The site is located in an area of predominantly rural land with adjoining agricultural land uses. At the time of the site inspection, neighbouring land consisted of the following:

Table 13.6 Off-Site Conditions

Direction	Description
North	School, residential houses with private gardens, church, plant nursery
East	Agricultural lands
South	<5m - Adjacent to the railway line, agricultural fields 300m - caravan park, 63m - Woodgate autos 995m - Lidsey Oil Field
West	School, residential houses with private gardens, sport centre
Area topography	Local rise (<5°) to a slight ridge (Westergate Street) trending N/S to the W of the site and Woodgate to the SE. At the northern end of the site, the land rises slightly (<5°) to the N and NE towards Eastergate. Generally flat with local undulations.
Vegetation	Gardens, agricultural fields, grasslands (some overgrown) and mature shrubs and trees in and on the boundaries of adjacent properties. Some allotments.
Potential Contamination Sources	The Railway line located at the southern boundary

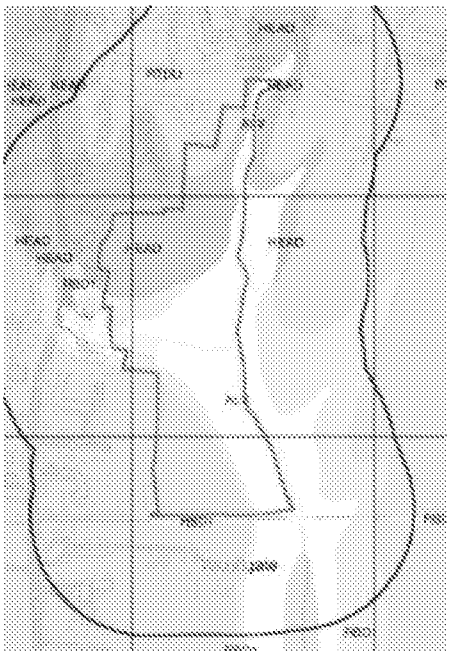
13.9.6 Geology, Hydrogeology and Hydrology and Radon

Published Geological Mapping

Anticipated Geology

13.9.6.1 The 1:50,000 scale BGS Geology map showed the site to be situated on London Clay Formation bedrock, with complex overlying superficial deposits. The site has a watercourse running through its centre from west to east, feeding into another water course which runs north to south along the eastern site boundary. Alluvium was recorded adjacent to both water courses, with Raised Beach Deposits evident to the central northwest. To the north, Head deposits and to the south, River Terrace Deposits are also present. Made Ground was noted on the southeastern boundary as a Railway embankment.

Figure 13.1: Published Geological Mapping of Site



Superficial

13.9.7 Made Ground

13.9.7.1 Made Ground comprises a material that has been placed by man or spread by man. It can comprise demolition material from former structures on the site or imported material placed to raise levels. Its composition can be very variable both laterally and with depth and may contain putrescible matter and voids.

13.9.8 Alluvium

13.9.8.1 Alluvium is the most recent river or estuarine deposit and generally comprises silty clays usually with an appreciable organic content. Lenses of sand and gravel are also commonly found, as are pockets of peat.

13.9.8.2 The BSI Code of Practice for Foundations, BS8004: 1986, Clause 2.2.2.3.4 Peat and organic soils, includes the caveat that 'all these soils are highly compressible, and even lightly loaded foundations will be subject to

considerable settlements over a long period if placed on them. For this reason, these soils are not suitable for carrying the loads for important structures'.

13.9.9 Head

13.9.9.1 Head Deposit are drifts produced by solifluxion, the downslope movement of debris outwash during the periglacial period, and characteristically comprise poorly sorted sands gravels and chalk of local derivation.

13.9.10 River Terrace Deposits

13.9.10.1 The rivers of the south-east of England, including the River Thames and its tributaries, have been subject to at least three changes of level since Pleistocene times. One result has been the formation of a complex series of River Terrace Deposits. These terraces represent ancient floodplain deposits that became isolated as the river cut downwards to lower levels. The composition of the River Terrace Deposits varies greatly, depending on the source material available in the river's catchment. Deposits generally consist of sand and gravel of roughly bedded flint or chert commonly in a matrix of silt and clay.

13.9.11 Raised Beach Deposits

13.9.11.1 Raised Beach Deposits consist of shingle, sand, silt and clay. Beach deposits may be in the form of dunes, sheets or banks, now above the level of the present shoreline as a result of earth movement or a general fall in sea level.

13.9.12 Bedrock – London Clay Formation

13.9.12.1 The London Clay Formation comprises stiff grey fissured clay, weathering to brown near surface. Concretions of argillaceous limestone in nodular form (Claystones) occur throughout the formation. Crystals of gypsum (Selenite) are often found within the weathered part of the London Clay, and precautions against sulphate attack to concrete are sometimes required.

13.9.12.2 The upper boundary member of the London Clay Formation is known as the Claygate Member and marks the transition between the deep water, predominantly clay environment and succeeding shallow-water, sand environment of the Bagshot Formation.

13.9.12.3 The lower boundary is generally marked by a thin bed of well-rounded flint gravel and/or a glauconitic horizon. The formation overlies the Harwich Formation or where the Harwich Formation is absent the Lambeth Group.

13.9.12.4 In the north London area the upper part of the London Clay Formation has been disturbed by periglacial action and may contain pockets of sand and gravel.

13.9.13 Hydrogeology

13.9.13.1 From Google Earth Pro, the nearest water feature was the tributary stream onsite - a tributary stream crosses the middle of the site running east-west. The site is not located within an area designated as of landscape sensitivity or of international or national ecological importance. It is not designated as, or within the setting

of, a Building Conservation Area or Scheduled Ancient Monument. The South Downs National Park is located 2 miles to the north. A single statutory site for nature conservation (Brooks Local Nature Reserve) is located within 2 km of the site (approx. 1.65km to the southwest). There are also two non-statutory sites of Nature Conservation Importance (SNCI) within 2km of the site, comprising Fontwell Racecourse (0.82km to the northwest) and Slindon Bottom (located 1.27km to the north).

Table 13.7: Hydrogeological Assessment

Hydrogeological Data		Comment
Aquifer Designation	Superficial	Secondary A[1] or undifferentiated
	Bedrock	Unproductive[2]
Groundwater Vulnerability		Superficial aquifers are medium to highly vulnerable, bedrock unproductive
Source Protection Zones (SPZ)		None onsite
Abstractions	Licensed	None noted within 1km
	Non-licensed	Spray Irrigation from surface waters 45-56m SE
Sensitive land uses		Nitrate Vulnerable Zone - Surface Waters – on site
Surface Water Features		On Site – Inland Rivers – 5no noted
Flood Risk from Rivers or Sea		Potential for flooding on site[3]
Flood Risk from Surface Water		Potential for flooding on site[3]
Flood Risk from Groundwater		Potential for flooding on site[3]

Notes: [1]Secondary A are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. [2] Unproductive strata are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow. [3] A Detailed Flood Risk Assessment is strongly indicated as the site may be at potentially significant risk from flooding.

13.9.13.2 Any works or development which has the potential to have an impact on surface water, aquifer or groundwater quality must be approved by the Environment Agency prior to implementation.

13.9.14 Hydrology

13.9.14.1 The approximate elevation of the site was circa 7m Above Ordnance Datum (AOD). The anticipated groundwater flow direction is given in Table 13.8.

Table 13.8: Hydrological Assessment

Type	Direction	Notes
Surface water	East/South	Following and feeding into local water courses or into underlying superficial aquifers
Groundwater	East/South	Following and feeding into local water courses through underlying superficial aquifers, flow into and through London Clay negligible – Unproductive Strata[1]

Note(s):[1] flowing through Unproductive Strata of the London Clay Formation at a very low rate

13.9.15 Minerals

13.9.15.1 Mines and Quarries - Based on BGS GeoIndex Onshore Data

- Woodgate Brick Field circa 50m S - Easting:494111 Northing:103999 Reference:157580
- West Barnham Brick Field >2000m W - Easting:495396 Northing:104763 Reference:157619
- Lidsey Canal Brick Works >1000 m S - Easting:493400 Northing:103240 Reference:18269
- Lidsey Oil Site circa 995m S - Easting:494500 Northing:103300 Reference:4621
- Northfields Farm Gravel Pits circa 850m NE - Easting:494660 Northing:105980 Reference:157595

13.9.16 Radon Gas

13.9.16.1 The British Geological Survey, in conjunction with the Radiation Protection Division of the Health Protection Agency, indicates the site to lie within an area where there is a probability of 3-5% of present or future homes being above the action level of 200Bq/m^3.

13.9.16.2 The guidance recommends that basic radon protective measures are required in any new structures. However, confirmation with local building control is advised.

13.9.17 Other Potential Gas

13.9.17.1 According to the 19522/GRA dated June 2022, based on the nature of the sources identified both on-site and in the updated CSM, the high groundwater table and the limited monitoring data recorded, the residual risk from ground gases at the site is considered very low. This will required to be confirmed by further scheduled monitoring including during summer months i.e., at such times as groundwater levels are anticipated to be falling and the Alluvium may not be as waterlogged. Visits should be targeted towards capturing low and falling pressure events in compliance with current guidance (CIRIA 665).

13.9.18 Soil Geochemistry

13.9.18.1 The results of this survey are obtained from BGS GeoIndex Onshore and 19522/PIR. The results of the local soil chemistry are presented in Table 13.9.

Table 13.9 Soil Geochemistry

Determinant	Estimated soil concentration (mg/kg)
Arsenic	<15
Cadmium	<1.8
Chromium	60-90
Lead	<100
Nickel	15-30

Note: None of the results noted exceeded current residential guidance values

13.9.19 Site History

Historical Map Review

13.9.19.1 The object of this study was to report on the evidence of site history and redevelopment of the site and its environs from available County Series and Ordnance Survey Maps dating from the mid to late 19th Century to the present day. Mapping was supplied by Landmark Environmental.

13.9.19.2 The published maps only represent a "snap-shot" of the site and its environs at the date of the survey. The detail of the information recorded can vary between epochs, map scale and county areas. It should be noted that changes in land uses, processes or activities may have occurred outside of published epochs and these may not have been recorded on subsequent epochs. Also note that as methods of projection, production and recording have changed over time, this can result in geo-reference errors that may indicate the established site boundary is off-centre from its true location on older historical maps.

13.9.19.3 Any distances quoted for features remote from the site have been scaled from the maps and are only approximate. Dates given in brackets are the published/edition date of the maps, and may not reflect the date the survey data was collected. The information reported might not represent all pertinent information that could be obtained. The interpretation of the maps and/or other data commented on in this report is subjective.

13.9.19.4 As part of the review of the historical plans, only features considered to have or to have had a potential contaminative impact on the site and usually within a notional 250m radius are discussed. The north point and approximate extent of the site are indicated in each figure.

Table 13.10: Historic Development of the Site

Site History	Date Range	
	From	To
The site is agricultural and open land adjacent and to the west of a north to south trending un-named watercourse. An east-to-west trending Railway Line forms the southern boundary. The only notable construction activity on site is a small Sewage Works noted on the eastern boundary adjacent to the un-named watercourse on maps dating 1974-1979 but not present from 1986 onwards.	1876[1]	2021[2]

Notes: [1]Earliest available map [2] No small-scale maps (1:2500) available for period 1937-1974

Table 13.11: Historic Off-Site Development

Off-Site Development	Date Range	
	From	To
The site lies between the settlements of Westergate to the northwest and west, Eastergate to the northeast and Woodgate to the southwest. Land to the east and south over the Railway Line is also agricultural.	1876[1]	1913
A Nursery and Orchard have been developed directly east and southeast of the site and similar developments are occurring around Eastergate 250m-1km northeast.	1913	1949
The Aerial Photograph noted the start of the development of new housing and garages adjacent to the north western corner of the site. No obvious evidence of military activities or wartime damage on or around the site.	1949	1951
A Brickfield has been established 300m south of the site across the Railway Line. Westergate School is established 100m northwest of the northern boundary of the site.	1951	1974
Eastergate School has been developed to the east across the un-named watercourse at the northern end of the site. The former Brickfield is no longer marked. Ryefield Piggeries has now been developed 100m south of the site. As the 1970's progress, new housing is being developed along the eastern and south eastern boundaries of the site as Westergate and Woodgate continue to expand. Allotment Gardens are noted directly north of the site from 1979	1974	1986
The former Piggeries is now noted as a Farmhouse	1986	1999
The Westergate School to the northwest is being redeveloped with the addition of an adjacent Sports Centre including the area of former allotments to the north. This site is renamed Ormiston Six Villages Academy in 2021.	1999	2021

Notes: [1]Earliest available map [2] No small-scale maps (1:2500) available for period 1937-1974

Table 13.12: Geological Hazards

Source	Nearest Distance from Site/Type
Coal Mining Affected Areas	Unlikely / No Hazard
Mining Instability	None noted
Natural and Mining Cavities	None noted
Potential for Collapsible Ground Stability Hazards	None to Low[1]
Potential for Compressible Ground Stability Hazards	None to Moderate[1]
Potential for Ground Dissolution Stability Hazards	None
Potential for Landslide Ground Stability Hazards	Very Low
Potential for Running Sand Ground Stability Hazards	Very Low to Low[1]
Potential for Shrinking or Swelling Ground Stability Hazards	Very Low to Low[1]
Notes: [1] The variability is due to the wide range of superficial deposits noted on site	

13.9.20 Bomb damage and the potential for Unexploded Ordnance

13.9.20.1 Based on the assessment of the historical maps from Zetica UXO, the risk was low. It is not considered that a specialist UXO risk assessment is required to determine the risk to the proposed development.

13.9.21 Regulatory Enquires

13.9.21.1 As part of the Preliminary Investigation Report 19522/PIR, the local authority, the Environmental Health Department of Arun District Council, was contacted and asked to provide any information on potential risks pertaining to the site.

13.9.22 Their response dated 8th August 2023 was stated as follows:

> **Re.: Land to the east of Westergate Street, Westergate, West Sussex**
>
> **Our ref.: 250523**
>
> *Further to your enquiry regarding contaminated land and associated issues at the above site, I am writing on behalf of this Department to advise you of the results of a search of our records and to inform you of the Council's position with regard to Part IIA.*
>
> *Arun District Council is in the process of implementing its contaminated land strategy to identify land within the district that is potentially contaminated. At the current time, this Department is identified and prioritising sites within the area that have been or are currently occupied by a potentially contaminative use. Initial investigations in the form of desktop studies and/or site inspections are in the process of being undertaken, with the intention of re-prioritising sites for more detailed inspection at a later date. At present, Arun District Council has no entries into its Register of Contaminated Land and is not considering taking formal or informal action under Part IIA of the Environmental Protection Act 1990.*

Following a search of this Department records, there are no areas highlighted as potentially contaminated land within a 250 metre radius of the site. If the site were put forward for development, however, it is likely that a condition would be recommended to any planning permission, the minimum requirement of which is submission of a human health-based risk assessment, conducted by a suitably qualified, independent consultant. This is due to the historic and continued use of the land as agricultural/grazing land and proximity to the railway located along the southern perimeter of the subject site.

In response to your specific questions:

The history of the site and any adjoining areas. Please refer to the main body of this report above.
Review of any previous desk study or site investigation information held for the site. This Department does not hold any previous desk studies or site investigation information carried out at the subject site.
the proximity of waste disposal sites. Please refer to the main body of this report above.
Petroleum licences. Please refer to the main body of this report above.

13.9.23 Based on the information obtained during the compilation of 19522/PIR and 19522/MIR completed by Soils Limited, no potentially significant sources have been either identified or confirmed based on the known site history. The further intrusive investigation also confirmed that no substances tested were found to be exceeding their soil guideline values when compared against generic guidance values for a 'Residential with homegrown produce' end-use.

13.10 Likely Significant Environmental Effects – During Construction

13.10.1 The following section identifies the potential impacts of the soils and geology that may occur as a consequence of the proposed development. The potential impacts are first assessed assuming no mitigation. For this purpose of this ES impact identification has been separated into construction and operation:

13.10.2 Potential environmental effects on developments are related to the following factors:

- potential pollution incidents or mobilisation of existing land contaminants
- interruption of existing groundwater
- interruption of existing groundwater or surface water flows

13.10.3 Excavation of soils combined with uncontrolled surface run-off may affect neighbouring surface water bodies, including increased turbidity and sediment deposition leading to effects on flora and fauna, as well as impacting any nearby drinking water abstraction.

13.10.4 There is the potential for impacting groundwater and surface water from pollution incidents resulting from spillage, incorrect transport or storage processes of oil, fuel or other chemicals used in the construction phase, affecting both public water supplies and the natural environment. Controlled waters may be at risk due to construction activities, such as excavation or piling, whereby an increased migration pathway may be created to the adjacent watercourse and/or underlying aquifer.

13.10.5 Storing fuel or hazardous materials in a flood-risk area can have significant environmental and public safety implications. Floodwaters can interact with stored substances, potentially leading to spills, leaks, and contamination that can harm the environment, human health, and property. Here are some of the potentially significant effects of fuel storage in a flood-risk area:

- Spills and Leaks: Floodwaters can dislodge fuel storage tanks, drums, or containers, leading to spills and leaks of hazardous substances. This can result in the release of pollutants into the environment, including soil and water bodies.
- Water Contamination: Floodwaters can carry spilt fuel into nearby water bodies, contaminating rivers, streams, lakes, and groundwater. This can harm aquatic ecosystems, aquatic life, and water quality.
- Soil Contamination: Spilled fuel can seep into the soil, potentially contaminating large areas. Contaminated soil can impact plant health, alter soil properties, and potentially migrate pollutants further downstream through water infiltration.
- Fire and Explosion Risks: In flood-risk areas, there's a heightened risk of fuel coming into contact with electrical systems or other ignition sources present in floodwaters, increasing the potential for fires and explosions.
- Health Risks: Inhalation of fuel vapours or direct contact with contaminated water can pose health risks to humans. Exposure to fuel vapours can cause respiratory issues, while direct contact with skin can lead to irritation and other health problems.
- Groundwater Contamination: Spilled fuel that infiltrates the ground can eventually reach groundwater reserves, potentially contaminating drinking water sources and posing long-term risks to human health.
- Long-Term Remediation: Cleaning up after a fuel spill in a flood-risk area can be challenging and costly. Remediation efforts might require excavation, soil replacement, and groundwater treatment.
- Emergency Response Challenges: Flooding can hinder emergency response efforts, making it more difficult to contain and mitigate spills and leaks effectively.

13.10.6 Furthermore, there is a potential scenario where the construction of new infrastructure might impact natural drainage pathways, modify the trajectories of existing underground utilities, and necessitate the construction of a bridge. These activities could block the flow of water, leading to negative impacts on the water supply for nearby ecosystems or extractions. This is especially concerning if proper supervision is lacking, particularly when they take place in flood-risk areas.

13.10.7 Here are some potential effects on drainage to consider:

- Altered Water Flow Patterns: Diverting underground services and building a bridge can change the natural pathways of water. This alteration can affect how water moves through the area during rainfall and flooding events.
- Increased Flood Risk: Poorly planned diversions and bridge construction can disrupt the natural drainage pathways, potentially increasing the risk of flooding by directing water into unintended areas.
- Hydraulic Changes: Changes in underground services and the presence of a bridge can lead to alterations in water flow velocities, depths, and directions. These hydraulic changes can impact drainage efficiency and increase the risk of erosion and sediment transport.
- Erosion and Sedimentation: Construction activities associated with diverting underground services and building a bridge can disturb soil and contribute to sediment runoff, which can affect the quality of water bodies and lead to sediment deposition in drainage systems.
- Obstruction of Watercourses: The construction of a bridge can alter the natural course of waterways, potentially causing blockages or reduced flow capacity, which can impact drainage and lead to localized flooding.
- Infrastructure Compatibility: Changes in underground services and the construction of a bridge should be compatible with existing drainage infrastructure to ensure effective water flow and prevent bottlenecks or disruptions.
- Urban Runoff Management: Both activities can influence urban runoff patterns, potentially leading to changes in stormwater management and impacting downstream areas.
- Ecological Impact: Altered drainage patterns can affect aquatic ecosystems and habitats in and around the water bodies, potentially harming aquatic life and disrupting natural balance.
- Water Quality: Changes in water flow and sediment transport can impact water quality by introducing pollutants and contaminants into drainage systems and water bodies.
- Sustainable Drainage Solutions: Incorporating sustainable drainage solutions during bridge construction can help manage water runoff, reduce flooding risks, and improve overall drainage efficiency.

13.10.8 The presence of construction plants, machinery, fuel stores and general construction operations could potentially impact soils and groundwater through localised spillages and leaks. The underlying near-surface soils are predominantly of low permeability and therefore any effect would likely be localised.

13.10.9 The most likely potential adverse impacts to arise during the demolition and construction works without appropriate environmental controls in place would be:

- Mobilisation of potential contaminants to air or groundwater (including the major aquifer) from contaminated soils during excavation and piling activities.
- Creation of new pollution pathways arising from the excavation of soils and installation of buried services and foundations.
- Contamination of parts of the site due to accidental spillages of fuels and chemicals used and stored on-site.
- Health and safety hazards to development workers whilst working with potentially contaminated materials.

Table 13.13: Summary of Potential Impacts and Potential Effects of Relevant Receptors

Activity	Potential Receptor	Potential Effect
Access Road Construction	Soil	Disposal of excess excavated material
	Surface water bodies	Soil disturbance and discharge of suspended soils
	Underlying Aquifer	Soil disturbance and discharge of suspended soils
Pollution from fuel, oil or concrete spillage	Soil	Discharge of contaminants
	Surface water bodies	Discharge of contaminants
	Underlying Aquifer	Discharge of contaminants
	Human Health	Dermal contact Inhalation of contaminated dust
Compound Construction	Soil	Disposal of excess excavated material Pollution from fuel, oil or concrete spillage
	Surface water bodies	Soil disturbance and discharge of suspended soils Disposal of excess excavated material Pollution from fuel, oil or concrete spillage
	Underlying Aquifer	Soil disturbance and discharge of suspended soils Disposal of excess excavated material Pollution from fuel, oil or concrete spillage
Cable & Service Laying	Soil	Disposal of excess excavated material Pollution from fuel, oil or concrete spillage
	Surface water bodies	Soil disturbance and discharge of suspended soils Mobilisation of existing contaminants Impedance to surface water flow
	Underlying Aquifer	Soil disturbance and discharge of suspended soils Mobilisation of existing contaminants Impedance to surface water flow
Transport of Materials	Soil	Discharge of contaminants Mobilisation of existing contaminants
	Surface water bodies	Discharge of contaminants Mobilisation of existing contaminants

Activity	Potential Receptor	Potential Impact
	Underlying Aquifer	Discharge of contaminants Mobilisation of existing contaminants
	Human Health	Dermal contact Inhalation of contaminated dust
Construction	Soil	Disposal of excess excavated material Pollution from fuel, oil or concrete spillage
	Surface water bodies	Soil disturbance and discharge of suspended soils Mobilisation of existing contaminants Impedance to surface water flow Obstruction to surface water flows by Foundation Construction Creation of new flow paths by service trenches foundation excavations (including choices of backfill materials).
	Underlying Aquifer	Soil disturbance and discharge of suspended soils Mobilisation of existing contaminants Impedance to surface water flow Obstruction to surface water flows by Foundation Construction Creation of new flow paths by service trenches foundation excavations (including choices of backfill materials).

13.10.10 The impacts detailed in Table 13.13 are all potential effects which, without the appropriate mitigation measures, could have an adverse effect on the geology and soil environment within and near the application site.

13.10.11 Nonetheless, certain effects cannot be entirely eliminated even with the implementation of suitable mitigation measures, most of which align with the principles of optimal operational procedures.

13.11 Likely Significant Environmental Effects – Post-Construction

13.11.1 Once the proposed development has been completed, there are some potential impacts on the environment and human health after construction:

- Soil Erosion: Newly disturbed soil can be susceptible to erosion after construction, potentially leading to sedimentation in nearby water bodies and affecting water quality.
- Water Quality: Stormwater runoff from newly constructed areas can carry pollutants and contaminants into water bodies, impacting aquatic ecosystems and drinking water sources.
- Waste Generation: Completed construction can generate waste materials, both during the construction phase and afterwards, which require proper disposal or recycling to prevent environmental impacts.

13.11.2 The following sections detailed the mitigation measures to be implemented, where appropriate following completion of the investigation and construction phases.

13.12 Mitigation

13.12.1 Construction

13.12.1.1 Excavation and storage of soil will be required during the construction of the development, access road, site compound, and service laying. It is expected that sub-soil and topsoil will be stockpiled separately for use in the backfilling and reinstatement processes.

13.12.2 Stockpiling

13.12.2.1 The stockpiling area should be properly designed away from flood risk areas and managed to prevent contamination spread, ensure proper drainage, and minimize risks. Stockpiled soils might be sent to an appropriate treatment facility or landfill once the necessary permits and arrangements are in place.

13.12.3 Storage Area

13.12.3.1 There is a possibility of fine particles in surface water runoff, spillages of fuels/oils/chemicals during refuelling or movement of construction equipment, use of hazardous building materials and run-off from concrete placement. In the absence of environmental management controls, these have the potential to have minor negative impacts on the groundwater and soil.

- **Containment Structures:**

  Install impermeable barriers, such as berms or curbing, around the storage area to contain spills and prevent them from flowing into adjacent areas.

  Construct a secondary containment structure or a spill containment pallet for fuel containers or tanks. This can capture leaked fuel and prevent it from entering surface runoff.

- **Elevation and Grading:**

  Design the storage area on a slightly elevated surface to allow water to flow away from the storage area rather than towards it.

  Ensure proper grading to direct surface runoff away from the storage area and towards appropriate drainage systems.

- **Drainage Management:**

  Design the site to prevent water pooling near fuel storage areas.

  Implement proper drainage pathways that direct rainwater away from the storage area, using swales, channels, or underground drainage systems.

- **Spill Prevention Equipment:**

  Install spill prevention equipment, such as spill containment pallets, drip trays, and absorbent materials, to capture any fuel that might leak from containers.

- **Spill Response Plan:**

  Develop a spill response plan that includes procedures for containing and cleaning up spills promptly to prevent them from reaching surface runoff.

- **Good Housekeeping:**

  Implement a rigorous maintenance and inspection schedule to identify and address potential spills or leaks before they become significant issues.

  Store fuel containers on shelves or racks to prevent contact with water or ground surfaces.

- **Proper Infrastructure:**

  Use storage tanks and containers that are in good condition and compliant with regulations.

  Install secure lids, valves, and fittings on storage tanks to prevent accidental spillage.

- **Regular Inspections:**

  Regularly inspect storage areas, tanks, and containers for signs of leakage or deterioration.

  Address any maintenance issues promptly to prevent potential spills.

- **Signage and Training:**

  Clearly mark storage areas with appropriate signage indicating the presence of fuels and the need for caution.

  Train employees and personnel on spill prevention, containment, and proper response procedures.

13.12.3.2 Given these potential effects, the storage of hazardous materials, including fuels and oil will be outside of flood-risk areas in appropriately bunded storage areas whenever possible. If storage is necessary, strict safety measures, spill prevention protocols, and contingency plans should be in place to minimize the risk of spills, leaks, and environmental damage. Regulatory agencies often have specific guidelines and requirements for hazardous material storage, particularly in flood-prone zones. It's essential to comply with these regulations to protect both the environment and public safety.

13.12.3.3 A Materials Management Plan will be developed with the intention of minimising the movement of soil either to or from the site.

13.12.3.4 During construction in the absence of appropriate mitigation, such as the use of Personal Protective Equipment (PPE), potential contamination could present a risk to construction site workers. However, the

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protection of worker safety is subject to mandatory requirements under the Construction (Design and Management) Regulations 1994, ref. 6.12.15 the Control of Substances Hazardous to Health (COSHH) Regulations ref. 6.12.12, and other relevant health and safety legislation.

13.12.3.5 Implementation of protection measures for site workers required by legislation, such as the use of PPE and adherence to standard practice management methods, would reduce the risk of exposure by minimising the risk of direct/indirect inhalation, ingestion or contact with contaminated soil and/or contaminated surface water run-off. Assuming adequate safety controls are in place, the effect on construction workers is therefore considered negligible.

13.12.3.6 The perimeter areas of the site would be secured using site hoarding to prevent unauthorised access by the public. Standard environmental control measures would also be put in place to control dust generation during the works. The potential risk of exposure to the public from demolition and construction activities would therefore be negligible.

13.12.4 Mobilisation of Existing Soil Contaminants and Disposal of Excess Excavated Material

13.12.4.1 The development does not include any basements, however large volume of wastes from foundation excavation will be expected. Excavated material would be tested to determine any associated hazardous properties and Waste Acceptance Criteria (WAC) classification under the Landfill (England and Wales) Regulations 2002, ref 6.12.44, and the Hazardous Waste Regulations 2005, ref 6.12.45. During excavation, waste arisings would be carefully controlled and managed to prevent the uncontrolled release of contaminants. Assuming that relevant legislative requirements are met, the disposal of this material would result in negligible environmental effects.

13.12.5 Impedance to Surface Water Flow and Discharge of Suspended Solids

13.12.5.1 The construction of any above-ground structure has the potential to impede natural land drainage if mitigation measures are not put in place. Hard standing put in place for the site compound will be temporary and will be removed on completion of construction back to baseline conditions. Drainage should be constructed as required for these temporary structures.

13.12.5.2 Access roads will be utilised and upgraded as required. New roads will be constructed of granular material, and drainage will be constructed as appropriate, depending on the requirements of the individual accessways.

13.12.5.3 There is a possibility of the discharge of suspended solids in surface water runoff, spillages of fuels/oils/chemicals during refuelling or movement of construction equipment, use of hazardous building materials and run-off from concrete placement. In the absence of environmental management controls, these have the potential to have minor negative impacts on the groundwater and soil.

13.12.6 Impedance to Shallow Groundwater Flow

13.12.6.1 Groundwater was encountered within ten of the twenty-eight trial holes in the intrusive investigation 19522/MIR dated September 2021, completed by Soils Limited ranging from 1.10m to 2.00m bgl.

13.12.6.2 However, much shallower groundwater levels were recorded in 19522/GRA dated June 2022 completed by Soils Limited. Groundwater was recorded in ten boreholes at depths during winter period varying between 0.76m and 1.70m bgl for short-term settled levels. Given the site has two water courses running through and alongside it and is situated between ~5m and ~10m AOD, shallow groundwater would be anticipated, particularly in the east of the site where the site lies directly adjacent to a water course and is lower. It is noted that the areas immediately adjacent to the water courses, through the centre of the site and along the eastern edge, comprise a flood zone with no residential development proposed in these areas.

13.12.6.3 Given the proposed adoption of appropriate techniques and design solutions for the development, no pathways would be created to sensitive controlled water receptors, and any residual effects are anticipated to be negligible.

13.12.7 Pollution due to Chemical Storage/Spillage

13.12.7.1 Current best practices require the storage of materials within a suitably sized secondary containment. The primary concern regarding chemical spillage would be the nearby water courses. However, the presence of the impermeable London Clay Formation as an unproductive layer significantly reduces the potential impact, making it negligible. To mitigate any residue risks, the storage areas should be located away from water courses and any potential flood risk areas and managed according to the set standards listed at the beginning of the Mitigation section 13.12.

13.12.8 Potential Leaching from Concrete Leading to Altered pH Levels

13.12.8.1 Whilst there is the chance that over time the concrete foundations may degrade and potentially affect pH levels of the surrounding soil and shallow groundwater. Selection of the correct concrete class should ensure that any potential impact will be negligible.

13.12.9 Operation

13.12.9.1 Mitigation measures during the construction operation phase are crucial to minimize the environmental impact of construction activities. These measures aim to reduce disruptions to ecosystems, prevent pollution, and ensure the overall sustainability of the project.

- **Erosion and Sediment Control:**

  Implement erosion control measures, such as silt fences, sediment basins, and gravel construction entrances, to prevent soil erosion and sediment runoff into water bodies.

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- **Stormwater Management:**

  Implement best management practices (BMPs) for stormwater management, including using temporary sediment ponds, infiltration systems, and vegetated buffers to treat and control runoff.

- **Waste Management:**

  Establish a waste management plan that includes waste separation, recycling, and proper disposal of construction waste materials.

- **Hazardous Material Handling:**

  Develop and implement protocols for the proper handling, storage, and disposal of hazardous materials to prevent spills and contamination as stated above in Section 13.12.

- **Site Security:**

  Secure the construction site to prevent unauthorized access, vandalism, and theft of construction materials.

- **Waterbody Protection:**

  Use silt curtains and sediment traps to prevent construction-related pollutants from entering nearby water bodies.

- **Health and Safety Measures:**

  Implement health and safety protocols to protect workers, including proper use of personal protective equipment (PPE), training, and emergency response plans.

- **Spill Response Plans:**

  Develop spill response plans and provide spill kits on-site to contain and manage accidental fuel or chemical spills.

- **Monitoring and Reporting:**

  Regularly monitor the effectiveness of mitigation measures and adjust them as needed based on environmental conditions and project progress.

- **Environmental Compliance:**

  Ensure compliance with all relevant environmental regulations, permits, and approvals throughout the construction operation phase.

13.12.9.2 By incorporating these mitigation measures into the construction operation phase, you can help minimize the negative environmental impacts of the project, maintain community goodwill, and promote a more sustainable and responsible construction process.

13.12.9.3 The potential effects for the operational phase would be mitigated with the aim of reducing them to negligible levels, by implementing the measures to control and prevent potential pollution of soils and controlled waters.

13.12.10 The Health of Site Occupants

13.12.10.1 In view of the nature of the proposed development and the fact that a large proportion of the site is to be covered with buildings or hard standing, the effects on human health are not considered to be an issue during operation. This is considered to be a permanent effect and the resultant impact would be minor positive.

13.12.10.2 The potential for the inhalation of Radon, once the development is complete, is considered to be very low as we understand the proposed buildings will include appropriate radon protection measures. Therefore, the risk of inhalation of Radon is low and the resultant impact would be minor positive.

13.12.11 Controlled Waters

13.12.11.1 Controlled waters could potentially be at increased risk due to run-off from the completed development, specifically from roads and areas of hard standing, infiltrating into the ground and the aquifer. Such run-off could contain oils and greases along with other contaminants. Mitigation measures will be incorporated within the development design including hardstanding and appropriate drainage infrastructure. Given the proposed mitigation measures, any residual effects on controlled waters are anticipated to be negligible.

13.12.12 Property Stability

13.12.12.1 The risk is assessed as ranging from moderate to significantly negligible due to the presence of shrinkable soils from the London Clay Formation and varying degrees of superficial deposits. We understand that suitable foundation schemes will be designed, and remediation be undertaken to address the varying conditions. The new permanent structures and foundations would be designed to carry the vertical and lateral loads imposed on them by the superstructures, together with any associated earth/wind/water pressures. This would ensure that the long-term settlement (total and differential) of the superstructures would be maintained within acceptable limits. Consequently, the potential effect of ground movements is considered to be negligible.

13.13 Residual Effects

13.13.1 Construction

The Health of Workers/General Public

13.13.1.1 Given the proposed mitigation measures any residual effects to the construction workforce/general public are anticipated to be negligible.

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Controlled Waters

13.13.1.2 Given the proposed adoption of appropriate techniques and design solutions during the design of the development, no pathways would be created to sensitive controlled water receptors, and any residual effects are anticipated to be negligible.

Pollution due to Chemical Storage/Spillage

13.13.1.3 Given the proposed mitigation measures, any residual effects on soils or groundwater arising from the plant, machinery, fuel stores and general construction operations are anticipated to be negligible.

13.13.2 Operation

The health of site occupants

13.13.2.1 Given the proposed mitigation measures any residual effects to site occupants are anticipated to be minor positive.

Controlled Waters

13.13.2.2 Given the proposed adoption of appropriate techniques and design solutions during the design of the development, no pathways would be created to sensitive controlled water receptors, and any residual effects are anticipated to be negligible.

Property Stability

13.13.2.3 Given the proposed adoption of appropriate techniques and design solutions during the design of the development the long-term stability of the structures will be maintained within acceptable limits, and the potential effect should be considered negligible.

13.13.2.4 A summary of the residual effects before and after mitigation on the construction and operation stages of the proposed development is summarised in Table 13.14.

Table 13.14: Summary of Residual Effects

Environmental Topic	Description of Effect		Description of Mitigation Measures	Description of Residual Effect	
	Description	Significance		Description	Significance
Ground Conditions and Contamination: Construction	The health of construction workers and the general public affected by contaminated soils and materials	Minor Negative (Temporary)	Use of generic safe working practices, use of personal protective equipment, working to CDM regulations and COSHH regulations and implementing the Construction Management Plan.	Effect on health of construction workers and the general public affected by contaminated soils and materials	Negligible Negative (Temporary)
	Effect on soils and neighbouring sites from contaminated soils and materials	Minor Negative (Temporary)	Mitigation measures to be developed in line with published guidance and best practice, if required. Use of good environmental site practices to include designated refuelling areas, temporary drainage networks and adoption of pollution prevention guidelines.	Effects on soils and neighbouring sites from residual contaminated soils and materials	Negligible Negative (Temporary)
	Effect on controlled waters (surface water flow and groundwater flow) from contaminated soils and materials	Minor Negative (Temporary)	Mitigation measures are to be developed in line with published guidance and best practice, if required. Use of good environmental site practices and adoption of pollution prevention guidelines.	Effect on controlled waters from contaminated soils and materials	Negligible Negative (Temporary)
	Exposure to the public from demolition and construction activities	Minor to Moderate Negative (Temporary)	The perimeter of the site is to be secured, to prevent access by the public. Standard environmental control measures to control dust generation.	Effect on the health of the general public	Negligible Negative (Temporary)
	Effect to the health of site occupants from radon gas	Moderate to Major Negative (Permanent)	Mitigation measures implemented during design and construction to	Effect to the health of site occupants from radon gas	Minor positive (Permanent)

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			include appropriate radon protection measures.		
	Effect on the health of site occupants from potentially contaminated soils	Minor Negative (Permanent)	Mitigation measures involve the removal of any contaminated soils, if necessary.	Effect on the health of site occupants from potentially contaminated soils.	Minor Positive (Permanent)
	Effect on controlled waters from future activities	Negligible Negative (Permanent)	Mitigation measures within development design including hardstanding and appropriate drainage infrastructure	Effect on controlled waters from future activities	Negligible (Permanent)
	Effect on property stability	Moderate to Major Negative (Permanent)	New permanent structures and foundations would be designed to carry the vertical and lateral loads. No mitigation is necessary.	Effect on property stability	Negligible (Permanent)

13.14 Cumulative Effects

13.14.1 In the context of construction, these effects can accumulate and compound, leading to more substantial environmental changes. Here are some aspects to consider regarding cumulative effects during foundation construction:

- **Erosion and Sedimentation:**

  The construction of multiple foundations in an area can lead to increased soil disturbance, contributing to higher levels of erosion and sediment runoff into nearby water bodies. This can degrade water quality and impact aquatic habitats.

- **Stormwater Management:**

  The construction of multiple foundations can increase impervious surfaces, reducing the natural absorption of rainwater and increasing stormwater runoff. This can lead to increased flooding and erosion downstream.

- **Groundwater Impact:**

  Construction of multiple foundations may alter groundwater flow patterns and aquifer recharge rates, potentially impacting water availability and quality.

13.14.2 To mitigate these cumulative effects during the foundation construction phase and beyond, comprehensive planning, coordination, and environmental management are essential. Some measures to consider include:

- **Environmental Monitoring:**

  Implement regular environmental monitoring to assess the combined effects of construction activities and adjust mitigation strategies as needed.

- **Phased Construction:**

  Consider phasing construction projects to allow for recovery periods and to reduce the intensity of cumulative impacts.

- **Sustainable Practices:**

  Incorporate sustainable construction practices, such as erosion control, dust suppression, and green infrastructure, to mitigate cumulative environmental effects.

- **Regulatory Compliance:**

  Ensure compliance with local regulations and permits to manage cumulative environmental effects effectively.

13.14.3 By proactively addressing cumulative effects and implementing appropriate mitigation measures, construction activities can be conducted in a way that minimizes their long-term impact on the environment, surrounding communities, and ecosystems.

13.15 Summary and Next Steps

13.15.1 Regarding the comment by Arun District Council in Table 13.1, where Environmental Health expressed concerns about potential ground contamination due to the site's proximity to the railway line, information gathered during the preparation of 19522/PIR in September 2021, along with the preliminary conceptual site model (CSM), and referring to the chemical analysis from intrusive investigation ref:19522/MIR also dated September 2021, conducted by Soils Limited, indicates that no tested substances were found to exceed soil guideline values. These values were compared against standard guidance for a 'Residential with homegrown produce' land use.

13.15.2 It's essential to take specific steps to ensure environmental safety and compliance with regulations. Here's a breakdown of the next steps that should be taken both before and after construction:

Before Construction:

- Site Assessment: Conduct further groundwater monitoring in the summer period to have more understanding of water flow and trends on site for the design of new infrastructure as the previous study 19522/GRA was conducted during the winter period.
- Risk Assessment: Perform a risk assessment to evaluate the potential health and environmental risks associated with the contamination. This will help determine the appropriate remediation strategy.
- Remediation Plan: Develop a comprehensive remediation plan based on the site assessment and risk assessment findings. This plan should outline the specific remediation methods to be employed.
- Regulatory Compliance: Ensure that all necessary permits and approvals are obtained from regulatory authorities before starting construction. Compliance with environmental regulations is crucial.
- Engineering Controls: Implement engineering controls to prevent the spread of contamination during construction. This may include physical barriers, dust control measures, and containment systems.
- Worker Training: Provide training for construction workers regarding contamination hazards, safety protocols, and the use of personal protective equipment (PPE).

During Construction:

- Supervision and Monitoring detailed in Section 5.12: Continuously supervise construction activities to ensure that engineering controls are effective, and contamination is not spread.
- Emergency Response Plan: Have a well-defined emergency response plan in place in case of accidental releases or incidents during construction.
- Contaminated Material Management: Properly manage and dispose of contaminated materials generated during construction, following regulations and best practices.

After Construction:

- Post-Construction Assessment: After construction is complete, conduct a final assessment to verify that the remediation goals have been met. This may involve additional testing and analysis.
- Long-Term Monitoring: Establish a long-term monitoring program to assess the site's environmental conditions over time to ensure that contamination does not resurface.
- Maintenance: Maintain any engineered controls or containment systems that were put in place during construction to prevent contamination migration.
- Regulatory Reporting: Submit required reports to regulatory authorities to demonstrate compliance with remediation goals and ongoing monitoring.
- Public Communication: Maintain communication with the community and stakeholders to provide updates on the site's status and any relevant findings.
- Legal Closure: Seek regulatory closure or clearance once it's determined that the site meets all necessary remediation and safety requirements.

13.15.3 The development will bring with it modifications and upgrading of local infrastructure networks which will provide a positive enhancement to the local area.

13.16 References

13.16.1 Below is a list of Ground Conditions references:

- British Standard Institution (2013) BS 8576:2013. Guidance on investigations for ground gas. Permanent gases and Volatile Organic Compounds (VOCs).
- British Standard Institution (2015) BS 8485:2015+A1:2019. Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings.
- British Standard Institution (2017) BS 1075:+A2 (2017). Investigation of potentially contaminated sites, and code of practice.
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14. Minerals

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14 Minerals

14.1 Introduction

14.1.1 This chapter has been prepared by SLR Consulting Ltd and describes the baseline geology, mineral resources planning policies, methodology, and the potential impact on identified mineral resources as a result of the proposed development. This assessment is based on known and published information about the geology underlying the Scheme and the surrounding area. Where necessary, this chapter also describes proposed mitigation, compensation and enhancement measures.

14.1.2 This Section is written by Siobhan Hall CGeol, Principal Geologist at SLR Consulting Ltd with 11 years' experience in the UK Aggregates and Industrial Minerals Industry. She has experience in the assessment of sites for minerals development and safeguarding issues across many geological settings and throughout England and Wales. She also specialises in geological modelling, reserve and resource assessments and quarry design.

14.1.3 This chapter is supported by a Minerals Resource Assessment, which is included at Appendix 14.1.

14.2 Background

14.2.1 Land within the application area has been Identified as located within a Mineral Safeguarding Area (MSA) and Mineral Consultation Area (MCA) for Sharp Sand and Gravel as defined in the West Sussex County Council (WSCC) Joint Minerals Local Plan (JMLP).

14.2.2 The scheme comprises a Hybrid Application: 1) Full Planning Application for western section of East/West Link Road with new access, road bridge & associated works; 2) Outline Planning Application with all matters reserved for up to 400 No. dwellings with access & associated works.

14.2.3 The potential for cumulative effects with projects highlighted within the Scoping Opinion Response received from Arun District Council dated June 2022, set out in Chapter 3 and which are considered as part of this assessment.

14.3 Minerals Policy Context

14.3.1 Minerals are important national resources and adequate and steady supplies are vital for development and sustaining the economy and society. Minerals are a finite natural resource that can only be worked where they are found. A key aspect of sustainable development is the conservation and safeguarding of non-renewable resources for future generations. As such it is important that other development does not needlessly prevent the future extraction of mineral resources.

14.3.2 The proposed scheme falls within the administrative boundaries of Arun District Council (as Local Planning Authority) and WSCC (as the Mineral Planning Authority, MPA).

14.3.3 The assessment has been carried out with reference to national and local policy and guidance. The following key policy and guidance has been taken into consideration:

- National Planning Policy Framework (NPPF);
  - Strategic Policy 20;
  - Section 17 Facilitating the sustainable use of minerals: Paragraphs 215 to 218;
- West Sussex County Council Joint Minerals Local Plan, July 2018 (Partial Review March 2021):
  - Policy M9
  - Minerals and Waste Safeguarding Guidance (March 2020);
- Arun Local Plan 2011 - 2031 (July 2018);
  - Natural Resources and mineral safeguarding.

National Planning Policy Framework

14.3.4 The National Planning Policy Framework (NPPF, 2023) sets out the Government's planning policies for England and how these are expected to be applied. The presumption in favour of sustainable development sits at the heart of the NPPF, and this requires that local planning authorities should positively seek opportunities to meet the development needs of their area, and that local plans should meet objectively assessed needs, with sufficient flexibility to adapt to rapid change. The NPPF also states that development proposals that accord with an up-to-date development plan should be approved without delay (paragraph 11c).

14.3.5 The NPPF recognises that minerals are essential to support sustainable economic growth and mineral planning authorities must ensure that there is an adequate supply of minerals to provide the infrastructure, buildings, energy and goods the country requires. In addition to an adequate supply, it is important to note that minerals are a finite source and can only be worked where they are found, and measures must be put in place to secure their long-term conservation. National planning policy requires that local planning authorities should seek to safeguard mineral deposits (and associated infrastructure sites) from sterilisation by other development to ensure a future supply of minerals.

14.3.6 Section 17 of the NPPF sets out the requirements for planning policy to facilitate the sustainable use of minerals, including the requirement to safeguard minerals from sterilisation by non-mineral development (paragraph 216c). Planning policies do this in two ways; landbanks and mineral safeguarding.

14.3.7 A 'landbank' is a stock of permitted or allocated minerals sites to be worked in the future. The landbank for sand and gravel is determined to be at least 7 years, and at least 10 years for rock. Since minerals are a non-renewable resource, minerals 'safeguarding' is the process used in the planning system to ensure that non-minerals

development does not needlessly risk sterilisation or prevent the future extraction of mineral resources, of local and national importance.

West Sussex County Council Joint Minerals Local Plan

14.3.8 The West Sussex Joint Minerals Local Plan (JMLP) was adopted in July 2018. A Soft Sand Review of the JMLP was required following adoption of the Plan in July 2018. The partial review resulted in revisions to Policies M2 and M10 of the JMLP, in relation to the supply strategy for soft sand and the allocation of three sites for future extraction. The formal changes to the Plan were adopted in March 2021.

14.3.9 The JMLP is therefore based on the principle of sustainable development and this is reflected in the Spatial Vision and the Strategic Objectives, and the policies that seek sustainable solutions. The strategic objectives set out in the JMLP are underpinned by an ambition to manage mineral extraction and supply according to the principles of sustainable development and as far as mineral extraction is concerned.

14.3.10 The JMLP sets out the key principles to guide the future winning and working of minerals in the County up to 2031. It also sets out the development management policies against which planning applications for minerals and waste development will be considered. It also seeks to ensure the protection of mineral resources from the risk of sterilisation by development which potentially prevents future extraction.

14.3.11 Known locations of mineral resources of national and local importance need to be safeguarded to ensure the long-term security of minerals supply and to ensure their presence is factored into decisions about future land-use when proposals for other development arise. Safeguarding mineral resources does not create a presumption that the resources defined will ever be worked.

14.3.12 In relation to land-won sharp sand and gravel, the JMLP states that with the level of existing reserves at the time of the plan making that 'there are sufficient supplies of sharp sand and gravel to last for the plan period'. At the time of the plan the landbank for sharp sand and gravel was 65 years.

14.3.13 The strategy of the plan is to safeguard the existing permitted reserves and the provision of additional reserves Is to be made only If the needs of the county cannot be met with other sources from West Sussex Including marine won aggregate. It also states that "*additional allocations for sharp sand and gravel sites are not required and so not included in the Plan.*"

14.3.14 Any mineral proposals are expected to be assessed against Policy M1: Sharp sand and gravel, which states:

> *Proposals for land won sharp sand and gravel extraction, including extensions of time and physical extensions to existing sites, will be permitted provided that:*

(a) the proposal is needed to ensure a steady and adequate supply and to maintain at least a 7-year landbank, as set out in the latest Local Aggregates Assessment; and

(b) the proposal is located outside the AONB/South Downs National Park unless there are exceptional circumstances and that it is in the public interest, in accordance with Policy M13, to locate within those areas; and

(c) where transportation by rail or water is not practicable or viable, the proposal is well-related to the Lorry Route Network.

14.3.15 WSCC have used a number of criteria to develop Mineral Safeguarding Areas (MSA) that highlight areas of geology and locations of deposits that are, or may in the future constitute an economically viable resource. MSAs are defined simply on the basis of geological mapping and do not in this case consider existing constraints and sterilisation of deposits, mineral quality, thickness of deposit and viability of extraction.

14.3.16 Mineral Consultation Areas (MCA) are published separately to the JMLP and cover the same area as MSA but also include safeguarded minerals infrastructure. The main aim of the MCA is to ensure that consultation between the County and District Planning Authorities takes place. MCAs are drawn up to an area of 250 metres from each safeguarded permitted minerals development and Preferred and Reserve Site allocation as shown on the policies maps.

14.3.17 Policy M9 Safeguarding Minerals states:

(a) Existing minerals extraction sites will be safeguarded against non-mineral development that prejudices their ability to supply minerals in the manner associated with the permitted activities.

(b) Soft sand (including potential silica sand), sharp sand and gravel, brick-making clay, building stone resources and chalk reserves34 are safeguarded against sterilisation. Proposals for non-mineral development within the

Minerals Safeguarded Areas will not be permitted unless:

(i) Mineral sterilisation will not occur; or

(ii) It is appropriate and practicable to extract the mineral prior to the development taking place, having regard to the other policies in this Plan; or

(iii) The overriding need for the development outweighs the safeguarding of the mineral and it has been demonstrated that prior extraction is not practicable or environmentally feasible.

14.3.18 Policy M9 of the JMLP is of key relevance, stating that soft sand, sharp sand and gravel are safeguarded against sterilisation. Proposals for non-mineral development within the MSA will not be permitted unless mineral sterilisation will not occur; it is not appropriate and practicable to extract the mineral

prior to the development taking place, having regards to other planning policies; or the overriding need for the development outweighs the safeguarding of the mineral and it has been demonstrated that prior extraction is not practicable or environmentally feasible.

14.3.19 Policy M9: Safeguarding Minerals requires that "Where non-mineral development is proposed, developers may be required to carry out investigation work to ascertain whether economically viable mineral resources are present and whether prior extraction is practicable. The results of this work should be reported in a 'Minerals Resource Assessment' that is submitted with any application (for more detail see separate guidance on safeguarding)."

14.3.20 This will ascertain whether there is an opportunity for the prior extraction of that mineral to avoid the sterilisation of the resource, as required by the National Planning Policy Framework (NPPF) (Para 215).

14.3.21 Additional guidance is provided within Paragraph 6.9.13 of the JMLP which states; "*Where non-mineral development is proposed, developers may be required to carry out investigation work to ascertain whether economically viable mineral resources are present and whether prior extraction is practicable...For the Authorities to raise no objection to the non-mineral development, they will need to be satisfied that either minerals sterilisation will not occur (either because the mineral resources are not economically viable or that an appropriate and practicable level of prior extraction can take place) or because there is an overriding need for the development.*"

Minerals and Waste Safeguarding Guidance

14.3.22 This document provides guidance on how minerals safeguarding in West Sussex takes place. It sets out thresholds for non-mineral developments and when Local Planning Authorities are to consult with the MPA. It also sets out guidance on mineral resource assessments in relation to Policy M9 and information that may be included within the assessment depending on the size of the site and scarcity of mineral deposit.

Arun Local Plan

14.3.23 Section 19: Natural resources and minerals safeguarding of the Arun Local Plan sets out that the MSAs Identified by the JMLP are replicated within the policies map to ensure that economically viable mineral reserves within the District are safeguarded.

West Sussex County Council Joint Minerals Local Plan, Local Aggregates Assessment (LAA) 2021 (January 2023)

14.3.24 LAAs are prepared and used by Mineral Planning Authorities, to help them plan for a steady and adequate supply of aggregates. The LAA is updated annually and provides the latest aggregates situation, to support the determination of planning applications for aggregate proposals.

14.3.25 The plan was prepared to provide an annual provision of 0.101 million tonnes per annum (mtpa) of sharp sand and gravel from West Sussex over the plan period. The 'strategy for the provision of land won sharp sand and gravel is therefore to safeguard existing permitted reserves and make provision for additional reserves only if needs cannot be met from other sources...' (WSCC JMLP Paragraph 6.2.9).

14.3.26 The 10-year average sales data Indicates that annual sales for sharp sand and gravel is 67,323 tonnes. The national PPG states that a three-year average annual sales should also be factored into consideration of a sales trend. The three-year average annual sales figure for sharp sand and gravel in West Sussex is 104,458 tonnes.

14.3.27 Existing reserves are provided by a single existing permission at one gravel site which has an estimated remaining yield of circa 575,000 tonnes.

14.3.28 The JMLP provides for sand and gravel for the plan period, in 2021 the landbank for land-won sand and gravel sat at 5.5-5.7 years, which was based on the three-year average and 10-year average sales. However, the JMLP and LAA note that the majority of sharp sand and gravel is sourced from marine and recycled aggregates within the county. Using the 10 year or three year average sales the data and a series of assumptions around demand the LAA Indicates that there Is a theoretical shortfall of land-won sharp sand and gravel over the plan period to 2033.

14.4 Minerals Assessment Methodology

Assessment Methodology

14.4.1 A Mineral Resource Assessment (MRA) has been prepared to establish the presence of a mineral deposit, the viability of the prior extraction of mineral such that the resource is not sterilised where this can be avoided. The MRA is included as Appendix 14.1.

14.4.2 The MRA has been produced having regard to mineral and waste safeguarding guidance produced by the British Geological Survey (BGS), WSCC and Mineral Products Association. These documents not only provide practical guidance to Local Planning Authorities and 'non-mineral' developers affected by Mineral Safeguarding, it also includes guidance on the scope and format of MRAs.

14.4.3 The approach for determining the significance of effects is a two stage process that involves defining the sensitivity of the receptors and the magnitude of potential change, should that potential change occur on those receptors. This section describes the criteria applied in this chapter to assign values to the sensitivity of receptors and the magnitude of potential impacts.

14.4.4 Criteria for determining the significance of effects from a minerals perspective, adapted to reflect the criteria that have been used to assess the magnitude of the change are defined in Table 1 (magnitude of impact) and nature and value of the receptor are provided in Table 2 (receptor sensitivity). The magnitude of change reflects the permanence, size, and scale of a change on an attribute is defined in Table 3 (overall significance).

14.4.5 Professional judgement and a qualitative risk assessment methodology have been used to assess the findings in relation to each of these criteria to give an assessment of significance for each potential impact. Once the degree of impact and sensitivity has been assessed these are then combined to determine the likelihood of each potential overall effect occurring.

14.4.6 Assessment of the impacts of the Scheme on the mineral interests has considered a number of parameters including extent, magnitude, duration and reversibility of the development as well as the extent, likely quality and situation of the mineral reserve. The significance is assessed on the impacts on identified mineral resources in relation to national and local planning policy.

14.4.7 The impact of the Scheme has been considered as a whole, there being no distinction in terms of impact on mineral resources between construction, operation and decommissioning phases on the basis that as soon as construction commences the impact on mineral resources effectively occurs and remains until such time as the Scheme is decommissioned.

Significance Criteria and Receptors

14.4.8 The criteria for defining magnitude in this chapter are outlined in Table 14.1 below.

Table 14.1: Magnitude of an Impact

Magnitude of Impact	Definition
Major	Fundamental loss (long term or permanent) change to baseline of resource and/or quality and integrity of resource; likely to cause exceedance of statutory objectives and/or breaches of legislation; severe damage to key characteristics, features or elements. permanent sterilisation of mineral resource.
Moderate	Loss of resource but not adversely affecting the overall integrity; partial loss of/damage to key characteristics, features or elements with/without exceedance of statutory objectives or with/without breaches of legislation. medium-term or local scale loss of mineral resources.
Minor	Some measurable change in attributes, quality or vulnerability; reversible or minor loss of, or alteration to, one (maybe more) key characteristics, features or elements. short-term or very localised effects on mineral resources.

Negligible	Very minor or no loss or detrimental alteration to one or more characteristics, features or elements; impact of insufficient magnitude to affect the use/integrity. no impact on mineral resources.

14.4.9 The criteria for defining sensitivity in this chapter are outlined in Table 14.2 below.

Table 14.2: Sensitivity of the Receptor

Sensitivity of the Receptor (Value)	Description
High	Existing quarry or site specific allocation for future mineral working; Safeguarded nationally scarce mineral resources or mineral resources of exceptional quality
Medium	Safeguarded regional mineral resource.
Low	Local or widespread mineral resource.
Negligible	No economically viable minerals.

14.4.10 The significance of the effect upon Minerals is determined by correlating the magnitude of the impact and the sensitivity of the receptor, as outlined in Table 14.3 below.

Table 14.3: Significance of Effect

Magnitude of Change	Sensitivity of Receptor: High	Medium	Low	Negligible
Major	**Major**	**Major**	**Moderate**	Negligible
Moderate	**Moderate**	**Moderate**	Minor	Negligible
Minor	**Moderate**	Minor	Minor	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

14.5 Baseline

14.5.1 Baseline data with respect to geology and land has been collected from publicly available information and open-source data from a range of sources. A desk-based review of soil and geological maps, Ordinance Survey (OS) mapping and Digital Terrain Model (DTM) mapping has been undertaken. Third party data from bodies such as the Environment Agency (EA) and DEFRA's MAGIC website has been used to characterise the geological features and identify any geological designated areas.

Geology

14.5.2 The regional geology of West Sussex comprises gently a sequence of sedimentary rock of Cretaceous age deposited in large basins. Gentle folding, broadly east-west and subsequent erosion has led to the outcrop of the chalk escarpments of the South Downs. Along the coastal plains to the south of the South Downs bedrock sediments of shallow marine clays and carbonate rich sandstones of Paleogene age overly the chalk. The bedrock Is overlain by a variety of Quaternary deposits, comprising clays (head deposits) and alluvial and fluvial deposits deposited along river and stream valleys. River Terrace Deposits dominate much of the southern areas of the county.

14.5.3 The BGS 1:50,000 map for Chichester/Bognor (sheet 317/332) indicates the Site lies on bedrock of the London Clay Formation. This is largely masked by superficial deposits of Head (gravel, sand silt & clay) in the northern part and River Terrace Deposits (sand, silt & clay) in the southern part, of the existing site. The river valley of the Lidsey Rife comprises of Alluvium (clay, silt, sand & gravel) and Raised Beach Deposits (sand and gravel).

14.5.4 Site specific geotechnical and geo-environmental ground investigation was undertaken in 2017. The ground Investigation comprised a series of trial pits to obtain Information to feed into foundation design.

14.5.5 The general strata proven by the ground Investigation comprise topsoil overlying head deposits. The thickness of Head ranged from 0.65m to 2.8m, however the base of the head deposits were not proven in several boreholes. The site underlain by the London Clay Formation which has been proven in two boreholes across the site. These two boreholes were barren proving topsoil directly overlying the bedrock clay, further detail on the ground investigation can be found within the MRA.

Minerals

14.5.6 There are three main sources of minerals land-won aggregates, which is rock and sand and gravel extracted directly from the land at quarries or pits and mariner-dredged aggregates which are sands and gravels dredged from the sea floor and landed at dedicated mineral wharves. A further source of aggregates comes from recycled and secondary aggregates which come from various sources including the demolition of buildings and structures, or from civil engineering works.

14.5.7 The main minerals worked, or with the potential for working, in West Sussex are:

- construction aggregates, including sharp sand and gravel and soft sand;
- natural building stone;
- brick clay;
- industrial sands including silica; and
- oil and gas resources.

14.5.8 The northern half of the site falls within a designated MSA and MCA for Sharp Sand and Gravel as defined in the JMLP, while the southern part of the site does not fall within any safeguarding zone. The area of the proposed scheme extends over an area of around 19ha, of which approximately 14ha lies within the MSA.

14.5.9 The safeguarded sharp sand and gravel is defined as 'sharp sand tends to be relatively coarse with more angular grains. These sands are generally used within concrete products' (WSCC, 2014). Typically, In the southern parts of the county gravel and sharp sands are found within the superficial deposits overlying the bedrock. It Is Indicated that 'cleaner, better-sorted gravels' are found overlying the London Clay to the south of a line approximating the route of the A27 which have been exploited through 'wet working'. To the north the gravels are known to be coarser, silty gravels which lie over the chalk. Gravel sites are clustered around Chichester and from the Funtington area in the west to Slindon in the east. Westergate and the site Is located approximately 5km south west of Slindon.

14.5.10 The BGS Mineral Resource Information identifies the Head gravels as being a potential sand and gravel mineral resource in the vicinity of the site. The mapping identifies that the deposits are likely to cover the northern half of the site only. It describes the Head gravels as a wedge shaped sheet deposit thinning southwards from about 7m in thickness in the north. There Is a large variation in the deposit grading of gravels to fines, noting that the fines ratio can make it uneconomic to work in some locations.

14.5.11 The BGS mineral resource maps does not identify any current or mineral workings associated with these head deposits in the vicinity of the site, but notes that they have been extensively worked to the south east of Chichester. There is one BGS record of historic nearby gravel workings, which is a reference to several gravel pits, (Northfields Farm Gravel Pit) 1.5km northeast of the site around Eastergate Lane.

14.5.12 Five samples were taken from the site's excavated materials during the ground investigation and underwent particle size distribution (PSD) testing. In summary, the PSD results indicate that three of the samples comprise 10% silt or clay, and the material has been logged as head deposits. The remaining two samples have high percentage of fines (-0.063mm) which comprise silts and clays, recorded at 33% and 61% clay. The description of the deposits within the trial pit logs and testing results suggest a high level of clay contents within the deposits. The gradings across the site are very variable and show samples from parts of the site contain very high clay content.

14.5.13 The West Sussex Minerals Local Plan does not Include any allocations for future mineral extraction in the vicinity of the site.

14.5.14 There Is only currently one operational sharp sand and gravel site with permitted reserves in West Sussex for which operations commenced in 2017. The majority of sharp sand and gravel for the county comes from marine sources.

Groundwater

14.5.15 Considering the topography and underlying impermeable geology it is likely that groundwater within the superficial deposits is in hydraulic continuity with the Lidsey Rife and Westergate Stream located along the eastern boundary and through the centre of the site, respectively.

14.5.16 The site-specific ground investigation included the installation of water monitoring pipework. Groundwater data has been provided from March 2016 to November 2016 and reviewed as part of the MRA. It Is understood that groundwater monitoring was to continue and the data provided was correct at the time of the reporting.

14.5.17 The data indicates that groundwater levels are consistent and within an expected range considering the underlying geology and the proximity of the monitoring wells to nearby watercourses. This data Indicated that the depth of the water was monitored ranging from 0.40m to 2.00m. The groundwater Is shown to be present within the superficial deposits.

Environmental Constraints

14.5.18 There are no statutory or non-statutory designations within the site.

14.5.19 The site is crossed by a network of Public Rights of Way, footpath numbers 317, 300, 298 and 296.

Services / Utilities

14.5.20 A review of aerial photography indicates that an overhead electricity supply appears to be present crossing the site.

14.5.21 The following information on underground utilities has been provided by the client. Southern Water has three foul sewers crossing the site, with foul and surface water sewers in Westergate Street. Portsmouth Water has two potable water mains across the site.

14.5.22 It is also understood that BT Openreach has existing apparatus near the northern and western site boundaries and no capacity issues are anticipated in connecting to the site. There is also an existing low pressure gas main near the northern and western site boundaries and confirmation has been given that there is capacity to supply the site.

Housing Allocation

14.5.23 The site lies within the Arun District Council site specific strategic housing allocation SD5 BEW (Arun Local Plan 2011-2031 – Local Plan Policy Map 1). The site also forms the westernmost part of the BEW Strategic Site Allocation, as set out in Policy H SP2c of the Adopted Local Plan.

14.6 Likely Significant Environmental Effects

14.6.1 Assessment of Impact on Sterilisation of Mineral Resources

14.6.2 The proposed development has the potential to sterilise safeguarded mineral deposits within West Sussex. Part of the Scheme falls within an MSA and MCA, and therefore is subject to Policy M9 of the JMLP. Depending upon the level of disturbance the Scheme has the potential:

- to disturb a mineral deposit to the extent the deposit becomes unviable to exploit; or
- that the presence of the Scheme imposes a constraint on mineral extraction in the local vicinity by physically preventing its exploitation.

14.6.3 In terms of potentially disturbing a mineral deposit to the extent it becomes unviable to exploit at a point in the future, in this case the only identified surface mineral the scheme affects are head deposits. On the basis that the scheme does not require deep excavations and foundations are to limited depths into the ground, disturbance is limited to the surface layers comprising overburden clays rather than underlying deposits and the scheme would not disturb the potential mineral deposit. The impacts would be indirect, as the majority of the deposit is unlikely to be disturbed but the impact would be long term to permanent i.e. for the duration of that the development will be present on the site.

14.6.4 The presence of the scheme prevents mineral extraction directly below and in the vicinity of the proposed development boundary. The impacts are predicted to be permanent and would affect the receptor directly.

14.6.5 The MRA identifies two areas (Area A and Area B) where potential safeguarded mineral deposits may be present within the site. A smaller area, Area A south of the water course and larger area, Area B north of the water course. The total Identified potential resource equates to 109,000t.

14.6.6 The safeguarded area affected is at the southern periphery of the safeguarded deposit which is likely to mean it will be the thinnest part of the deposit. The safeguarded mineral resource within this site is likely to be isolated pockets of mineral; boreholes indicate that areas within the site are barren and testing indicated that some samples of the deposit shows very high clay content.

14.6.7 This deposit is also identified as being partially concealed, meaning that to work the sand and gravel would probably require the removal of overburden (the Alluvium and clay predominant Head deposits BGS identify as the surface geology).

14.6.8 Although likely to contain a sand and gravel deposit, exploiting it would be difficult given the existing constraints including; the presence of built development, Public Rights of Way and overhead and buried utilities. A minerals development on this site would require the temporary relocation the Public Rights of Way present

within the site, and removal or permanent relocation of the of the overhead and underground services that are present within the site itself.

14.6.9 If any number of the services or utilities present within the site were not relocated outside of the potential mineral resource areas, standoff margins (buffers) would need to be applied to protect the services from damage during mineral extraction. It is known that as part of the proposed scheme the underground sewers and water pipes will be relocated but retained within the site. It is considered that as the potential mineral area is already limited, any margins to services would reduce the potential resource and further limit the economic viability of the site for mineral extraction.

14.6.10 Construction aggregates, for use in concrete, asphalt, mortar, or as low value fill material, are considered as low 'place-value' products. Their low value and high cost of transport is such that the distance to market is critical in defining market values and viability of production sites. It is not possible to estimate the specific value of a construction mineral resource on a general basis, as many operational factors such as processing costs, overburden ratios, water management, as well typically high capital costs for items such as land acquisition, planning and permits, and plant and infrastructure are bound up in the cost of producing the mineral. Different products (i.e. material types and sizes) will have different market values determined by their end uses, and factors of supply and demand. Certain materials may be sold 'at cost' in order to access more valuable materials within a site.

14.6.11 Extraction and processing of the mineral require significant up-front investments in processing plant and infrastructure to produce saleable products from the raw materials. Such large investments require a suitably large mineral reserve to justify the life of the investment, such as the existing quarry site Kingsham with c575kt of remaining permitted reserve.

14.6.12 Within the proposed development site there is estimated to be c.109,000t of potential mineral resource. If this site was worked at an average sand and gravel production rate of about 100,000t per annum, the proposed site would be worked out and closed after just over one year. Experience of working in the minerals industry has shown that a new minerals site can take between five and ten years from conception and site investigation through to gaining planning permission and initiating extraction.

14.6.13 The proposed site is small in terms of sand and gravel resources as demonstrated above. It is considered that that as a standalone operation with no future potential of expansion (based on the surrounding constraints), the quantity of potential resource would not warrant the investment in time required to set up the site, nor would it warrant the up-front investment costs of planning applications, or costs of the extraction and processing infrastructure required.

14.6.14 The scarcity of the mineral should also be considered in the relative value of a deposit. Head deposits and other sources of sharp sand and gravel are reasonably extensive units of superficial deposits throughout West Sussex

and the south east of England. Noting also that the JMLP Indicates that the majority of the county's sharp sand and gravel resource come from marine sources.

14.6.15 In summary, It is considered that there may be a small resource of sharp sand and gravel on the site, however it would be difficult to work due to existing built environment and environmental constraints. Furthermore, the size of the potential deposit is unlikely to warrant the time and Investment to gain planning permission, purchase necessary equipment to set up the site. Therefore, it is considered that there is no economically viable mineral deposit present within the site. It is therefore assessed that the magnitude of Impact Is negligible.

14.6.16 The potential mineral resources within the site are partially covered by a MSA, but the site is not allocated within the JMLP, nor is it an existing active mineral site, therefore the sensitivity of the receptor is assessed as medium. Overall the effect will, therefore, be of negligible significance, which is not significant in EIA terms.

14.7 Mitigation and Residual Effects

14.7.1 No mitigation is considered necessary because the likely effect in the absence of secondary mitigation is not significant in EIA terms.

14.8 Cumulative Effects

14.8.1 The process of environmental impact assessment also requires consideration of the cumulative impact of the Scheme in conjunction with other plans and proposals. In terms of the direct impact on the mineral deposits affected by the scheme, there are no other plans or proposals for other developments that directly affect these deposits.

14.8.2 There are no economically viable deposits present within the site therefore there are no potential cumulative impacts identified.

14.9 Summary

14.9.1 Minerals are of fundamental importance to the economy. The land has been designated as within a Mineral Safeguarding Area (MSA) and Mineral Consultation Area (MCA) for Sharp Sand and Gravel as defined in the West Sussex County Council (WSCC) Joint Minerals Local Plan (JMLP), July 2018 (Partial Review March 2021). MSA's are defined to protect finite mineral resources from sterilisation by surface developments.

14.9.2 A Minerals Resource Assessment is required under the JMLP Policy M9 to determine the extent and nature of the safeguarded mineral deposit and, if present, to assess the viability and practicality of prior extraction of the mineral. ort that there is no need for new sites to come forward during the plan period up to 2033.

14.9.3 There are no permitted or proposed mineral extraction sites within close proximity of any of the sites that might be affected by the scheme. Current local planning policy and local aggregate assessments report that there is no need for new sites to come forward during the plan period up to 2033.

14.9.4 A Mineral Resource Assessment (MRA) has been undertaken to assess the potential of the proposed development to sterilise safeguarded mineral deposits within West Sussex. The MRA has concluded that no economically viable mineral has been identified within the site, there Is not considered to be any conflict with the relevant mineral policies.

14.10 References

14.10.1 Below are the relevant references:

- Arun Local Plan 2011 - 2031 (July 2018).
- British Geological Survey, Mineral Safeguarding in England good practice advice (2011). British Geological Survey.
- Minerals Safeguarding Practice Guidance V1.4, Mineral Products Association and the Planning Officers' Society (April 2019).
- National Planning Policy Framework. Department for Levelling Up, Housing and Communities (2023).
- West Sussex County Council Joint Minerals Local Plan, July 2018 (Partial Review March 2021)
- West Sussex County Council Joint Minerals Local Plan, Local Aggregates Assessment 2021 (January 2023).
- West Sussex County Council Minerals and Waste Safeguarding Guidance (March 2020).
- West Sussex County Council, Background Paper 2: Minerals In West Sussex (2014).

15. Climate Change and Resilience

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15 Climate Change and Resilience

15.1 Introduction

15.1.1 This chapter has been written by Stantec, who are Institute of Environmental Management and Assessment ('IEMA') EIA Quality Mark registrants. The section is informed and supported by the following appendices:

- Appendix 15.1: Relevant Policies, Legislation, and Guidance;
- Appendix 15.2: Average Annual Daily Traffic ('AADT') Flow Data;
- Appendix 15.3: Westergate Construction Emissions Factor Toolkit;
- Appendix 15.4: Westergate Operational Emissions Factor Toolkit Assessment;
- Appendix 15.5: Mean Annual Temperature Anomaly;
- Appendix 15.6: Mean Annual Precipitation Anomaly;
- Appendix 15.7: Maximum Summer Temperature Anomaly;
- Appendix 15.8: Summer Precipitation Anomaly;
- Appendix 15.9: Minimum Winter Temperature Anomaly; and
- Appendix 15.10: Winter Precipitation Anomaly.

15.1.2 This chapter has been prepared by Neil Slattery (Senior Environmental Planner). Reviews have been undertaken by Kiri Heal (Senior Associate) and Lucy Wood (Director). Neil has 4 years' experience in climate change in EIA. Neil has undertaken a range of climate change mitigation and adaptation/resilience assessments for EIAs across the residential, urban regeneration, commercial, industrial and infrastructure sectors. Kiri is a Senior Associate in the Sustainability Team, with 15 years' consultancy experience in EIA and climate change. Lucy is the Climate Solutions Leader for Stantec and has 18 years' experience in environmental consultancy, including EIA and climate change assessment for a range of industry sectors.

15.2 Background

15.2.1 'Climate' is generally understood to mean the weather conditions prevailing over a long period of time and climate change refers to changes in recorded long term climate trends. As a topic for the assessment within EIA, climate change is relatively new. Guidance is evolving and there is no prescribed way in which climate change should be incorporated into an ES. However, guidance has been prepared by IEMA (discussed further below) which sets out the two main approaches that can be taken to determine a project's climate change impact.

15.2.2 This chapter is split into two main parts:

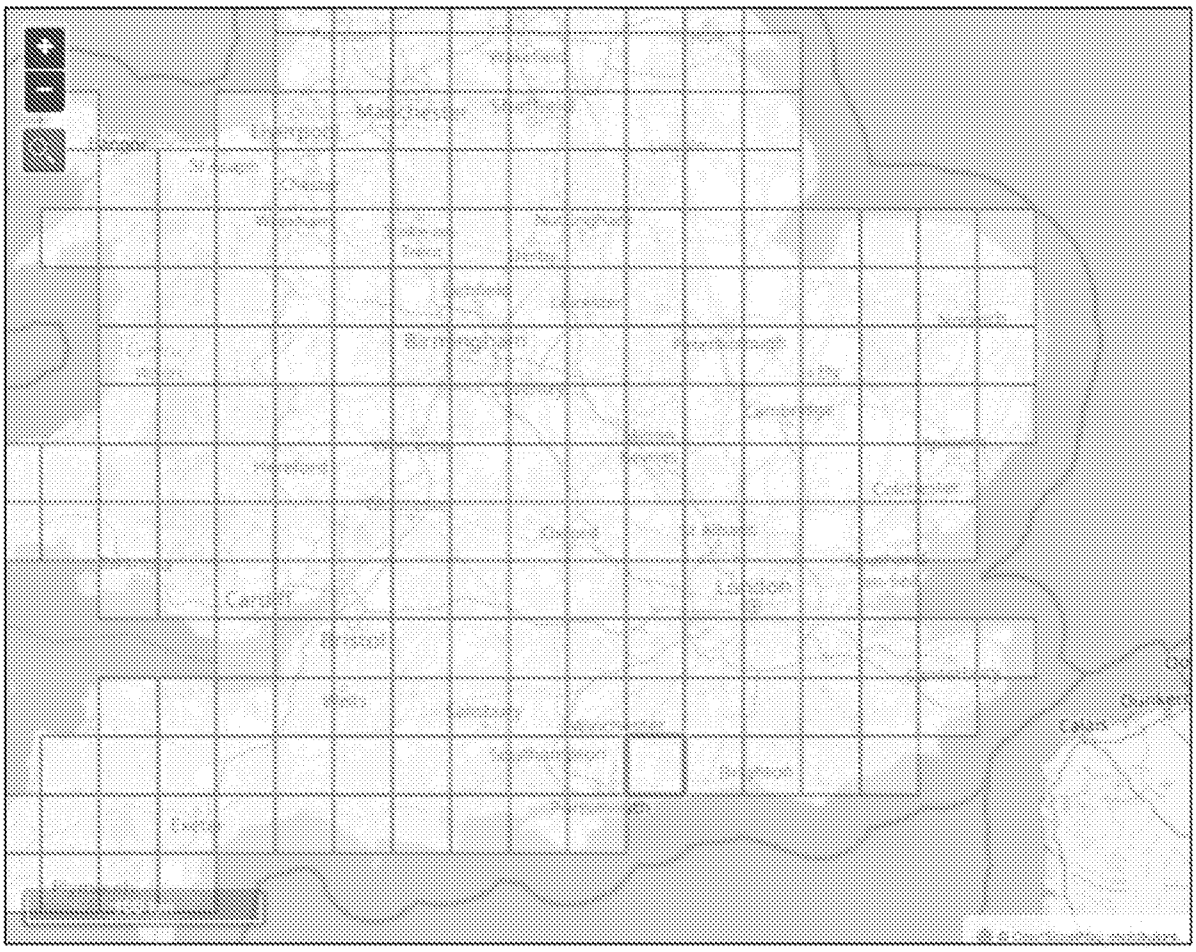
- Climate Change Mitigation (Greenhouse Gas ('GHG') Emissions); and
- Climate Change Resilience (assessing the vulnerability of the Development to climate change).

15.2.3 The Site

Climate Change Mitigation (GHG Emissions)

15.2.3.1 The study area for the assessment of GHG emissions arising through the lifecycle of the Development will include direct emissions arising from within the Site boundary (Figure 15.1) and indirect emissions arising from outside the Site boundary (such as GHG emissions from construction vehicles).

Figure 15.1: 25km grid square where the site is located



15.2.3.2 The data available to allow an assessment of GHG emissions from vehicle movements associated with the Development is limited to the study area of the Transport Assessment ('TA'). The study area involves a detailed study area and a wider general modelling area, covering 25 road links surrounding the Site. The study area links, provided by the WSP, the Transport Consultant for this project, are included in Appendix 15.2.

15.2.3.3 Given that climate change is a global issue, a qualitative assessment of the Development's effects is also made at the global scale.

15.2.4 Climate Change Resilience

15.2.4.1 The assessment of climate change resilience differs somewhat from other assessment within the ES. In that, the assessment looks at the effect of an external factor on the Development itself, which is the receptor. The study area for the assessment of climate resilience is the Site boundary i.e., all the assets, homes, and infrastructure which comprise the Development which can be affected by climate change.

15.2.4.2 Scientific evidence shows that our climate is changing. However, there are significant uncertainties in the spatial occurrence within the climate projections utilised in this assessment (25km grid square where the Site is located) (Figure 15.1). The UK Climate Projections ('UKCP') 2018 are not predictions or forecasts but simulations of potential scenarios of future climate under a range of hypothetical emissions scenarios and assumptions, and therefore cannot be treated as exact or factual, but projection options.

15.2.5 The Development

15.2.5.1 The Development will Interact with climate change in different ways.

15.2.5.2 In regard to GHG emissions, the Development comprising up to 400 new residential dwellings on previously agricultural land will change the Site baseline and emit GHG emissions through the operational energy and transport associate with the Development.

15.2.5.3 The Site's ability to sequester carbon will also change with agricultural grassland being removed for a variety of surfaces and habitats, which, over time will begin to sequester carbon.

15.2.5.4 The Development will also be vulnerable to a changing climate in various ways such as rising temperatures, Increased precipitation and more climatic extremes. The Development will be designed accordingly to adopt to and become resilient to climate change. An assessment of the Development's ability to be resilient to climate change Is provided throughout this chapter.

15.2.6 Potential Cumulative Effects

15.2.6.1 The potential for cumulative effects with projects highlighted within the Scoping Opinion Response received from Arun District Council ('ADC') dated 21st November 2022 is assessed within Section 15.11 of this Chapter.

15.3 Chapter Structure

15.3.1 Climate Change Mitigation (GHG Emissions)

15.3.1.1 This part of the Climate Change Chapter assesses the effects of the Development on climate change by:

- Establishing the existing baseline conditions (2019 – when baseline traffic data was recorded);
- Determining future baseline conditions;
- Assessing of the likely significant effects of the Development on the established baseline and future conditions;
- Identification of mitigation measures; and
- Assessment of residual effects.

15.3.2 Climate Change Resilience

15.3.2.1 This part of the Climate Change Chapter assesses the effects of climate change on the Development by:

- Establishing the existing baseline conditions (using historical trend climatic data) (2023);
- Determining future baseline conditions by reviewing climatic projections up to 2100 (including identifying sensitive receptors);
- Assessing the likely significant effects of the Development, with embedded mitigation measures incorporated, on the established baseline and future conditions;
- Identification of additional mitigation measures; and
- Assessment of residual effects.

15.4 Climate Change and Resilience Policy Context

15.4.1 Climate Change Mitigation (GHG Emissions)

15.4.1.1 Further policies, legislation, and guidance relevant to the chapter is included in Appendix 15.1.

15.4.2 National Planning Policy

15.4.2.1 This chapter assesses the effects of the Development in relation to climate change, in line with the requirements of the 2017 EIA Regulations (as amended):

> *"The EIA must identify, describe and assess in an appropriate manner, in light of each individual case, the direct and indirect significant effects of the proposed development on climate. "*

> *"A description of the likely significant effects of the development on the environment resulting from, inter alia: (f) the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change".*

15.4.3 Climate Change Act 2008

15.4.3.1 The Climate Change Act (2008) set a legal duty to reduce GHG emissions, In particular, carbon dioxide ('CO2'), by at least 80% (on 1990 levels) by the year 2050 in the United Kingdom ('UK'). The 2050 Target Amendment Order 2019 amended this to increase the target for reducing GHG emissions by 100% from the 1990 baseline ('net zero') in GHG by 2050.

15.4.3.2 In setting these targets, the Act established the Committee for Climate Change ('CCC'), which is responsible for setting binding interim targets for the Government over five-year periods.

15.4.3.3 The government's plans for achieving the emissions reductions it has committed to, including actions and incremental five-year milestones, are set out in the UK Carbon Plan which includes an interim target of 34% reduction in CO2 emissions on 1990 levels by the year 2029 .

15.4.4 National Planning Policy Framework and Planning Practice Guidance

15.4.4.1 The National Planning Policy Framework ('NPPF') , which was revised in July 2021, requires developments to "take a proactive approach to mitigating and adapting to climate change." Section 14 of the NPPF (Meeting the challenge of climate change, flooding and coastal change) emphasises the planning system's pivotal role in sustainable development through "minimising vulnerability and improve resilience to the impacts of climate change". Paragraph 158 of the NPPF states:

15.4.4.2 "Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure."

15.4.4.3 Section 11 (Making effective use of land) of the NPPF promotes an effective use of land in meeting housing requirements whilst safeguarding and improving the environment. The use of Brownfield land helps to regenerate derelict sites and remediate land contaminated by previous uses. It can also help to protect the environment by minimising the use of Greenfield sites for development. The re-use of previously developed land provides a desirable and sustainable approach for accommodating future growth; as such sites are often located close to existing services and facilities (i.e. public transport, community amenities, open space). This can help to increase the likelihood of people choosing more sustainable modes of transport, such as walking, cycling or public transport, thereby helping to reduce carbon emissions and the negative effects of climate change.

15.4.4.4 Section 12 (Achieving Well-Designed Places) emphasises the need for sustainability measures, climate mitigation and adaptation to contribute to the character and quality of urban environments. All new streets

are proposed to be tree-lined, with trees incorporated elsewhere within developments as possible such as in parks and community orchards.

15.4.4.5 National Planning Practice Guidance ('PPG') was published in June 2014. The guidance advises how to identify suitable mitigation and adaptation measures in the planning process to address the impacts of climate change.

15.4.4.6 The PPG on climate change (Paragraph 007) also recognises that 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:

- Robust evaluation of future emissions will require consideration of different emission sources, likely trends taking into account requirements set in national legislation, and a range of development scenarios;
- The distribution of new development and the potential for servicing sites through sustainable transport solutions, are particularly important considerations that affect transport emissions; and
- Different sectors may have different options for mitigation. For example, measures for reducing emissions in agricultural related development include anaerobic digestion, improve 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.

15.4.5 Local Planning Policy

15.4.5.1 The ADC Local Plan was adopted in July 2018 and sets out a vision for development in the District up to 2031. The following polices in the local plan are considered most relevant to climate change mitigation:

"Policy SD SP1
Sustainable development
When considering development proposals, the Council will take a positive approach that reflects the presumption in favour of sustainable development contained in the National Planning Policy Framework. It will work pro-actively with applicants to jointly find solutions which mean that proposals can be approved wherever possible and to secure development that will contribute to the social, economic and environmental conditions south of the National Park through to the coast and throughout its settlements (both coastal and inland)."

"Policy ECC SP2
Energy and climate change mitigation
All new residential and commercial development (including conversions, extensions and changes of use) will be expected to be energy efficient and to demonstrate how they will:

a. Achieve energy efficiency measures that reflect the current standards applicable at the time of submission;

b. Use design and layout to promote energy efficiency; and

c. Incorporate decentralised, renewable and low carbon energy supply systems, for example small scale renewable energy systems such as solar panels".

15.4.5.2 All major developments must produce 10% of the total predicted energy requirements from renewable or low carbon energy generation on site, unless it can be demonstrated that this is unviable. Energy efficiency measures will be taken into consideration when the total predicted energy requirements are calculated. The Council will consider 'allowable solutions' where it is clearly demonstrated that the provision of on site renewable or low carbon energy generation is unviable or not feasible.

15.4.5.3 Where planning permission is required to retrofit energy efficiency measures into existing development, schemes will be permitted, subject to the Design and Built Heritage policies. In assessing the achievement of these standards the Council will consider:

- Site constraints;
- Technical viability;
- Financial viability; and
- Delivery of additional benefits."

Climate Change Resilience

15.4.6 National Planning Policy

National Planning Policy Framework and Planning Practice Guidance

15.4.6.1 The PPG published in 2014 recognises that the planning system can "increase resilience to climate change impact through the location, mix and design of development". The guidance advises how to identify suitable mitigation and adaptation measures in the planning process to address the impacts of climate change.

15.4.6.2 Paragraph 005 of the PPG puts forwards recommendations for Local Planning Authorities to consider:

15.4.6.3 Further detailed guidance is also provided with regards to specific considerations for climate change. For example, the PPG companion document to the NPPF sets out the required approach to climate change for the assessment of flood risk. It provides recommendations for sensitivity ranges and allowances for future increases in rainfall, sea levels, river flows and tidal effects such as wind speed and wave height. For example, paragraphs 160 and 161 of the NPPF state:

"Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.

Strategic policies should be informed by a strategic flood risk assessment, and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards."

15.4.7 Local Planning Policy

15.4.7.1 The following polices in the ADC local plan are considered most relevant to climate change resilience.

"Policy ECC SP1 Adapting to climate change

The Council will support development which is located and appropriately designed to adapt to impacts arising from climate change such as the increased probability of tidal and fluvial flooding; water stress; health impacts as a result of extreme temperatures and a decline in the quality of habitats and richness of biodiversity.

In order to achieve this, development must be designed to take account of the following issues:

a. Location (in relation to flood risk and vulnerability to coastal erosion);
b. Water efficiency;
c. Shade, cooling, ventilation, solar gain;
d. Connectivity to the green infrastructure network;
e. Layout and massing;
f. Resilience of buildings and building materials to extreme weather events; and
g. Capacity of drainage systems and incorporation of Sustainable urban Drainage Systems (SuDS)."

15.4.7.2 It should be noted that there are other policies within the ADC local plan that are relevant to climate change resilience and adaptation, such as Policy ENV SP1 Natural Environment, Policy ENV DM5 Development and biodiversity and Policy W DM1 Water supply and quality. These are addressed in topic specific chapters within this ES.

15.5 Climate Change and Resilience Assessment Methodology

15.5.1 Consultation

15.5.1.1 An EIA Scoping Report for the Development was submitted to ADC in June 2022 and did not include a scope for climate change. The EIA Scoping Opinion from ADC, adopted in November 2022, included a request to scope climate change and resilience into the ES.

15.5.2 Climate Change Mitigation (GHG Emissions)

15.5.2.1 Technical guidance which will support the methodology is set out below.

Building Regulations

15.5.2.2 The Buildings Regulations, specifically Approved Document Part L; 'Conservation of Fuel and Power', determine the energy efficiency and carbon emission standards required by new buildings. Part L was updated on the 15th June 2022 . Part L addresses controls for:

Future Homes Standard

15.5.2.3 The Government has released the first stage of consultation on proposed changes to Part L (conservation of fuel and power) of the Building Regulations under the document: 'The Future Home Standard: 2019 Consultation on Changes to part L (conservation of fuel and power) and Part F (ventilation) of the Building Regulations for new dwellings'.

15.5.2.4 The goal of the Future Homes Standard is to deliver homes that are zero-carbon ready from 2025. New homes will meet these standards through measures such as phasing out fossil fuel heating and ensuring new homes have high levels of energy efficiency. It is recognised that no further energy efficiency retrofit work is anticipated for them to become zero-carbon as the electricity grid continues to decarbonise.

IEMA Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance

15.5.2.5 In February 2022, IEMA published this guidance (the 'IEMA GHG Guidance'), to complement the guidance above and to assist practitioners with addressing GHG emissions assessment and mitigation in EIA. The guidance indicates that a 'good practice' approach is advocated where GHG emissions are always considered and reported but at varying degrees of detail depending on the project.

15.5.2.6 The IEMA GHG Guidance places a much more prominent role for mitigation within the EIA. It is no longer an element to be considered towards the later stages of the EIA process. Instead, mitigation should be considered from the outset and throughout the projects' lifetime.

15.5.2.7 The IEMA GHG Guidance sets out there are a number of different assessment methods available for measuring and quantifying the GHG emissions associated with the built environment, ranging from general guidance to form standards for the use of an EIA. The IEMA GHG Guidance recognises that:

"qualitative assessments are acceptable, for example: where data is unavailable or where mitigation measures are agreed early on in the design phase with design and engineering teams".

15.5.2.8 The IEMA GHG Guidance outlines that an EIA must give proportionate consideration to whether and how a development will contribute to the 2050 net zero target. Therefore, the crux of significance is not whether a project emits GHG emissions, nor even the magnitude of GHG emissions, but whether it contributes to reducing GHG emissions relative to a comparable baseline, consistent with a trajectory towards net zero by 2050.

UK GHG Statistics

15.5.2.9 The Department for Business, Energy & Industrial Strategy ('BEIS') (now the Department for Energy Security and Net Zero ('DESNZ')) reports on energy and emissions projections by source and reports on local and regional GHG emissions. This has allowed the collection of baseline data for the period 2005-2021 for ADC.

UK Carbon Budgets

15.5.2.10 Carbon Budgets are a five-year statutory cap on total GHGs, introduced under the Climate Change Act 2008 (as amended). As previously discussed, the Climate Change Act originally targeted an 80% reduction in GHGs by 2050 until it was amended in 2019. Therefore, the first five carbon budgets (with the fifth budget running from 2028-2032) are aligned to the 80% reduction. The most recent sixth carbon budget is aligned to the new objective of achieving a 100% reduction in GHGs and covers the period from 2033-37.

15.5.2.11 The relevant UK Carbon Budget will be utilised for the contextualisation of how the Development's emissions are likely to contribute, positively or negatively, towards a pathway to Net-Zero by 2050.

Assessment Methodology

15.5.2.12 The first part of the assessment considers the up front and in use effects of the Development on climate change. The London Energy Transformation Initiative ('LETI') defines emissions within the whole lifecycle as follows:

- Upfront Carbon: Carbon emissions from the construction phase including, construction vehicles, raw material supply, manufacturing, and the installation process; and
- In-Use Carbon: Carbon emissions from the operational use of the Development including operational regulated energy, use, maintenance, repair, replacement, and refurbishment.

15.5.2.13 This chapter provides a quantitative, assumptions – based assessment of the effects of the following sources:

- Upfront carbon emissions from construction vehicles;
- In-Use carbon emissions from operational regulated energy usage; and
- Carbon emissions from operational transport usage.

15.5.2.14 As the planning application is a hybrid application, there is currently limited detail on the materials to be used during construction as well as the anticipated construction waste. Accurate details of construction materials

and methods will be considered at the detailed design stage. Modules A1-A3[13] and A5[14] from the whole lifecycle process have therefore been scoped out of this ES Chapter. Furthermore, lifecycle modules B1-B5[15] and the end-of-life phase[16] (C1-C4) have also been scoped out of this ES Chapter, as there is currently limited information on materials to be used and details on the emissions from the maintenance, repair, replacement, refurbishment, and decommissioning is not currently known.

Temporal Scope

15.5.2.15 The assessment assumes a development completion year of 2031, (see Chapter 5 Construction Methodology and Phasing for information). The data available to allow an assessment of GHG emissions from vehicle movements associated with the Development is limited to the modelling scenarios assessed in the TA and ES Chapter 4 Transport. Therefore, this chapter is aligned with Chapter 4 Transport.

Significance Criteria and Receptors

Determining Significance

15.5.2.16 There is currently no industry-wide agreed threshold of carbon emissions which, if exceeded, can be defined as significant or potentially significant. The IEMA GHG Guidance acknowledges that all emissions could lead to cumulatively significant effects. The receptor for the assessment is the global atmosphere; the impacts of GHG emissions, in terms of their contribution to climate change, are global and cumulative in nature, with every tonne contributing to impacts on natural and human systems. The potential impacts of the Development, therefore, contribute to this global issue.

15.5.2.17 The IEMA GHG Guidance notes that the cumulative impact of carbon emissions arising from global human activity is considered major however, the contribution from individual developments, such as the Development assessed in this ES, could be considered negligible/ minor in the context of the UK's emissions. This is because, in isolation, the quantity of carbon emissions from an individual development is likely to have limited potential to significantly increase atmospheric carbon emissions towards global environmental targets.

15.5.2.18 The IEMA GHG Guidance states that the significance of the impact of GHG emissions should be determined by considering whether a project contributes to reducing GHG emissions relative to a comparable baseline, consistent with a trajectory towards net zero by 2050. The trajectory towards net zero is mandated within the relevant carbon budget through which the specific activity falls.

[13] Module A1, A2 and A3 may be declared as one aggregated module A1-A3. All stages include the provision of all materials, products, and energy, as well as waste processing up to the end-of-waste state or disposal of final residues during the product stage. The assessment takes only the building and its parts into account, but not furniture or appliances, for example.

[14] Stages A4 and A5 include all impacts and aspects related to any losses during this construction process stage (i.e. production, transport, and waste processing and disposal of the lost products and materials). A5 is related to installation into the building.

[15] B1: Use or application of the installed product; B2: Maintenance; B3: Repair; B4: Replacement; and B5: Refurbishment.

[16] It covers deconstruction and demolition (C1), transport (C2), waste processing for reuse, recovery, or recycling (C3) and disposal (C4), until the site is cleared, level and ready for further use.

Assessing Vehicle GHG Emissions

15.5.2.19 The climate change impact is assessed as the difference between the carbon emissions associated with the baseline and that associated with the fully completed Development. The study area for carbon emissions assessment is defined by the red line Site boundary and the study area which utilises the transport network assessed in the TA, submitted in support of the planning application.

15.5.2.20 Construction traffic emissions were calculated by inputting the peak construction two-way movements of HGVs and LGVs included in Appendix 15.2 into the construction EFT (Appendix 15.3).

15.5.2.21 The peak construction year was assessed as 2026, which is within the 4th carbon budget (2023-2027). Therefore, for the purposes of the construction vehicle emissions assessment, the 4th carbon budget has been used for contextualisation.

15.5.2.22 It should be noted that the TA assessed a wider study area across the transport network consisting of 25 road links. In order to provide a more proportionate assessment of the Development's GHG impact from operational vehicle emissions, four road links were selected for assessment in this Chapter, and agreed with the Transport Consultant, as being the most relevant to the Development.

15.5.2.23 Focussing on four road links deemed most relevant to the Development provides a proportionate assessment, as GHG emissions from the uplift in traffic as a result of the Development is assessed, as opposed to accounting for traffic movements on road links across the wider road network.

15.5.2.24 The uplift in vehicles from 2019 to 2031, including projected baseline growth and cumulative schemes from the four selected road links is included in Appendix 15.2 and has been inputted into the Operational Emissions Factor Toolkit ('EFT') (Appendix 15.4) alongside other assumptions outlined in this Section.

15.5.2.25 The baseline conditions of the Site were based on the trip rates and existing published data sets (Appendix 15.2). The baseline for the Site is defined as the current carbon emissions arising from vehicles in the study area. In terms of transport-related emissions, whilst forecasting can be carried out to project potential increases in traffic flows, and, by inference, the impact on CO2 levels, the impact of technological changes is harder to infer. This includes the introduction and uptake of electric vehicles. Hence, the assessment in this broadly assumes negligible impacts in terms of electric vehicles, other than assumptions which are inherent in the EFT V11.0 utilised for the assessment.

15.5.2.26 It is recognised that whilst GHGs are released in the production of electricity to power electric vehicles, this is not to an extent considered significant to affect the assessment results. The EFT uses datasets on fleet growth assumptions which were current before the COVID-19 outbreak in the UK. As a result, default fleet outputs from the EFT do not reflect short or longer term impacts on emissions in 2020 and beyond resulting from

behavioural change during the national or local lockdowns. Therefore, the assessments use best practice assumptions, but still represent a worst-case assumption of climate change impacts.

Traffic flow data

15.5.2.27 24-hour, Average Annual Daily Traffic ('AADT') flows (Appendix 15.2) were provided by WSP, the projects Transport Consultant for the following scenarios:

- Construction AADT;
- 2019 Base;
- 2031 Base (Baseline + growth + committed developments); and
- 2031 Base + Dev (Baseline + growth + committed developments + the Development).

15.5.2.28 Fleet composition was provided utilising the baseline split of Heavy Duty Vehicles ('HDV') and Light Duty Vehicles ('LDV') for each of the four road links assessed as part of the Study Area for this assessment, which was informed from the data available from the TA modelling.

15.5.2.29 As per Appendix 15.2, mean vehicle speeds for the links used in the assessment were estimated based on maximum permitted speeds in the area and analysis of the road network. An average of the permitted speed limit per link was taken for each scenario.

15.5.2.30 In the absence of pre-defined distances for vehicles, the most recent UK average journey distance is defined by the National Travel Survey provided by the Department for Transport as 9.2km (5.7 miles). This is considered to be a conservative over-estimate of the distance travelled on each individual road link, however, is utilised as a constant factor across all of the scenarios assessed.

Vehicle Emissions Factors

15.5.2.31 Assumptions of the inputs used in the carbon modelling are provided in Table 15.1 and details provided at Appendix 15.2. This includes the percentage of HDV vehicles per road link.

Table 15.1: Operational Traffic Data Assumptions

Variable	2019 Base	2031 Base	2031 Base + Dev
24-hour Average AADT of the Development*	42,700	53,906	54,978
Link Length	9.2km		
Road Type	England - Not London		
Average Vehicle Speed**	Posted Speed Limits		
*Trips are two way **Based on the posted speed limit of the road link			

15.5.2.32 The fleet comparison for the operational phase of the Development was taken from the baseline fleet projection and predicted changes in fleet composition due to the Development. The road type utilised was 'England – Not London' to reflect the location of the Site. The assessment presents a worst-case scenario as it does not consider the use of public transport, including a potential reduction in vehicular trips. The breakdown of emissions for conventional vehicle types includes conventional vehicle categories and does allow for, with some degree of uncertainty, the likely phasing of alternative (electric) vehicles as previously discussed.

Operational Energy Use

15.5.2.33 The operational energy usage assessed within this Chapter is derived from the findings of the Energy Statement, submitted in support of the planning application. The Energy Statement calculates the predicted regulated energy demand and associated carbon emissions for house types provided from the Applicant.

Carbon Sequestration

15.5.2.34 The carbon sequestration potential (i.e. the potential to remove CO2 from the atmosphere) from the existing habitats within the Site has been estimated. This has been conducted through categorising habitats present on the Site provided by the Project Ecologist. The carbon sequestration potential for the existing habitat is provided by Natural England's Capital Accounts and Natural England's Carbon Storage and Sequestration by Habitat October 2021 , which provides tonnes of CO2 equivalent per hectare year (tCO2eq/ha/yr) for differing types of habitats.

15.5.2.35 The Site comprises of arable agricultural land and improved grassland land with hedgerows that define field boundaries, as well as scattered trees and areas of wet woodland. A tributary stream crosses the middle of the Site running east-west with a wet woodland located adjacent to the Westergate settlement boundary. The Site extends to approximately 19.35 hectares (ha). The habitat types have been matched to those provided by Natural England's Capital Accounts as closely as possible. Where the habitat found on the Site does not accurately fit a classification provided, a worst-case scenario assumption of the habitat sequestrating no carbon has been undertaken. Other habitats provided have been grouped according to shared characteristics and agreed with the Project Ecologist.

15.5.2.36 This is considered proportionate and appropriate given the high-level nature of this assessment. The habitats used for the post-Development assessment are based only upon what planning permission is sought for.

Significance Criteria

15.5.2.37 In the absence of any significance criteria or a defined threshold, it might be considered that all carbon emissions are significant and beneficial effects only arise if there is a net loss in carbon and emissions. The IEMA GHG Guidance outlines that it is essential to provide context for the magnitude of GHG emissions reported in the EIA in a way that aids evaluation of effects. The impacts have therefore been defined as either

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negligible, beneficial, or minor, moderate, or major as set out in Table 15.2 below. As per the IEMA Guidelines, when evaluating significance, all new GHG emissions contribute to an adverse environmental effect.

15.5.2.38 IEMA provide examples of significance criteria, which are outlined below in Table 15.2. These examples have been utilised alongside professional judgement for assessing the impact of the Development at the national level.

15.5.2.39 Effects that are described as 'minor' or 'negligible' are determined to be 'Not Significant' and effects that are described as 'moderate', or 'major' are determined to be 'Significant'.

Table 15.2: Emissions Significance Criteria

Effect Significance	Description of Criteria
Beneficial	'The project's net GHG impacts are below zero and it causes a reduction in atmospheric GHG concentration, whether directly or indirectly, compared to the without-project baseline. A project with beneficial effects substantially exceeds net zero requirements with a positive climate impact'
Negligible	'The project's GHG impacts would be reduced through measures that go well beyond existing and emerging policy and design standards for projects of this type, such that radical decarbonisation or net zero is achieved well before 2050. A project with negligible effects provides GHG performance that is well 'ahead of the curve' for the trajectory towards net zero and has minimal residual emissions.'
Minor	'The project's GHG impacts would be fully consistent with applicable existing and emerging policy requirements and good practice design standards for projects of this type. A project with minor adverse effects is fully in line with measures necessary to achieve the UK's trajectory towards net zero.'
Moderate	'The project's GHG impacts are partially mitigated and may partially meet the applicable existing and emerging policy requirements but would not fully contribute to decarbonisation in line with local and national policy goals for projects of this type. A project with moderate adverse effects falls short of fully contributing to the UK's trajectory towards net zero.'
Major	The project's GHG impacts are not mitigated or are only compliant with do-minimum standards set through regulation, and do not provide further reductions required by existing local and national policy for projects of this type. A project with major adverse effects is locking in emissions and does not make a meaningful contribution to the UK's trajectory towards net zero.'

15.5.2.40 In order to provide specific context for an individual project and the contribution it makes to climate change, national and local 'carbon budgets' have been utilised alongside professional judgment and the IEMA GHG Guidance. The CCC have published 6 carbon budgets of 5-year periods, which limit the volume of carbon emissions that the UK can legally emit, in order to reach net zero by 2050.

15.5.2.41 Table 15.3 below shows the adopted carbon budgets up to 2037 for the UK.

Table 15.3: UK Carbon Budgets

Carbon Budget	Total Budget (MtCO2e)
3rd (2018-2022)	2,544
4th (2023-2027)	1,950
5th (2028-2032)	1,725
6th (2033-2037)	965

15.5.2.42 The Tyndall Centre carbon budget tool scales down the UK national carbon budget between Local Planning Authorities ('LPA'), to show how each LPA can make its 'fair' contribution towards a 1.5-degree warming trajectory and net zero.

15.5.2.43 Table 15.4 below presents the ADC energy CO2 only budget in the format of the 5-year carbon budget periods in the UK Climate Change Act. To align the 2020 to 2100 carbon budget with the budget periods in the Climate Change Act, estimated CO2 emissions for ADC for 2018 and 2019 have been based on BEIS (now DESNZ) provisional national emissions data for 2018 and assuming the same year on year reduction rate applied to 2019.

Table 15.4: ADC Carbon Budgets

Carbon Budget	Total Budget (MtCO2e)
3rd (2018-2022)	2.4
4th (2023-2027)	1.2
5th (2028-2032)	0.6
6th (2033-2037)	0.3

15.5.2.44 As the completion year of the Development is predicted to be 2031, the 5th carbon budget has been adopted for the operational assessment within this ES chapter.

Limitations and Assumptions

15.5.2.45 The following assumptions and limitations that apply to this assessment have been set out in this section.

15.5.2.46 The assessment of climate change and GHG emissions is based on available best practice information.

15.5.2.47 There are inherent assumptions and limitations with adopting local carbon budgets for contextualisation. Local carbon budgets are assumed from the UK national carbon budget and there is no legally binding framework behind the local budgets. Furthermore, the carbon budgets are across a 5-year period, whereas

the operational assessment only assesses the effects from emissions for one year (2031) within a carbon budget.

15.5.2.48 Local carbon budgets also do not distinguish carbon emissions into different sectors (domestic, transport, industrial, and commercial) as is the case in the BEIS (now DESNZ) data. Therefore, emissions from operational transport, for example, will be compared against the entire ADC carbon budget, as opposed to an allocated transport budget based on transport emission sources.

15.5.2.49 The initial modelling of carbon emissions for vehicles during operation is illustrative as real – time carbon emissions associated with the Development are not available.

15.5.3 Climate Change Resilience

Assessment Methodology

15.5.3.1 The vulnerability of the Development to climate change considers effects on the Development as a receptor (this is referred to in IEMA Guidance as Climate Change Resilience and Adaptation). A high-level climate change risk and resilience assessment has been undertaken to identify the potential risks of climate change on the Development and to highlight design measures to increase its resilience and adaptation to climate hazards, such as extreme hot and cold weather, intense rainfall, high winds, and storm events.

15.5.3.2 Guidance is evolving and there is no prescribed way in which climate change should be incorporated into an ES, however, some guidance has been prepared by IEMA, discussed further below, which sets out the two main approaches that can be taken to determine a project's climate change impact.

15.5.3.3 In lieu of a prescribed methodology, IEMA guidance on Climate Change Resilience and Adaptation (2020) has been prepared to assist practitioners with the effective consideration "of both climate change resilience and adaptation in the EIA process". The guidance stresses that climate change should be an integrated consideration within the EIA, by undertaking an assessment that is "proportional to the evidence base available to support any assessment" and focusses on impacts "specific to project".

Temporal Scope

15.5.3.4 In considering future climate change scenarios, managing climate change resilience and adaption, the IEMA guidance (2020) recommends the use of the UKCP Website. The latest UKCP is UKCP18 which provides updated observations and climate change projections up to 2100 in the UK. Therefore, this assessment assumes projections for the 2100 as the most far-reaching projection and is considered to be appropriate for the design life of the Development.

15.5.3.5 As the construction phase is anticipated to be approximately 7 years, it is considered that changes in the climate that may give rise to potential significant effects are not anticipated to manifest in this timeframe.

Therefore, a climate resilience assessment during the construction phase of the Development has been scoped out of this chapter.

Significance Criteria and Receptors

Identification of Sensitive Receptors

15.5.3.6 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 Development. In accordance with IEMA guidance, the sensitivity of receptors to climate change effects during operation is described in Table 15.5. In ascribing the sensitivity of receptors in relation to potential climate change effects, the susceptibility of the receptor (e.g. ability to be affected by a change) and the vulnerability of the receptor (e.g. potential exposure to a change) must be taken into account. These are defined in IEMA 2020 guidance as follows:

"The susceptibility of the receptor can be determined using the following scale:

- *High susceptibility = receptor has no ability to withstand/not be substantially altered by the projected changes to the existing/prevailing climatic factors (e.g. lose much of its original function and form).*
- *Moderate susceptibility = receptor has some limited ability to withstand/not be altered by the projected changes to the existing/prevailing climatic conditions (e.g. retain elements of its original function and form).*
- *Low susceptibility = receptor has the ability to withstand/not be altered much by the projected changes to the existing/prevailing climatic factors (e.g. retain much of its original function and form).*

The vulnerability of a receptor can be defined using the following scale:

- *High vulnerability = receptor is directly dependent on existing/prevailing climatic factors and reliant on these specific existing climate conditions continuing in future (e.g. river flows and groundwater level) or only able to tolerate a very limited variation in climate conditions.*
- *Moderate vulnerability = receptor is dependent on some climatic factors but able to tolerate a range of conditions (e.g. a species which has a wide geographic range across the entire UK but is not found in southern Spain).*
- *Low vulnerability = climatic factors have little influence on the receptors."*

Table 15.5: Receptor Sensitivity

Receptor	Sensitivity	Reasoning
Future Users of the Site	High	Some future users of the Site will be more susceptible to climate change (extreme temperatures, intense rainfall) than others, depending on a range of factors such as age and existing poor health.
Infrastructure including buildings and roads	Moderate to High	Infrastructure across the Development ranges in value. Critical infrastructure, such as energy and water pipes/cables are considered to be of moderate susceptibility given that it can tolerate some changes in climate but is critical for the operation of the Development. The Site is within an area served by Portsmouth Water. The Environment Agency Water Stressed Areas Final Classification for 2021[i] classifies the region in which the Site is located as 'Seriously Water Stressed'. Water supply to the Development is therefore considered to be of High sensitivity.
Ecology, Landscaping and Planting	Moderate	There are no international or national designated sites present within 2km of the Site. There are two locally designated / non-statutory sites are present within 2km, Fontwell Park Racecourse LWS is located approximately 1.21km to the north and Barnham Road Designated Road Verge is located approximately 0.38km to the north-east of site. The vegetation within the Site comprise: • Modified grassland; • Other neutral grassland; • Wet woodland; • Bramble scrub; • Winter stubble; • Hedgerow; and • Other rivers and streams. There is also a small area of developed land and sealed surfaces.

		The Site is also suitable for many species such as bats, badgers, dormouse, breeding and nesting birds, and hedgehogs. Habitats and species on-site are considered to be sensitive to climatic changes.
Flood Risk	High	The Site is within Flood Zones 2 and 3 throughout the central portion of the Site as well as the entire eastern boundary of the Site. Flood Zone 2 is at a 0.1-1% of fluvial flooding in any given year. Whereas Flood Zone 3 is the highest flood risk zone, with a >1% of flooding from rivers or the sea in any given year. The north western and south western portions of the Site are in Flood Zone 1, which Is the lowest risk area from fluvial flooding. There is high surface water flood risk which is located only within the fluvial flood risk areas on the Westergate Stream and the Lidesey Rife. The rest of the Site has low surface water flood risk from overland flows. The residual flood risk from fluvial sources is from partial or full blockages of culverts along the Lidsey Rife and the Westergate Stream. The main risk is from the culvert under the railway embankment located at the downstream (south-east corner) of the existing site. Other culverts along the Westergate Stream are not placed beneath embankments and therefore can be easily overtopped, without creating backwater effects upstream. Flooding from other sources (coastal, tidal, groundwater, foul) is considered to be very low. The latest climate change peak river flow allowances for the Site (which falls within the Arun and Western Streams Management Catchment) shows a 25% allowance for a central estimate, a 36% allowance for a higher estimate, and an upper estimate of 64%.

Determining Significance and Significance Criteria

15.5.3.7 In general EIA practice, the sensitivity of a receptor is typically defined by taking into consideration the vulnerability, value, and recoverability of the receptor. IEMA guidance states that receptor vulnerability and uncertainties must be considered. Significance has therefore been determined by IEMA guidance and professional judgement.

15.5.3.8 To ensure climate change adaptation is assessed, this chapter draws on recognised climate change projections, existing guidance and emerging good practice, as well as relevant information presented in the ES and documents which form part of the planning application, to ensure that appropriate project mitigation and risk management is included in the Development design. In particular, this chapter draws upon the findings of Chapter 7 Ecology, Chapter 11 Water Environment and Drainage, and Chapter 5 Transport.

15.5.3.9 A comprehensive Flood Risk Assessment ('FRA') has been carried out, to assess the vulnerability of the Development to all possible types of flooding. The assessment followed technical guidance within the NPPF and examined flood risks at the existing baseline level and at the future baseline for the lifetime of the Development, taking into account projected climate change impacts for all sources of flooding.

15.5.3.10 Chapter 7 Ecology provides a detailed assessment of potential ecological impacts associated with the Development and evaluates the importance of the habitats and species present on the Site, which is summarised in Table 15.5 above. This Ecology Chapter is based on a wide array of surveys as described in Chapter 7 of this ES.

15.5.3.11 An assessment of the effect significance with regard to the Developments' vulnerability to climate change is provided qualitatively with the most significant risks and opportunities for the project identified using professional judgement. The criteria for identifying the vulnerability of a receptor are set out in Table 15.5 above. This view has been taken given the longevity of the life span of the Development (estimated to be 60 years) and in consideration with the uncertainty of the projected pathway of climate change. Professional judgement is drawn as to whether climate changes (considering the future baseline) are likely to lead to a significant impact on the Development or not.

15.5.3.12 Effects that are described as 'minor' or 'negligible' are determined to be 'Not Significant' and effects that are described as 'moderate', or 'major' are determined to be 'Significant'.

Identifying Climate Change Projections

15.5.3.13 The current UKCP18 projections, released in November 2018, are the most up to date climate change projections available. In line with IEMA Guidance, this Chapter utilises climate projections using the 'worst

case scenario' of future weather projections, and therefore Representative Concentration Pathway ('RCP') 8.5[17] scenarios are used. The 2020 IEMA Guidance sets out that the use of the high emissions scenarios (Met Office UKCP18 RCP 8.5) is generally recommended, unless the case can be made for using a different, lower emissions scenario.

15.5.3.14 Climate projections have been derived from the UKCP18 50th Percentile[18] Climate Projections at a 25 km grid square 487500, 112500 (where the Site is located, as shown in Figure 15.1) using baseline 1981-2000 scenario, with an RCP 8.5.

15.5.3.15 This worst-case scenario assumes a 'business-as-usual' pathway through a combination of assumptions about high population levels, relatively slow income growth with modest rates of technological change and energy intensity improvements, leading in the long term to high energy demand and GHG emissions in absence of climate change policies.

15.5.3.16 Taking into account the nature and location of the Development, the following climate related parameters/hazards are also considered to have the potential to impact upon the operation of the Development:

- Wind (speed, direction and gustiness);
- Temperature; and
- Precipitation.

Assessment of Likely Significant Effects

15.5.3.17 The resilience of the Development to climate change impacts is qualitatively assessed, based on professional expertise and judgement, with quantitative evidence where appropriate.

15.5.3.18 A high value receptor that has very little resilience to changes in climatic conditions should be considered more likely to be significantly affected than a high value receptor which is more resilient to changes in climatic conditions. If there is uncertainty about how a receptor will adapt to a changing climate, the IEMA 2020 Guidance recommends that a precautionary approach should be employed. Therefore, receptors have been assumed to have a moderate to high sensitivity to the changing climate, as summarised in Table 15.5 above.

Limitations and Assumptions

15.5.3.19 The UKCP18 climate change projections are not climate change predictions as they include a degree of uncertainty. As stated in the UKCP18 Science Overview Report .

[17] RCP 8.5 refers to the concentration of carbon that delivers global warming at an average of 8.5 watts per square meter across the planet. The RCP 8.5 pathway delivers a temperature increase of about 4.3˚C by 2100, relative to pre-industrial temperatures and is considered to be a 'worst-case scenario'.

[18] The 50th percentile is chosen as it is the average from the typical plume which shows the 5th, 10th, 25th, 50th, 75th, 90th and 95th percentiles for the chosen emissions scenario.

"While the global and regional projections of future climate use the latest climate models and are diverse they cannot cover all potential future climate outcomes out to 2100 (or beyond in the case of sea level)..."

15.5.3.20 The 21st century projections presented in this report are produced for the RCP climate change scenarios. The results are therefore subject to any inherent limitations of the assumed emissions scenarios including:

"The probabilities represent the relative strength of evidence supporting different plausible outcomes for UK climate, based on the climate models, physical insight, observational evidence and statistical methodology used to produce them. However, they may not capture all possible future outcomes, because, for example, some potential influences on future climate are not yet understood well enough to be included in climate models."

15.5.3.21 The assessment of the Development's direct contributions to climate change, and the resultant resilience of the Development has been based on the information available at the time of writing. This includes transport modelling scenarios which include the totality of the quantum of the Development. A qualitative appraisal of resilience to climate change is provided for the Development.

15.5.3.22 The following receptors identified in other ES topic chapters and other supporting documents, are considered potentially sensitive to climate change:

- Air Quality;
- Noise and Vibration;
- Ecology;
- Water Resources, Flood Risk and Drainage; and
- Traffic and Transport.

15.6 Baseline

15.6.1 Climate Change Mitigation (GHG Emissions)

15.6.1.1 The current GHG emissions at the District level are provided in Table 15.6 below. A breakdown of total GHG emissions from the four main sources for ADC are provided over the period of 2005-2021 utilising the most recent DESNZ data set.

Table 15.6: GHG Emissions within ADC 2005-2021

Year	Commercial total (kt)	Industrial total (kt)	Domestic total (kt)	Transport total (kt)	Grand total* (kt)	Population (000s, mid-year estimate)	Per capita emissions (t)
2005	128.3	72.9	386.2	240.6	993.3	146.0	6.8
2006	125.3	70.4	386.0	239.5	974.3	146.8	6.6
2007	118.0	67.4	371.2	238.6	939.7	147.7	6.4
2008	117.3	61.5	371.2	228.2	909.1	148.5	6.1
2009	103.1	56.7	338.2	218.6	820.1	148.9	5.5
2010	111.3	64.5	365.4	215.9	891.5	149.5	6.0
2011	96.6	56.7	319.6	212.5	792.5	149.8	5.3
2012	112.2	62.1	345.8	209.6	831.4	151.8	5.5
2013	105.3	59.0	335.9	207.2	802.7	153.4	5.2
2014	88.1	54.3	286.5	208.9	735.3	155.3	4.7
2015	74.3	49.6	276.0	212.4	702.7	157.0	4.5
2016	64.7	48.6	265.8	225.4	661.1	159.3	4.2
2017	63.0	49.3	249.5	227.0	648.0	161.0	4.0
2018	33.3	58.8	242.5	220.2	617.9	162.4	3.8
2019	29.8	53.0	230.9	214.1	588.9	163.4	3.6
2020	23.0	56.0	228.4	176.0	540.8	164.2	3.3
2021	26.5	68.3	233.1	183.6	564.8	165.2	3.4

* Includes sectors not shown in the table (Public Sector, Land Use and Land Use Change and Forestry, Agriculture and Waste Management.

15.6.1.2 Table 15.6 above shows a declining trend In GHG emissions across all sectors within ADC. Between 2005 and 2021 per capita emissions fell from 6.8 tonnes CO2 ('tCO2') to 3.4 tCO2.

15.6.1.3 GHG emissions have fallen in all sectors, with a decrease of approximately 80% in the commercial sector.

15.6.1.4 Domestic emissions have declined approximately 40% in this period whereas transport emissions have fallen by 25%.

Future Baseline

15.6.1.5 In absence of the Development, GHG emissions arising from the transport Study Area (utilised in this assessment) in the future could be expected to decrease. This is as a larger proportion of vehicle movements in the Study Area would be electric vehicles and would therefore have zero emissions. Furthermore, the Site itself would continue to sequester carbon at its current rate.

15.6.2 Climate Change Resilience

15.6.2.1 This section summarises current climate conditions for the local area based on historic weather data and information about extreme weather events. The information presented below presents average weather conditions along with exceptional weather occurrences. To maintain relevance to current weather trends the displayed information has been calculated using data collected over the past two decades. The climate profile is taken from the closest available data source to the Site, which is the Bognor Regis climate station , approximately 5.4km south of the Site.

15.6.2.2 Climatic averages (1991-2020) for the weather station Indicate the following:

- Average annual maximum temperature was 14.66°C;
- Warmest month on average was August (mean maximum temperatures of 21.40°C);
- Coldest month on average was February (mean minimum temperature of 3.15°C);
- Average total annual rainfall was 733.91 mm (approximately 9% below the District (England SE & Central S) average);
- Wettest month on average was December (average monthly rainfall of 87.73 mm); and
- Driest month on average was May (average monthly rainfall of 42.79 mm).

Future Baseline

15.6.2.3 Future Climate Projections (up to 2100)

Table 15.7: 50th Percentile Climate Projections at 25km grid square 487500, 112500 using baseline 1981-2000 scenario RCP 8.5

Data	Climate Variable at 50th Percentile					
	Mean Air Temperature anomaly* at 1.5 m (°C)	Annual Precipitation rate anomaly (%)	Minimum Summer air temperature anomaly at 1.5 m (°C)	Average Summer Precipitation rate anomaly (%)	Minimum Winter air temperature anomaly at 1.5 m (°C)	Average Winter Precipitation rate anomaly (%)
2023	0.90	1.17	1.30	-9.14	0.79	8.74
2031	1.13	0.78	1,63	-13.18	1.03	10.41
2050	1.91	0.50	2.79	-24.09	1.77	14.41
2080	3.67	0.99	5.53	-40.95	3.16	26.32
2099	5.11	-0.47	7.92	-57.72	4.40	32.92

*Anomaly refers to the change compared to the baseline. The projections are not absolute values.

15.6.2.4 The full datasets can be viewed in appendices 15.5-15.10.

15.6.2.5 The projections in Table 15.7 above show a continuous increase in annual average air temperature over the next 80 years. Annual precipitation is also projected to fluctuate over the 80-year period but decrease slightly over this time.

15.6.2.6 The projections suggest that summers will become warmer and drier, with an expected increase in maximum summer temperatures and overall significant decline in summer precipitation over the lifespan of the Development. Natural variations may mean that some cooler and/or wetter summers will occur.

15.6.2.7 Winters may become milder and wetter, with an overall increase in both minimum winter temperature and winter precipitation. Natural variations may mean that some cold and/or dry winters may still occur.

Wind Speed and Storms

15.6.2.8 Winds associated with major storm events can be some of the most damaging and disruptive events for the UK with implications for property, power networks, road and rail transport and aviation. Calm periods with little wind, particularly over prolonged periods, can affect air quality whilst winds from a particular direction can be a critical factor in the spread of pathogens. Both cases are also examples where the combination of factors such as wind, temperature and precipitation can exacerbate their impacts (e.g., air quality issues tend to be worse under conditions of light winds and higher temperatures; pathogen spread can require wind, temperature, and precipitation conditions to be favourable) .

15.6.2.9 Changes in wind speeds are not currently available at the regional level and there remains considerable uncertainty in wind speed projections. However, there are small changes in projected wind speed. Across the UK, near surface wind speeds are expected to increase in the second half of the 21st century with winter months experiencing more significant impacts of winds. This is accompanied by an increase in frequency of winter storms over the UK. However, the increase in wind speeds is projected to be modest. There are no compelling trends in storminess as determined by maximum gust speeds from the UK wind network over the last four decades .

15.7 Effects During Construction

15.7.1 Climate Change Mitigation (GHG Emissions)

Construction Transport Emissions

15.7.1.1 The Development will have an impact on climate change due to carbon emissions during construction as well as operation. During the construction phase, there may be some emissions of CO_2 from construction traffic accessing the Site, non-road mobile machinery and small generators temporarily used to power machinery and equipment on-site. However, these emissions will be temporary, occurring between 2024 and 2031. These are highly unlikely to make a significant contribution to the overall UK GHG emissions though they will lead to a net increase in carbon in the short-term due to the nature of the construction operations.

15.7.1.2 Carbon emissions associated with construction are relatively small when compared with the total user carbon emissions over the study period. Daily construction vehicle movements are anticipated to be approximately 26 HDVs and 102 LDVs per day.

15.7.1.3 These construction traffic movements represent the peak construction year of 2026. GHG emissions from construction vehicle movements are 102.65 tCO2e, as shown in Appendix 15.3.

15.7.1.4 In total, construction vehicle emissions represent 0.01% of ADC's 4th carbon budget (1.2 MtCO2e) and 0.000005% of the UKs 4th carbon budget (1,950 MtCO2e).

15.7.1.5 In line with the IEMA GHG Guidance and the significance criteria displayed in Table 15.2, vehicular movements, and emissions as a result of construction phase of Development would result in a **Minor Adverse** effect, which is **not significant**.

15.8 Effects Post Construction

15.8.1 Climate Change Mitigation (GHG Emissions)

Operational Transport Emissions

15.8.1.1 The impacts of carbon emissions arising from the operational phase of the Development are identified as having a contribution to climate change.

15.8.1.2 Inherent mitigation designed into the Development includes an east-west link through the Development being LTN1/20 compliant, with a bi-directional cycle route as well as the bridge located to the east of the Development only being accessible for buses, pedestrians and cyclists. Public Rights of Way ('PRoWs') within the Development will be upgraded to provide connections to off-site facilities, improving the pedestrian environment throughout the Development.

15.8.1.3 The Development will result in an increase in vehicle movements on the local road network. As shown in Appendix 15.2 and Table 15.1, the AADT traffic flow (from the four road links most relevant to the Development) associated with the 2019 baseline scenario is 47,200 vehicle trips per day. The 2031 (baseline growth + committed developments + the Development) is 54,978 vehicle trips per day. The Development, with growth values and committed developments applied, therefore results in an uplift of 7,778 vehicle trips per day.

15.8.1.4 In total, the uplift in vehicular trips represents 3,142.71 tCO2e/year of vehicular emissions locally. This accounts for 0.52% of ADC's 5th carbon budget (0.6 MtCO2e).

15.8.1.5 Nationally, the uplift in vehicular trips represents 0.00018% of the UK's 5th carbon budget (1,725 MtCO2e).

15.8.1.6 In line with the IEMA GHG Guidance and the significance criteria displayed in Table 15.2, the uplift in vehicular movements and emissions as a result of the Development (and wider growth + cumulative schemes) would result in a **Minor Adverse** effect, which is **not significant**.

Operational Regulated Energy

15.8.1.7 The Energy Statement, submitted in support of the planning application, has undertaken energy modelling for the operational energy use associated with the Development.

15.8.1.8 The Development will follow the 'Energy Hierarchy'[19] which includes demand reduction, energy efficiency, and low/zero carbon technologies.

15.8.1.9 A range of energy efficiency measures have been incorporated into the Development including:

- Highly insulated building fabric with external walls, floors and roofs of low U-Values to reduce heat loss;
- Efficient double or triple glazed windows;
- Use of natural ventilation where feasible to reduce energy demands;
- Where feasible dwellings have been designed to allow for cross-ventilation to reduce the risk of overheating and help them stay cool in warmer conditions;
- Low energy lighting; and
- Strong continuity of insulation at building junctions to reduce thermal bridging heat loss including high efficiency insulated lintels.

15.8.1.10 A high-level feasibility study has also been carried out to determine the viable sources of low carbon technology and renewable energy that could be adopted by the Development.

15.8.1.11 The Development will seek to supply energy efficiently by designing for the use of only electric based heating and hot water systems meaning that the Development will be designed to be fossil fuel-free.

15.8.1.12 Dwelling heat and hot water demand will be met by low carbon technology using air source heat pumps ('ASHP') as individual heating systems.

15.8.1.13 Solar photovoltaic ('PV') panels would be a suitable renewable technology for roof space on buildings with south facing roofs within the Development, and the potential to incorporate PV technology will be considered as the design progresses.

15.8.1.14 Following the implementation of energy hierarchy measures outlined above, the current predicted residual regulated GHG emissions associated with the Development is 140.86 tCO2e/year. This is a 70% reduction below

[19] The Energy Hierarchy is a classification of energy options, prioritised to assist progress towards a more sustainable energy system.

the Part L 2021 Baseline. This represents 0.023% of ADC's 5th carbon budget (0.6 MtCO2e) and 0.000008% of the UKs 5th carbon budget (1,725 MtCO2e).

15.8.1.15 The ASHP-led electric only energy strategy proposed would allow the Development to achieve full Net Zero operation once the grid decarbonises.

15.8.1.16 In line with the IEMA GHG Guidance outlined in Table 15.2, the likely effect from operational energy emissions is considered to be Minor Adverse and not significant.

Carbon Sequestration

15.8.1.17 The potential levels of carbon sequestration at the Site pre and post Development have been calculated and are provided in Table 15.8 below.

Table 15.8: Carbon Sequestrian Potential

Habitat Type	Pre-Development (ha/tree)	Post-Development (ha/tree)	Habitat Sequestration potential (tCO2eq/ha/	Total sequestered (baseline) tCO2eq/yr	Total sequestered (development) tCO2eq/yr
Amenity Grassland	8.666	1.092	1.55	13.4323	1.6926
Semi-Natural Grassland	2.05	2.621	1.55	3.1775	4.06255
Scrub	1.759	1.659	1.55	2.72645	2.57155
Buildings / Hardstanding	0.336	6.42	0	0	0
Gardens	0	6.274	1.55	0	9.7247
Wet Woodland	0.8	0.466	10.71	8.568	4.99086
Arable	5.971	0	5.39	32.18369	0
Stream	0	1.05	3.91	0	4.1055
Broadleaved Woodland	0	0.606	10.71	0	6.49026
Total				60.09/yr	34.09/yr

15.8.1.18 Table 15.8 above shows that the baseline scenario for the Site sequesters approximately 60.09 tCO2e/year. This primarily comes from the grassland, arable land, and wet woodland throughout the Site.

15.8.1.19 The removal of habitats such as arable farmland and amenity grassland, alongside the introduction of new and varied habitats on the Site, as well as the retention of existing habitats will overall lead to a decrease in

the potential of the Site to sequester carbon as shown in Table 15.8 above. The carbon sequestration potential for the Site post Development is approximately 33.64 tCO2e/year.

15.8.1.20 Overall, the baseline carbon sequestration potential on the Site is approximately 60.09 tCO2e/year. The removal of wet woodland, amenity grassland and arable farmland for built development and varied planting will decrease the carbon sequestration potential of the Site by approximately 26.45 tCO2e/year.

15.8.1.21 This reduction in carbon sequestration potential of the Site Is considered to be a **Minor Adverse** effect, which is **not significant**.

Climate Change Resilience

15.8.1.22 Table 15.9 below outlines the likely significant effects from climate change on the identified receptors within the Development.

Table 15.9: Climate Change Risk Assessment

Climate Condition / Hazard	Receptor	Receptor Vulnerability	Potential Impact (with embedded mitigation)	Significance (Effects that are significant are in bold)
Long Term Changes to Climate Norms	Future Users of the Site	High	The climate is expected to become drier and hotter in summers and wetter and milder in winters in the region where the Site is located. Vulnerable residents will be more at risk to climate extremes rather than long-term changes to climatic norms. As outlined in the Heatwaves section below, the Development will be designed to reduce the risk of overheating during periods of hot weather. Table 15.7 shows the annual temperature at the Site is projected to increase throughout the lifespan of the Development. Appropriately designed homes will therefore reduce the risk of overheating on future residents, in particular vulnerable residents such as children and the elderly.	Minor Adverse
	Infrastructure	Moderate to High	Infrastructure may require more maintenance and repair as changes to climatic norms may cause increased stress on, for example, below ground cables and pipes. 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.	Minor Adverse
	The Natural Environment (Ecology, Landscaping and Planting)	Moderate	Habitats on-site are considered sensitive to long term changes in climate, as shown in Table 15.7, average annual temperatures are projected to increase, with a slight decrease in annual precipitation. A range of mitigation measures are embedded into the design of the development, including: • It is recommended wherever possible that existing vegetation is retained; • Some of the woodland and the majority of hedgerows are to be retained under proposals; and	Minor Adverse

			• Boundary habitats will be retained (including the stream, woodland, scattered trees and scrub). New and existing planting should be able to withstand these long term changes in climate.	
	Flood Risk	High	As shown in Table 15.7, the average annual precipitation is anticipated to fluctuate over the next 80-year period, but overall, slightly decrease over the lifespan of the Development. The risk of flooding from long term climatic changes is therefore reduced.	Negligible
Heatwaves	Future Users of the Site	High	As shown in Table 15.7, summer temperatures are anticipated to increase, and heatwaves will become more frequent. Therefore, placing vulnerable residents at risk. As outlined in the Energy Statement, submitted in support of the planning application, energy demand reduction measures will comprise the use of natural ventilation where feasible to reduce energy demands, as well as dwellings being designed, where feasible, to allow for cross-ventilation to reduce the risk of overheating and help them stay cool in warmer conditions. As shown in Table 15.7, climate projections show summer temperatures where the Site is located are anticipated to increase. Dwellings being designed to mitigate hot temperatures will reduce the effects of temperature extremes for future site users, in particular vulnerable residents such as children and the elderly.	Minor Adverse
	Infrastructure	Moderate to High	Infrastructure may require more maintenance and repair as changes to climatic norms may cause increased stress on, for example, below ground cables and pipes. 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. As stated in Table 15.5, potable water supply is in a region considered to be seriously water stressed. More frequent and intense heatwaves will lead to increased demand for potable water, therefore placing more stress on water supplies to the Development.	Moderate Adverse

	The Natural Environment (Ecology, Landscaping and Planting)	Moderate	New and existing plant species will be increasingly vulnerable to extreme high temperatures throughout the lifespan of the Development. Attenuation ponds may also evaporate, placing aquatic plants and species at risk of stress and fatality.	Moderate Adverse
Low Rainfall and Drought	Infrastructure	Moderate to High	Low rainfall and drought may reduce the potable water supply to the Development, which will potentially impact the operation of the Development. As shown in Table 15.5, the region in which the Development is located is served by Portsmouth Water, which is within an area that the EA defines as 'seriously water stressed'. As shown in Table 15.7, summer rainfall could significantly decrease through the lifespan of the Development, putting pressure on the water supply to the Development. During periods of low rainfall and drought, which are projected to become more frequent over the lifespan of the Development, the demand for water will increase in an area where potable water supplies are already considered to be stressed.	Moderate Adverse
	The Natural Environment (Ecology, Landscaping and Planting)	Moderate	New and existing plant species on-site will be vulnerable to periods of drought. As shown in Table 15.7, summer rainfall is projected to decrease significantly, increasing the likelihood of periods of drought. As the natural environment is of moderate sensitivity, without additional mitigation and management, the effect on planting due to drought will be Moderate Adverse.	Moderate Adverse
Heavy Rainfall and Flooding	Future Users of the Site	High	For a residential development, the central allowance of river flow increases of 25% would be sufficient in accordance with national guidance. However, the climate change allowance that has been adopted is 36% due to the presence of the East-West link road crossing (which is assumed as critical infrastructure). Flow increases have been generated above 36% along the Westergate Stream and the Lidsey Rife through the Site, by applying 20% increases in rainfall in the model.	Minor Adverse
	Infrastructure	Moderate to High		

			As demonstrated in the FRA, the size of the railway crossing is large (an approximately 3.3m wide by 2.6m high sprung arched brick culvert), it is possible that a large tree could be washed away during a flood event and become stuck at the inlet of this crossing. There are a number of trees along the Lidsey Rife which could potentially be washed away during a major flood event. Blockages of other culverts within the Site are considered to have no impact as floodwater would be able to bypass the culverts, over and around them. Although partial blockage of the railway culvert is possible during a 1 in 100-year flood event, the residential properties would still remain outside the flood extents; therefore, this residual risk is considered to be low. Although the upper estimate of climate change of increases in flows of more than 64% is possible, the residential properties would still remain outside the flood extents; thus confirming an additional resilience of the Development to climate change.	
	The Natural Environment (Ecology, Landscaping and Planting)	Moderate	Elevated flood risk on-site may result in potential significant effects on ecological receptors through flooding from various sources and pollution. There is potential for polluting substances to have a detrimental effect on the water quality of the surface water runoff and consequently the receiving water body. However, as outlined below, fluvial and surface water flood risk is appropriately mitigated through attenuation basins. These will provide storage of rainfall during periods of high rainfall and flooding. Additionally, riparian planting in and around attenuation basins will contribute to a betterment of water quality as planting will provide filtration of surface water runoff. The risk of an accidental pollution incident can never be completely removed but the risk can be minimised to an acceptable level and the potential effects identified are not significant.	Minor Adverse

	Flood Risk	High	As outlined above, the fluvial flood risk on-site is appropriately mitigated by culverts on-site and the appropriate orientation of residential dwellings away from areas of higher modelled flood risk. The FRA estimates that surface water flood risk will increase with climate change over the next 100 years, as it is anticipated that rainfall intensities could increase by 45%. Furthermore, Table 15.7 indicates that precipitation in winter months is projected to increase over the lifespan of the Development. The proposed surface runoff strategy caters for this increase in rainfall intensities as a result of climate change. As stated within the FRA, ground contours and the locations of the foul manholes, which are located in the vicinity of the watercourses, it is concluded that flooding from foul sources will be limited to the floodplains of the Lidsey Rife and the Westergate Stream. Therefore, if new residential dwellings are positioned away from fluvial flood risk, they will also be placed away from this residual foul flood risk. Attenuation basins are proposed for the Development to mitigate surface runoff flows to greenfield runoff rates. These are located outside the 1 in 100 year plus climate change fluvial extents. This allocation approach minimises the risk of fluvial water overflowing into the basins. The design includes a number of relatively shallow sealed attenuation basins located at the end of the drainage systems and prior to discharging into the Lidsey Rife, via flapped outfalls. They attenuate development runoff to greenfield rates, taking into account of long term storage. In addition to the East-West Link Road which will provide safe access / egress to and from the Site, there is also the potential access to the North via St Richard's Road and to Nyton Road. These are the alternative access routes, should Westergate Street become impassable during extreme rainfall events.	Minor Adverse

			Owing to mitigation embedded into the Development as outlined above, the anticipated effect of flood risk on the Development is to be Minor Adverse, in conjunction with the future baseline scenarios outlined in Table 15.7 and climate change allowances assessed in the FRA.	

15.9 Mitigation

15.9.1 Construction - Climate Change Mitigation (GHG Emissions)

15.9.1.1 Construction vehicles will be managed through a Construction and Environmental Management Plan (CEMP), as well as a Construction Traffic Management Plan ('CTMP'), to be secured by an appropriately worded planning condition.

15.9.1.2 Measures will include appropriate construction traffic routing, such as avoiding sensitive receptors including schools and driving at off-peak times. The CEMP will include measures such as the use of efficient vehicles, avoiding vehicle idling and limiting the time that vehicles are operating. These measures will contribute to a reduction in construction traffic emissions, although this cannot be accurately quantified.

15.9.2 Operation - Climate Change Mitigation (GHG Emissions)

Operational Transport Emissions

15.9.2.1 It is anticipated that there will be an Electric Vehicle ('EV') charging point at every plot throughout the Development. The exact details of the EV charging points will be determined at the detailed design stage. However, EV charging will contribute to reduced GHG emissions arising from the Development by encouraging the use of electric vehicles, although this is difficult to accurately quantify.

15.9.2.2 Further additional mitigation to be secured via planning conditions include an offered contribution to upgrade bus stops on the A29, which will contribute to increased public transport usage. A Travel Plan will also be secured and will set out measures to reduce private vehicle usage and increase public transport use form future residents of the Development, which will contribute to reducing transport emissions.

Operational Energy Emissions

15.9.2.3 The Development does have suitable roof space for solar PV panels to be installed on south facing roofs. This will be considered during the detailed design phases. Furthermore, battery storage at building level could reduce peak electrical demands. Domestic battery storage technology is currently expensive, but this is likely to decrease over the next five to ten years.

15.9.2.4 Further investigation at design stage is required to confirm whether this technology would be appropriate.

15.9.2.5 Confirmation of these low carbon technologies and renewable energies will be confirmed at the detailed design stage.

Carbon Sequestration

15.9.2.6 Ecological mitigation and long-term management for habitats and protected species should be set out in a Landscape and Ecology Management Plan ('LEMP'), which will be secured by a planning condition. The LEMP will provide the basis to set out the range of mitigation and enhancement measures that will be agreed within

the detailed design of the Development and will also specify how management will be ensured in perpetuity such that habitats are managed to maximise their biodiversity and recreation value.

15.9.2.7 The provision of a LEMP for the long-term management of the habitats established at the construction stage will ensure that habitats are managed through a management plan for a minimum of 30 years.

15.9.3 Climate Change Resilience

Future Site Users

15.9.3.1 Overheating assessments will be undertaken at the detailed design stage to ensure compliance with Approved Document O: Overheating, this will be secured through a suitably worded planning condition.

Infrastructure

15.9.3.2 At the detailed design stage risk assessments will be undertaken to manage risks from future climate change in accordance with nationally accepted standards and guidance.

15.9.3.3 As the Development is in a region already considered to be water stressed, demand for water supply will place extra stress on water utilities. Furthermore, with a reduction in summer rainfall and rising temperatures projected in the area where the Site is located, potable water supply will be placed under increased pressure throughout the lifespan of the Development.

15.9.3.4 Measures regarding domestic properties water consumption will be confirmed at the detailed design stage and should be designed to be equal to or less than 110 litres/person/day.

The Natural Environment (Ecology, Landscaping and Planting)

15.9.3.5 Ongoing ecological monitoring should be undertaken. The ongoing monitoring for a minimum of 30 years will be outlined within the LEMP for the Development, to be secured through a suitably worded planning condition at a later design stage.

15.9.3.6 The LEMP will ensure the appropriate maintenance of new and existing landscaping and plant species over the 30 years of the Development, this will reduce the risk of plant failure during periods of drought, heatwaves, or heavy rainfall. Furthermore, it is anticipated that some drought resilient species will be chosen in the landscaping of the Development to improve chances of survival of landscaped areas.

Flood Risk

15.9.3.7 As outlined in the FRA, a maintenance regime is targeted to avoid blockages of watercourses, in particular at culvert locations. This applies to all ditches within the Site or where there is shared responsibility, as follows:

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- Removal of potential sources of blockages in vicinity to the watercourses (in particular loose trees that could result in a partial blockage of the railway culvert);
- Removal of obstructions within the watercourses and plant growth (particular care needs to be taken to avoid affecting trees and tree roots;
- Walkovers to ensure that the watercourses will work as intended during a flood event (for example protecting the bank slopes to avoid erosion);
- Allow for a free access corridor to ensure easy access in the vicinity of the banks (the Environment Agency requires 8m access however for the other watercourses a 6m access corridor should be sufficient);
- Removal of silt at critical locations; and
- Ensure that the two proposed crossings over the Westergate Stream are structurally safe and maintained to the required standard.

15.9.3.8 Exact design specifications of SuDS features for the Development will be secured at the detailed design stage and will manage storm discharge across the Development.

15.10 Residual Effects

15.10.1 Climate Change Mitigation (GHG Emissions)

Construction Transport Emissions

15.10.1.1 As construction vehicle movements are small compared to the baseline and will be temporary, the residual effect of construction vehicle emissions is considered to be **Minor Adverse** and **not significant**.

Operational Transport Emissions

15.10.1.2 Following the implementation of additional mitigation measures and the increased uptake of EV's, the residual effect from operational transport emissions Is considered to be **Minor Adverse** and **not significant**.

Operational Energy Emissions

15.10.1.3 The use of net zero carbon ready technology allows the Development to achieve net zero operational carbon emissions once the grid decarbonises. The Development is therefore in line with a net zero trajectory and the residual effect of operational energy emissions is therefore considered to be **Minor Adverse** and **not significant**.

Carbon Sequestration

15.10.1.4 During the operational phase, with careful management outlined in a landscape maintenance regime to be secured through a planning condition, the carbon sequestration potential of new landscaping and planting would improve.

15.10.1.5 Should a LEMP be secured by a planning condition, long-term maintenance should improve the carbon sequestration ability of new and existing planting as part of the Development. The residual effect con carbon sequestration is therefore considered to be **Negligible**.

15.10.2 Climate Change Resilience

Future Site Users

15.10.2.1 The residual effect on future site users is anticipated to be **Minor Adverse** and **not significant** following the implementation of embedded and additional mitigation outlined in this Chapter, with respect to heatwaves and flood risk in particular.

Infrastructure

15.10.2.2 It is expected that infrastructure will be safeguarded at the detailed design stage to account for climate change.

15.10.2.3 During periods of heatwaves and drought, the effect on the potable water supply is anticipated to be significant as demand for potable water increase in a region considered to be 'Seriously Water Stressed' by the EA.

15.10.2.4 The detailed design stage should consider specifications to reduce potable water consumption equal to or below 110 litres per person per day. Should these measures be put in place, the residual effect with respect to potable water supply could be reduced to **Minor Adverse** and **not significant**.

15.10.2.5 The residual effect on other infrastructure services is **Minor Adverse** and **not significant**.

The Natural Environment (Ecology, Landscaping and Planting)

15.10.2.6 Varied habitats across the Development and long-term ecological management will increase the resilience of planting throughout the Development. Should long-term management be secured via a planning condition, and drought resilient species be planted throughout the Development, the residual effect on the natural environment from climate change is therefore considered to be **Minor Adverse** and **not significant**.

Flood Risk

15.10.2.7 The Development is at a high risk from fluvial and surface water sources. However, as outlined above the Development is appropriately mitigated through embedded design and a maintenance regime to be secured through a planning condition. The residual effect on flood risk is therefore **Minor Adverse** and **not significant**.

15.11 Cumulative Effects

15.11.1 Climate Change Mitigation (GHG Emissions)

15.11.1.1 Construction of the cumulative schemes is likely to result in GHG emissions owing to the scale and type of these schemes (residential and mixed-uses). It is assumed that all these schemes will be managed in accordance with a CEMP and/or CTMP, and the likelihood of cumulative schemes being constructed concurrently is low. In line with Table 15.2, it is assumed that all cumulative schemes will adhere to best practice and policy requirements, in line with a net zero trajectory, therefore the cumulative effect will likely be **Minor Adverse** and **not significant**.

15.11.1.2 It is assumed that all cumulative schemes will be designed and built out in accordance with up-to-date technical guidance and legislation in relation to operational regulated GHG emissions and will follow the energy hierarchy. An accurate quantification of GHG emissions across all cumulative schemes is difficult to obtain. Notwithstanding, should all committed developments follow up-to date technical guidance, in line with Table 15.2, the cumulative effects in relation to operational regulated energy emissions will be In line with a net zero trajectory and therefore a **Minor Adverse** and **not significant** effect is anticipated.

15.11.1.3 Furthermore, the assessment of operational transport emissions accounts for an uplift in traffic in the local area from projected growth, the Development and cumulative schemes and is therefore inherently a cumulative assessment.

Climate Change Resilience

15.11.1.4 It is assumed that the cumulative schemes identified would achieve policy compliance with regards to facets of climate resilience, such as overheating, and flood risk modelling accounting for climate change projections. Therefore, **Negligible-Minor Adverse** (**not significant**) cumulative resilience issues are anticipated with the Development's operational phase.

15.12 Summary

15.12.1 To reflect the requirements of the EIA Regulations, an assessment has been undertaken of the potential effects of the Development on climate change. This includes the effects of the Development on climate change (climate change mitigation) and the vulnerability of the Development to climate change (climate change adaptation/resilience).

15.12.2 The assessment has been undertaken in accordance with published guidance on considering climate change in EIA and consequently reviews how climate change has been considered at the current stages of project progression and assessment, as well as how future assessment will be conducted.

15.12.3 Construction of the Development is likely to result in emissions of CO2 from upfront and in-use carbon. Effects from construction transport emissions are anticipated to be Minor Adverse and not significant in comparison to the baseline.

15.12.4 Indicative results based on operational vehicle projections for traffic modelling scenarios for 2031 indicate the Development, committed developments and wider growth will result in an uplift of 7,778 vehicle trips per day for the chosen road links. In total, the uplift in vehicular trips represents 3,142.71 tCO2e/year of vehicular emissions locally. Following embedded and additional mitigation, residual effects from operational transport are considered to be Minor Adverse and not significant.

15.12.5 The implementation of the energy hierarchy for the Development will comprise demand reduction measures. Dwelling heat and hot water demand will be met by low carbon technology using ASHP. These measures will reduce operational energy emissions below the Part L baseline by 70% and render the Development net zero carbon ready. This will result in a Minor Adverse effect, which is not significant.

15.12.6 The removal of existing vegetation on-site will reduce the carbon sequestration potential of the Site by 26.45 tCO2e/year. As planting matures new and existing planting be able to sequester more carbon, resulting in a Negligible effect which not significant.

15.12.7 UKCP Projections for the 25km grid square where the Site is located project that summers are going to get drier and hotter, whereas winters will get wetter and milder. The Development is host to receptors of varying sensitivity to climate change, such as future users, infrastructure, the natural environment and flood risk.

15.12.8 Following embedded and additional mitigation measures, residual effects from climatic changes on future site users, infrastructure, the natural environment, and flood risk are not significant.

15.13 References

15.13.1 A list of Climate Change and Resilience references are listed below:

- BEIS.2021. UK local authority and regional carbon dioxide emissions national statistics - GOV.UK (www.gov.uk)
- Climate Change Act 2008. UK Public General Acts. 2008 c.27.
- DEFRA, November 2021, Emissions Factors Toolkit v11.0 User Guide. Link: https://laqm.defra.gov.uk/wp-content/uploads/2021/11/EFTv11.0-user-guide-v1.0.pdf
- Department for Levelling Up, Housing and Communities. 2022. Conservation of Fuel and power: Approved Document L. Link:: https://www.gov.uk/government/publications/conservation-of-fuel-and-power-approved-document-l

- HM Government (2011): The Carbon Plan: Delivering Our Low Carbon Future. Link: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47613/3702-the-carbon-plan-delivering-our-low-carbon-future.pdf
- HM Government (October 2019): Planning Practice Guidance. Link: https://www.gov.uk/government/collections/planning-practice-guidance
- https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/956094/Government_response_to_Future_Homes_Standard_consultation.pdf
- https://carbonbudget.manchester.ac.uk/reports/E08000016/
- https://ukclimateprojections-ui.metoffice.gov.uk/ui/home
- https://www.arun.gov.uk/download.cfm?doc=docm93jijm4n12844.pdf&ver=12984
- https://www.gov.uk/government/publications/cycle-infrastructure-design-ltn-120
- https://www.gov.uk/government/publications/water-stressed-areas-2021-classification
- https://www.leti.uk/_files/ugd/252d09_879cb72cebea4587aa860b05e187a32a.pdf
- https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gcp8bswvw
- https://www.theccc.org.uk/publicationtype/0-report/03-carbon-budget/
- IEMA (February 2022) Assessing greenhouse gas emissions and evaluating their significance, 2nd Edition.
- Met Office (2019): UKCP18 Factsheet: Wind. Link: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp18-fact-sheet-wind.pdf
- Met Office (Nov 2018, updated March 2019) UKCP18 Science Overview Report. Available at: https://www.metoffice.gov.uk/pub/data/weather/uk/ukcp18/science-reports/UKCP18-Overview-report.pdf
- National Planning Policy Framework https://www.gov.uk/government/publications/national-planning-policy-framework--2
- National statistics. National Travel Survey: 2021 https://www.gov.uk/government/statistics/national-travel-survey-2021
- Natural England. 2020. Accounting for National Nature Reserves. Available from: http://publications.naturalengland.org.uk/publication/4535403835293696
- Natural England. 2021. Carbon Storage and Sequestration by Habitat 2021 (NERR094). Available from: http://publications.naturalengland.org.uk/publication/5419124441481216
- Royal Meteorological Society (July 2018): International Journal of Climatology; State of the UK Climate 2017. Link: https://rmets.onlinelibrary.wiley.com/doi/epdf/10.1002/joc.5798

15.14 Glossary

15.14.1 A glossary of Climate Change and Resilience terms is listed below:

- Carbon budget - A Carbon Budget is a cap on the amount of greenhouse gases emitted in the UK over a five-year period. Budgets must be set at least 12 years in advance to allow policy-makers, businesses and individuals enough time to prepare.
- Carbon dioxide equivalent or CO2e - the number of metric tons of CO2 emissions with the same global warming potential as one metric ton of another greenhouse gas.
- Carbon Sequestration - is the process by which carbon dioxide is removed from the atmosphere and stored within a material – e.g. stored as 'Biogenic Carbon' in 'Biomass' by plants/trees through photosynthesis and other processes.
- Direct GHG emissions - are emissions from sources that are owned or controlled by the reporting entity.
- Emissions Factor Toolkit - The EFT allows users to calculate road vehicle pollutant emission rates for NOx, PM_{10}, $PM_{2.5}$ and CO2 for a specified year, road type, vehicle speed and vehicle fleet composition. The EFT is updated periodically due to updates to underlying data including vehicle fleet composition and emissions factors.
- GHG's –Greenhouse gas emissions from human activities strengthen the greenhouse effect, contributing to climate change.
- Indirect GHG emissions - are emissions that are a consequence of the activities of the reporting entity, but occur at sources owned or controlled by another entity.
- Lifecycle Modules - BS EN 15978 and the RICS PS set out four stages in the life of a typical project described as life-cycle modules:
    - Module A1 – A5 (Product sourcing and construction stage)
    - Module B1 – B7 (Use stage)
    - Module C1 – C4 (End of life stage)
    - Module D (Benefits and loads beyond the system boundary)
- Net Zero - The 'net zero target' refers to a government commitment to ensure the UK reduces its greenhouse gas emissions by 100% from 1990 levels by 2050. If met, this would mean the amount of greenhouse gas emissions produced by the UK would be equal to or less than the emissions removed by the UK from the environment.
- Representative Concentration Pathways (RCPs) – RCPs specify concentrations of GHGs that will result in total radiative forcing increasing by a target amount by 2100, relative to pre-industrial levels. RCPs are a method for capturing those assumptions within a set of scenarios. The conditions of each scenario are used in the process of modelling possible future climate evolution.
- UKCP18 - The UK Climate Projections (UKCP) is a set of tools and data that shows you how the UK climate may change in the future.

- 'Upfront Carbon' - emissions are the GHG emissions associated with materials and construction processes up to practical completion (Modules A0-A5). Upfront carbon excludes the biogenic carbon sequestered in the installed products at practical completion.
- Whole Life-Cycle Carbon (WLC) - emissions are the carbon emissions resulting from the materials, construction and the use of a building over its entire life, including its demolition and disposal.

16. Health Impact Assessment (HIA)

16.1 Introduction

16.2 Background

16.3 The Scheme

16.4 Chapter Structure

16.4 Planning Policy and Guidance

16.5 Assessment Methodology

16.6 Assessment Methodology

16.7 Baseline Health Conditions

16.8 Rapid Health Impact Assessment Matrix

16.9 References

16.10 Glossary

16 Health Impact Assessment (HIA)

16.1 Introduction

16.1.1 This Health Impact Assessment (HIA) has been prepared by Nexus Analytics and Research in support of an outline application at Land East of Westergate, Westergate.

16.2 Background

16.2.1 Public Health England's (PHE) Health Impact Assessment in spatial planning document (Ref 1.1) outlines the purpose of HIAs in the planning system. It defines HIAs as "a process that identifies the health and wellbeing impacts (benefits and harms) of any plan or development project. A properly conducted HIA recommends measures to maximise positive impacts; minimise negative impacts; and reduce health inequalities".

16.2.2 HIAs are designed to put health and wellbeing at the centre of the planning process and help to identify local health needs and address inequalities by influencing the wider determinants of health.

16.2.3 Table 2 of the document lists what it considers to be the wider determinants of health and wellbeing outcomes under the following categories:

- Access: local public key services and facilities; good quality affordable housing; healthy and affordable food; natural environment; green spaces and public realm; leisure, sport, recreation, play and physical activities within the environments
- Traffic and Transport: accessibility; access to public transport; opportunities for active travel (cycling and walking); links between communities; community severance; connections to jobs; connections to services; facilities and leisure
- Socio-economic: employment, including skills developments and training opportunities; local business activity; regeneration; tourism and leisure industries; community/social cohesions and access to social networks; community engagement
- Land Use: sustainable and efficient land use in urban and/or rural settings; quality of urban and natural environments, such as air and noise pollutions; climate change impacts

16.2.4 The PHE later identifies five stages to the HIA process:

1) Screening: Determine whether an HIA is needed and justified subject to anticipation of health impacts on population groups.
2) Scoping: Identify the potential health impacts and target population groups to assess.

3) Assessing: Assess the significance of health impacts, qualify and quantify potential costs and benefits, how health varies in different circumstances, across different populations and any alternatives.
4) Reporting: Engage all relevant stakeholders and recommend preventative and mitigation actions to deliver the greatest possible health gain.
5) Monitoring and evaluating: Include indicators and mechanisms, and set out processes and resources for the local authority and/or with the planning applicant to undertake and act on results of regular monitoring

16.2.5 The guidance also identifies that there are three types of HIA: comprehensive, rapid and desktop. The type of HIA that should be used depends on the focus, scale and scope of the development project.

16.3 The Scheme

16.3.1 The Proposed Development is a hybrid application including the following:

- Full planning application for western section of East/West Link Road with new access, road bridge and associated works;
- Outline planning application with all matters reserved for up to 400 dwellings with access and associated works.

16.3.2 The Proposed Development forms part of the wider Barnham/Eastergate/Westergate allocation as outlined in Policy H SP2c of the Adopted Arun Local Plan 2011-2031.

16.4 Chapter Structure

16.4.1 The structure of this HIA is as follows:

- An overview of relevant policy and guidance
- The methodology applied in preparing this HIA
- Baseline health context against which the Proposed Development will be assessed
- Impact assessment of the Proposed Development and recommendations to mitigate, avoid or reduce any impact

16.5 Planning Policy and Guidance

16.5.1 National Planning Policy Framework

16.5.1.1 Health is a key theme running throughout the National Planning Policy Framework (NPPF) (Ref 1.3) as a central element of the overarching social objective (paragraph 8) is to create strong, vibrant and healthy communities.

16.5.1.2 Section 8 of the NPPF encourages the promotion of healthy communities as part of the plan-making and decision-making processes. The specific principles encouraged (namely within paragraphs 95 to 100) include:

- Providing opportunities for all areas of the community to come into contact and interact through missed use developments, neighbourhood centres, active street frontages, shared spaces and community and leisure facilities.
- Creating safe and accessible environments in respect of crime, disorder and fear of crime.
- Enable and support healthy lifestyles through the provision of safe and accessible green infrastructure, sports facilities, local shops, access to healthier food, allotments and layouts that encourage walking and cycling.
- Guard against the loss of valued facilities and services and ensure that shops, facilities and services are adaptable to change.
- Ensure an integrated approach to considering the location of housing, economic uses and community facilities and services.
- Ensure that a sufficient choice of school places is available to meet the needs of existing and new communities

16.5.2 National Planning Practice Guidance

16.5.2.1 The National Planning Practice Guidance (PPG) (Ref 1.4) reiterates that local councils should promote healthy communities and support appropriate health infrastructure (ID: 53-001). Furthermore, the PPG highlights that health is an important element of the three dimensions of sustainable development and is intrinsically linked to policies throughout the whole NPPF (ID: 53-002).

16.5.2.2 The key health and healthcare infrastructure issues for consideration as part of the plan-making and decision-making processes include:

- Making physical activity easy to do and create places and spaces to meet.
- Reducing health inequalities.
- Delivery of healthcare infrastructure.
- Supporting opportunities for healthy lifestyles through promoting active travel and physical activity, access to healthier food, high quality open spaces, green infrastructure and sport, play and recreation.
- Potential pollution and other environmental hazards.
- Accessibility for the whole community

16.5.2.3 The PPG also outlines that local councils should help create a healthier food environment having regard to issues such as:

- Location where children and the young congregate;
- Evidence on obesity, deprivation and general poor health in specific locations;
- Over concentration and clustering of certain use classes within a specified area;
- Amenity factors including: odour, noise, traffic, refuse and litter.

16.5.2.4 The PPG highlights that HIA is a useful tool in firstly understanding the health and wellbeing impacts associated with a proposed development and secondly identifying mitigation measures (ID: 53-004).

16.5.3 Adopted Arun Local Plan 2011-2032 (2018)

16.5.3.1 The Arun Local Plan 2011-2031 was adopted In July 2018, and outlines the spatial vision, objectives and strategy of growth for the District over this period.

16.5.3.2 Section 12 of the Local Plan outlines the District's strategic objective for Housing Delivery:

"Plan and deliver a range of housing mix and types in locations with good access to employment, services and facilities to meet the District's housing requirements and the needs of Arun's residents and communities both urban and rural, ensuring that issues of affordability and the provision of appropriate levels of affordable housing are addressed while supporting the creation of integrated communities."

"Promote strong, well integrated and cohesive communities, through the promotion of healthy lifestyles, provision of good quality accessible community facilities and a safe environment, which delivers an enhanced quality of life to all. This includes meeting the needs of a growing elderly population."

16.5.3.3 Policy HWB SP1 relates to health and wellbeing principles can be placed and the centre of development and outlines the following:

"All development shall be designed to maximise the impact it can make to promoting healthy communities and reducing health inequalities. In particular regard shall be had to:

a) Providing or contributing to the necessary infrastructure to encourage physical exercise and health, including accessible open space, sports and recreation facilities (including outdoor fitness equipment) and safe, well promoted, walking and cycling routes.

b) Creating mixed use development and multi-use community buildings that reduce the need to travel by providing housing, services and employment in close proximity to each other; and

c) Ensuring that arts and cultural facilities are accessible to all residents and visitors to the District

Where new health, recreation and leisure facilities are planned, where possible, these shall be located along public transport corridors that are easily accessible to members of the wider community."

16.5.3.4 In addition, one of the strategic priorities listed In Policy HWB SP1 relates to *"a new high quality linear park as an integral part of the housing allocation at Barnham/Eastergate/Westergate"*.

Creating healthy and sustainable places, West Sussex County Council

16.5.3.5 In 2020, West Sussex County Council (WSCC) published 'Creating healthy and sustainable places - a public health and sustainability framework'. This framework relates to how health and wellbeing can be promoted through the development process.

16.5.3.6 The framework encourages the use of HIAs against which to identify the health and wellbeing impacts of a development, and to make recommendations to minimise negative impacts and maximise positive impacts.

16.5.4 West Sussex Joint Strategic Needs Assessment Summary 2021/22

16.5.4.1 The West Sussex Joint Strategic Needs Assessment (JSNA) outlines the health and wellbeing needs of the population in West Sussex. Health priorities are grouped into the following three themes: Starting Well, Living and Working Well and Ageing Well.

16.5.4.2 Start Well Priorities:

- Improved mother and baby health and wellbeing, especially for those in most need
- Children growing in a safe and health home environment with supporting and nurturing parents and carers
- Good mental health for all children
- Children and young people leaving care are healthy and independent

16.5.4.3 Live Well Priorities:

- Individuals, families, friends and communities are connected
- People have access to good quality homes providing a secure place to thrive and promote good health, wellbeing and independent living
- People are able to look after their own health
- People live, work and play in environments that promote health and wellbeing

16.5.4.4 Age Well Priorities:

- Fewer older people feel lonely or socially isolated
- There is a reduction in the number of older people having falls

- Older adults stay healthier, happier and independent for longer
- People receive good quality end of life care and have a good death

16.5.5 Rapid Health Impact Assessment Tool, London Healthy Urban Development Unit

16.5.5.1 The NHS London Healthy Urban Development Unit Rapid Health Impact Assessment Tool guidance ("the HUDU guidance") (Ref 1.7) provides an assessment framework that aligns with legislative and national policy and guidance requirements. This guidance has informed the assessment framework within this HIA.

16.5.5.2 The rapid HIA tool is an assessment matrix which sets out the issue, assessment criteria, the evidence, the potential health impact and recommended action.

16.6 Assessment Methodology

16.6.1 The approach followed in this HIA is that of a rapid HIA, as recommended In the PHE guidance and the WSCC framework for a development of this focus and scale.

16.6.2 This HIA goes beyond analysing primary and secondary healthcare services, to assessing the effects of development upon major health assets, which help people stay healthy. Many factors influence health and well-being, these include housing, community networks, places to play and modes of travel and opportunities to move. These are known as determinants of health.

16.6.3 The Proposed Development will have a direct and indirect impact on these determinants of health and by contributing an entirely new housing stock to the area will be able to have a positive influence on health and wellbeing. This HIA is also concerned with inequalities in health, as some population groups are more susceptible to change in the social, economic and physical environments and may be more susceptible to poor health.

16.6.4 Assessing Impact Themes

16.6.5 The following eleven health impact themes have been considered as part of this HIA. These themes have been based on the approach set out within the HUDU guidance:

a) Housing quality and design
b) Access to healthcare services and other social infrastructure
c) Access to open space and nature
d) Air quality, noise and neighbourhood amenity
e) Accessibility and active travel
f) Crime reduction and community safety
g) Access to healthy food
h) Access to work and training
i) Social cohesion and lifetime neighbourhoods

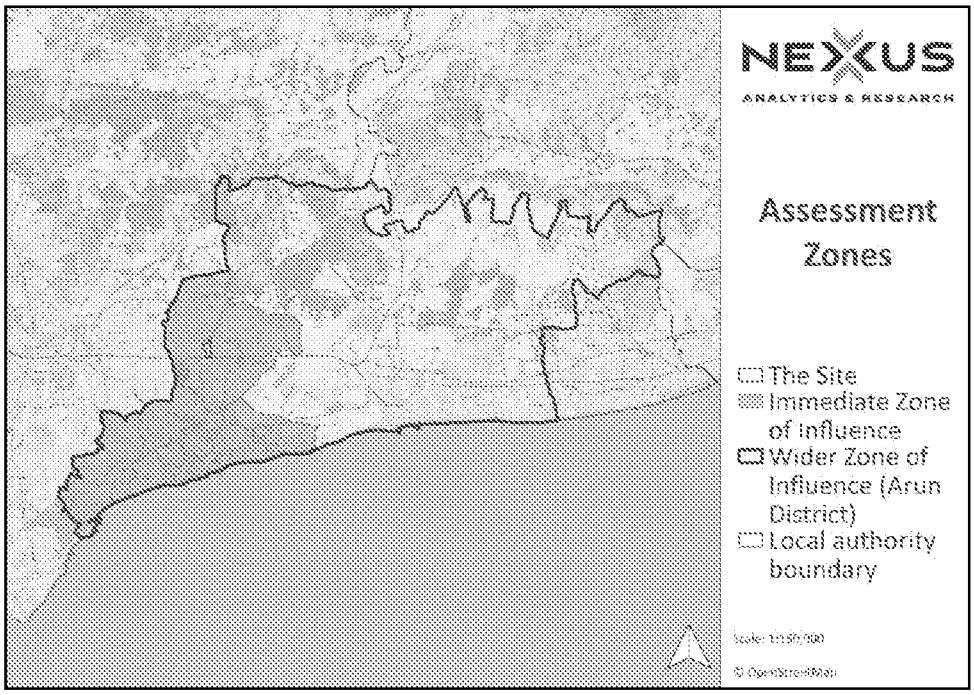
j) Minimising the use of resources

k) Climate change

16.6.6 Assessment Zones

16.6.7 Figure 16.1 illustrates the extent of the assessment zones used in this HIA, in relation to the Site.

Figure 16.1: Assessment Zones



16.6.8 The Immediate Zone of Influence is defined as the area most likely to be impacted by the Proposed Development. In this case, it has been identified as nine Middle Layer Super Output Areas (MSOAs) which cover the settlements of Westergate, Eastergate and Barnham, in addition to the built-up area of Bognor Regis, to the south of the Site.

16.6.9 The Wider Zone of Influence has been identified as Arun District.

16.6.10 This HIA will also make references to regional (South East) and national (England) averages.

16.7 Baseline Health Conditions

16.7.1 This section outlines the baseline health conditions of the Immediate Zone against which we can evaluate the impact of the Proposed Development.

16.7.2 General Health Profile

16.7.2.1 As outlined in Table 16.1, the Immediate Zone has an aging population. In comparison to England, both the Immediate Zone and the Wider Zone have a higher proportion of under 20s and a higher population of over 60s.

Table 16.1: Age Structure

	Immediate Zone	Wider Zone	England
0 to 4	4.3%	4.4%	5.4%
5 to 9	4.9%	5.0%	5.9%
10 to 14	5.1%	5.0%	6.0%
15 to 19	4.7%	4.6%	5.7%
20 to 24	4.9%	4.5%	6.0%
25 to 29	5.4%	5.1%	6.6%
30 to 34	5.8%	5.6%	7.0%
35 to 39	5.6%	5.4%	6.7%
40 to 44	5.4%	5.3%	6.3%
45 to 49	5.8%	5.7%	6.4%
50 to 54	6.9%	6.9%	6.9%
55 to 59	7.2%	7.2%	6.7%
60 to 64	6.6%	6.7%	5.8%
65 to 69	6.3%	6.5%	4.9%
70 to 74	7.4%	7.6%	5.0%
75 to 79	5.7%	5.9%	3.6%
80 to 84	4.0%	4.1%	2.5%
85+	4.2%	4.3%	2.4%

Source: Census 2021

16.7.2.2 As the socio-economic ES chapter outlines, deprivation levels according to the Index of Multiple Deprivation (IMD) in the Wider Zone are in line with national averages. On a more localised basis, the two LSOAs that the Site is located within - Arun 003C and Arun 003D - experience generally low levels of deprivation. Having said this, both LSOAs have a decile score of 6 in the domain of Health, which makes this one of the lowest-scoring domains.

16.7.2.3 Table 16.2 details average life expectancy at birth for the Wider Zone. As seen, life expectancies for both males and females are generally good, as they are either in line with, or above, national averages.

Table 16.2: Average life expectancy at birth, from 2008-2010 to 2016-2018

Location	2008-2010		2010-2012		2012-2014		2014-2016		2016-2018	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Wider Zone	79.1	83.1	79.6	83.4	79.7	83.7	79.7	83.5	79.7	83.5
South East	79.5	83.3	80.2	83.7	80.4	83.9	80.6	84.0	80.7	84.1

England	78.4	82.3	79.1	82.9	79.4	83.1	79.5	83.1	79.6	83.2

Source: Life Expectancy at birth and age 65 by sex

16.7.2.4 Census 2021 asked respondents to report the status of their own health; the results for the Immediate Zone, the Wider Zone and England are presented in table 16.3. The health profile of the Immediate and Wider Zones are very similar although as seen, reported health is slightly worse than national averages, with fewer people in the Immediate and Wider Zones reporting themselves as being in "very good health".

Table 16.3: General Health

General Health	Immediate Zone	Wider Zone	England
Very good health	43.3%	43.2%	48.5%
Good health	36.7%	36.6%	33.7%
Fair health	14.7%	14.8%	12.7%
Bad health	4.2%	4.3%	4.0%
Very bad health	1.1%	1.1%	1.2%

Source: Census 2021

Housing Quality and Design

Dwelling Size

16.7.2.5 According to Census 2021 data, the average dwelling size in the Immediate Zone is slightly smaller in the Immediate Zone when compared to the Wider Zone and England. There is a greater proportion of households living in 1- and 2-bed properties, and a smaller proportion of households living in properties with 3 or more bedrooms.

Table 16.4: Number of Bedrooms

Number of bedrooms	Immediate Zone	Wider Zone	England
1 bedroom	13.0%	11.8%	11.6%
2 bedrooms	31.2%	30.9%	27.3%
3 bedrooms	36.9%	38.4%	40.0%
4+ bedrooms	18.8%	19.0%	21.1%

Source: Census 2021

Housing Type

16.7.2.6 The most popular housing types in the Immediate Zone are broadly similar to that of the Wider Zone and England, although there are slightly fewer households living in houses and bungalows and slightly more households living in flats, maisonettes and apartments.

Table 16.5: Housing Type

Housing Type	Immediate Zone	Wider Zone	England
Whole house or bungalow	75.7%	77.6%	77.4%
Flat, maisonette or apartment	23.1%	21.0%	22.2%
A caravan or other mobile or temporary structure	1.2%	1.3%	0.4%

Source: Census 2021

Housing Tenure

16.7.2.7 Table 16.6 displays the housing tenure of households across the assessment areas. Home ownership rates are significantly higher in the Immediate Zone (71.4%) than In England (62.3%). Although the proportions of people living in the private rented sector are broadly similar, there is a far smaller proportion of people in the Immediate Zone living in the social rented sector (8.9%) when compared to England (17.1%).

Table 16.6: Housing Tenure

Housing Tenure	Immediate Zone	Wider Zone	England
Owns outright	43.6%	44.3%	32.5%
Owns with a mortgage or loan or shared ownership	27.8%	28.1%	29.8%
Social rented	8.9%	9.3%	17.1%
Private rented or lives rent free	19.7%	18.3%	20.6%

Source: Census 2021

Housing Completions

16.7.2.8 The most recent Housing Delivery Test (HDT) for Arun District Council was published in January 2022 (Ref 1.11). The HDT outlines the percentage of housing requirements which have been over the last three-year period:

- November 2018: 91%
- November 2019: 68%
- November 2020: 61%
- November 2021: 65%

16.7.2.9 As such, it is evident that housing delivery in the District is particularly low.

House Prices and Affordability

16.7.2.10 Data on house prices is available from the UK House Price Index (Ref 1.12) at a local authority level. In June 2022, the average house price in the Wider Zone was £361,347; this is significantly higher than the English national average of £303,557, but slightly below the South East average of £388,873.

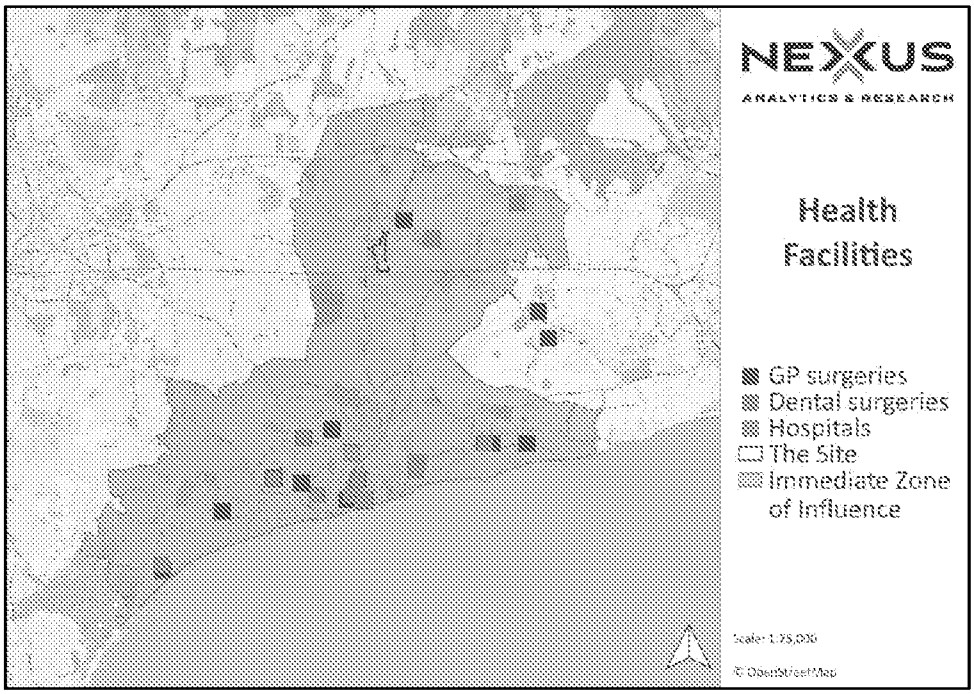
16.7.2.11 The ONS provides data on housing affordability through its ratio of house price to workplace-based earnings. The Wider Zone has an affordability ratio of 12.6, which means residents must pay, on average, 12.6 times their salary for a house. This ratio has steadily increased year-on-year. In 2011, when the Local Plan period began, the ratio was 10.0, and as such there has been a 26% increase. In England, the affordability ratio is 8.3, and as such housing within the Wider Zone is considerably less affordable than national averages.

16.7.3 Access to Healthcare Services and Other Social Infrastructure

Healthcare Services

16.7.3.1 Healthcare services and facilities within the Immediate Zone can be seen in Figure 16.2.

Figure 16.2: Health Facilities



16.7.3.2 The Site falls within the catchment areas of four GP surgeries, as seen in table 16.7. The Croft Surgery and Meadowcroft Surgery are two separate surgeries but share patients and staff, and so capacity numbers have only been listed once. Based on HUDU population size standards of 1,800 people to justify one General Practitioner[20], it can be seen that currently all surgeries are over-capacity. Across the surgeries there is a combined over-capacity of 8,717 patients, which equates to nearly 5 FTE GPs.

16.7.3.3 The Care Quality Commission (CQC) also inspects all providers of care, including GP surgeries. All relevant surgeries have received a grade of 'Good' at their most recent inspection, indicating that the quality of care in the local area is generally high.

[20] HUDU Planning Contribution Model Guidance Notes

Table 16.7: GP Surgery Capacities

GP Name	CQC rating	No. of patients (July 2023)	No. of FTE GPs	Patient capacity	GP capacity
The Croft Surgery	Good	12,072	5.5	-2,172	-1.2
Tangmere Medical Centre	Good	7,448	1	-5,648	-3.1
Avisford Medical Group	Good	11,697	6	-897	-0.5
Meadowcroft Surgery	Good	-	-	-	-
Net		**31,217**	**12.5**	**-8,717**	**-4.8**

Source: Patients registered at a GP practice

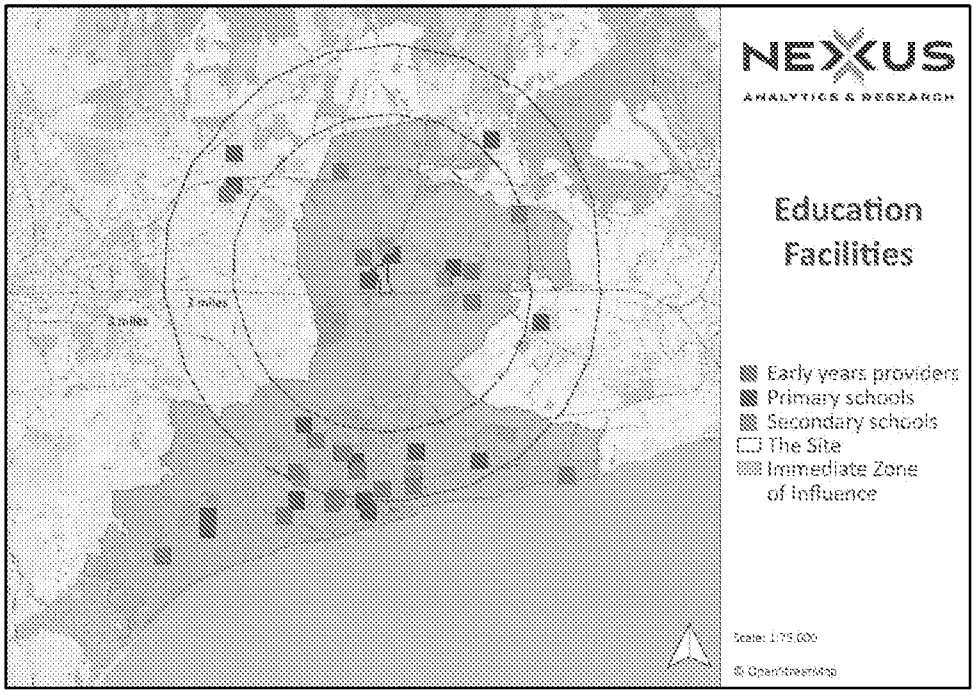
16.7.3.4 The nearest hospital Is Bognor Regis War Memorial Hospital, located around 5km from the Site. St Richards Hospital, located approximately 8km from the Site in Chichester, offers a wider range of facilities and services.

16.7.3.5 There are 14 dental surgeries located within the Immediate Zone. However, of the two practices located closest to the Site - Chantry House Dental Practice and Walberton Dental Surgery - neither are currently accepting new NHS patients.

Education Facilities

16.7.3.6 Figure 16.3 below illustrates the proximity of education facilities (including early years providers, primary schools and secondary schools) in relation to the Site.

Figure 16.3: Education Facilities



16.7.3.7 Within a 2-mile radius of the Site, five facilities offering early years childcare have been identified, as listed in Table 16.8. This includes two day nurseries, two pre-schools and one childminder, offering a level of variety to parents. Additionally, of the four nurseries which have had an inspection from Ofsted, all have received a grade of 'Good', suggesting the quality of childcare available is generally high. Recent and consistent capacity data at early years level is currently unavailable.

Table 16.8: Early Years Providers

Provider name	Ofsted grade	Type of provider
Hopscotch Pre-School	Good	Pre-School
Sarah Dominick Childminding	Good	Childminder
Seasons @ Aldingbourne Trust	Good	Day Nursery
Squirrel's Den Daycare	N/A	Day Nursery
Walberton Pre-School	Good	Pre-School

16.7.3.8 Within a 2-mile radius of the Site there are three primary schools, as seen in table 16.9. All three schools have achieved the grade of 'Good' at their latest Ofsted inspection.

16.7.3.9 Across the three schools there are a total of 735 school places with 708 enrolled pupils, resulting in a headroom of 27 pupils. There is some variation in capacity, however, with Barnham and Eastergate primary schools having some minor capacity, whereas Aldingbourne Primary School is already overcapacity.

Table 16.9: Primary School Capacity (2022)

School name	School places	Pupils on roll	Headroom
Aldingbourne Primary School	210	213	-3
Barnham Primary School	315	294	+21
Eastergate CofE Primary School	210	201	+9
Total primary school capacity	**735**	**708**	**27**

Source: Planning School Places 2023

16.7.3.10 West Sussex County Council's Planning School Places document (Ref 1.16) also discusses the capacity of primary schools within the District.

16.7.3.11 The Site falls within the Barnham/Westergate primary planning area. The capacity across all primary schools in this area was reported to be 92%. School planning areas are considered to be at full capacity when the capacity level exceeds 95%. Although this indicates the area currently has some capacity, the Council anticipates demand to increase and as such is exploring options to expand primary provision.

16.7.3.12 There are four secondary schools within a 3-mile radius of the Site; however, two of these, Felpham Community College and the Regis School are located within Bognor Regis and are not considered to be within a walkable distance from the Site.

16.7.3.13 Details of the other two schools can be seen in Table 16.10. As seen, there is existing capacity of 165 pupils at Ormiston Six Villages Academy but an overcapacity of 58 places at St Philip Howard Catholic School, resulting in a total capacity of 107 places.

16.7.3.14 However, the Planning School Places document indicates that the Barnham/Westergate secondary school planning area is already at 99% capacity, which exceeds the recommended 95% occupation level.

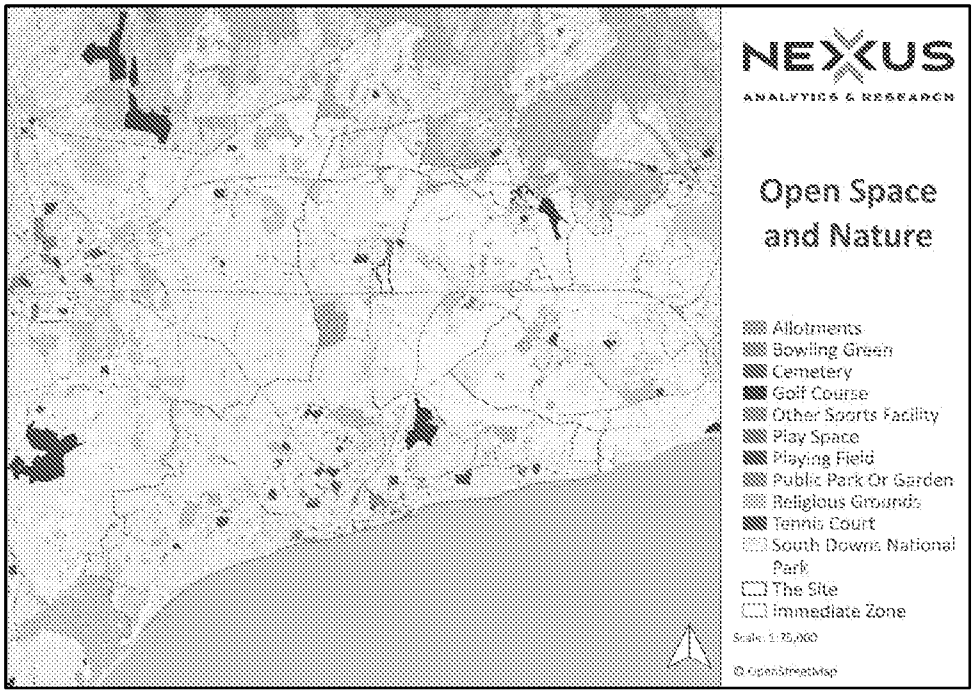
Table 16.10: Secondary School Capacity (2022)

School name	School places	Pupils on roll	Headroom
Ormiston Six Villages Academy	823	658	+165
St Philip Howard Catholic School	900	958	-58
Total secondary school capacity	**1,723**	**1,616**	**107**

Access to Open Space and Nature

16.7.3.15 Residents of the Immediate Zone have above average access to open space and nature. Figure 16.4 illustrates the different kinds of open space in the Immediate Zone, as defined by the OS Greenspace dataset.

Figure 16.4: Open Space and Nature



Source: OS Greenspace

16.7.3.16 In Westergate itself, the Six Villages Sports Centre and Aldingbourne Community Sports Centre offer a range of sports facilities. Other playing fields and play spaces are available throughout the settlement.

16.7.3.17 In Bognor Regis there is a wider range of open spaces and sports facilities, as indicated in Figure 16.4.

16.7.3.18 The Immediate Zone is also located on the border of the South Downs National Park, and is only 5km from the beach at Bognor Regis, and as such residents are able to benefit from these vast areas of natural open space.

16.7.3.19 Evidence from the Arun District Council Open Space Assessment (Ref 1.17) also suggests that residents are generally satisfied with both the quantity and quality of open space available.

16.7.4 Air Quality, Noise and Neighbourhood Amenity

16.7.4.1 As outlined in the Arun District Council Air Quality Annual Status Report (Ref 1.18), air quality in the District is generally good, and air quality objectives for Nitrogen Dioxide are being met. As such, no Air Quality Management Areas (AQMAs) have been designated in the District.

16.7.5 Accessibility and Active Travel

16.7.5.1 The Site is well connected by footpaths, allowing easy movement on foot between Westergate, Eastergate and Barnham.

16.7.5.2 The closest bus stops to the Site are located on Westergate Street and provide services to Bognor Regis, Eastergate, Barnham and Yapton, although these are not particularly regular.

16.7.5.3 The closest train station is Barnham train station, located just over 2km from the Site. The station provides regular services to locations including Portsmouth, Southampton, Brighton and London.

16.7.6 Crime Reduction and Community Safety

16.7.6.1 According to the IMD 2019 (Ref 1.9), both LSOAs that the Site is located in have a decile score of 8 in the domain of crime, which places them in the least 30% deprived LSOAs nationally.

16.7.6.2 Data from the ONS confirms that crime rates in the Wider Zone are generally low. In the year ending March 2023, Arun reported 70 crimes per 1,000 population, which is lower than the wider Sussex rate of 76 crimes per 1,000 population, and the national rate of 93 crimes per 1,000 population. However, the most frequent crime committed is "violence against the person" which is likely to require greater health support.

16.7.6.3 The Site is located away from main roads and as such it is anticipated road collisions would be a minor risk only. The main roads that travel through Westergate - Westergate Street and Nyton Road - both have 30mph speed limits in place. In the five-year period 2017-2021, there were only two collisions categorised as "serious" and twelve collisions categorised as "slight" along Westergate Street and Nyton Road. No fatal collisions were recorded during this time period[21].

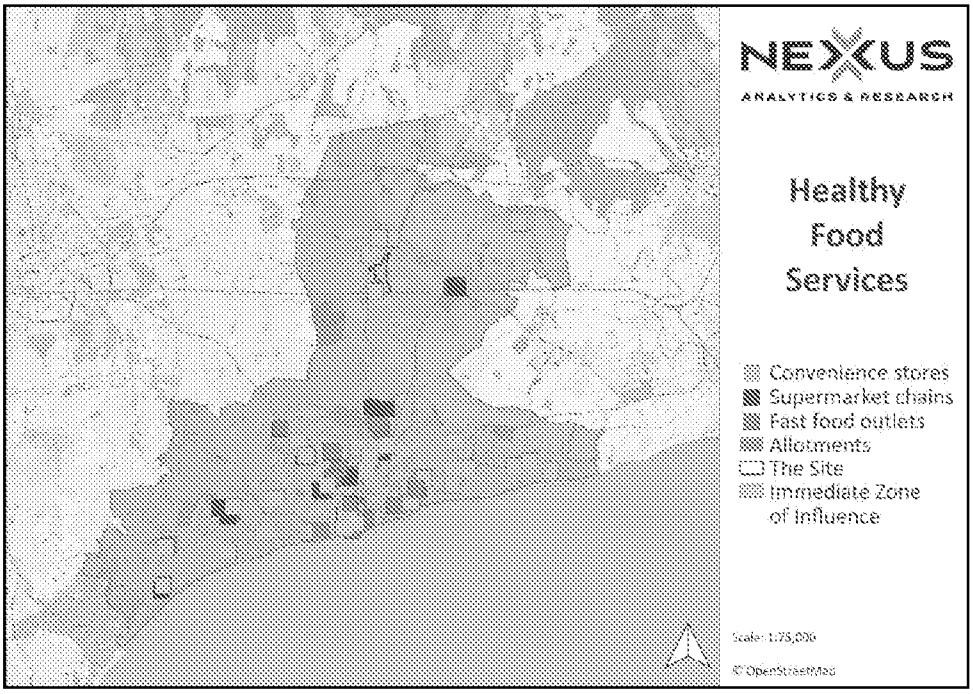
16.7.7 Access to Healthy Food

16.7.7.1 As seen in Figure 16.5, there are a number of convenience stores, supermarkets and fast-food outlets in the Immediate Zone. In Westergate Itself, there are four convenience stores. The nearest supermarkets are a Co-operative and Tesco Express at Barnham and an Aldi and Lidl located in the outskirts of Bognor Regis. There are no fast-food outlets or takeaways present in Westergate, though there are a few in Barnham.

16.7.7.2 Though there are a few allotments in Bognor Regis, there is only one allotment within Westergate, located to the immediate north of the Site. However, this is small, and it is unclear whether there is capacity for new members.

[21] Crashmap.co.uk

Figure 16.5: Healthy Food Services



16.7.8 Access to Work and Training

16.7.8.1 As outlined in socio-economic ES chapter, only 22.1% of residents in employment in the Immediate Zone work mainly from home, which is lower than District and national averages.

16.7.8.2 By far the most popular method of travelling to work is by private vehicle. At 62.8%, this is well above the national average of 49.6%.

16.7.8.3 Although levels of active travel (10.1%) are broadly similar to national averages, use of public transport (3.9%) is around half that of England (8.2%).

16.8 Rapid Health Impact Assessment Matrix

Table 16.11: Rapid Health Impact Matrix

Assessment criteria	Relevant?	Health evidence	Potential health impact	Recommended amendments or enhancement actions to be proposed under consideration
Housing quality and design				

Assessment criteria	Relevant?	Details/evidence	Potential health impact?	Recommended amendments or enhancement actions to the proposal under consideration
Does the proposal include a range of housing types and sizes, including affordable housing responding to local housing needs?	☒ Yes ☐ Partial ☐ No	The Proposed Development intends to deliver a range of housing types and sizes, from 1 bedroom flats to 4 plus bedroom houses. A quantum of the provided housing will be affordable.	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	Provide an appropriate housing mix that is informed by available local housing needs evidence at the time any reserved matter details are submitted and determined.
Does the proposal seek to meet all 16 design criteria of the Lifetime Homes Standard or meet Building Regulation requirement M4 (2)?	☒ Yes ☐ Partial ☐ No	The Proposed Development is at the outline planning application stage. Detailed design will be a matter for subsequent stages in the development process.	☐ Positive ☐ Negative ☐ Neutral ☒ Uncertain	In accordance with relevant adopted local policies the Proposed Development should provide Lifetime Homes Standard properties.
Does the proposal address the housing needs of older people, i.e. extra care housing, sheltered housing, lifetime homes and wheelchair accessible homes?	☒ Yes ☐ Partial ☐ No	In accordance with relevant adopted local policies, and identified local needs, the Proposed Development intends to provide an appropriate mix and type of homes to meet needs for older people.	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	Design could seek to maximise the number of dwellings with ground floor access or lift access built to Lifetime Home standards, or easily adaptable for residents with wheelchairs. Turning space for wheelchairs could also be taken into account within dining areas and living rooms along with adequate circulation space for

Assessment criteria	Relevant?	Details/evidence	Potential health impact?	Recommended amendments or enhancement actions to the proposal under consideration
				wheelchairs elsewhere.
Does the proposal include homes that can be adapted to support independent living for older and disabled people?	☒ Yes ☐ Partial ☐ No	The Proposed Development is at the outline planning application stage. Detailed design will be a matter for subsequent stages in the development process. However, the Proposed Development has been designed to secure the 12 Building for Life principles.	☐ Positive ☐ Negative ☐ Neutral ☒ Uncertain	In accordance with relevant adopted local policies the Proposed Development should provide an appropriate proportion of homes that can be adaptable to support independent living disabled people.
Does the proposal promote good design through layout and orientation, meeting internal space standards?	☒ Yes ☐ Partial ☐ No	The Proposed Development is at the outline planning application stage. Individual house design, layout, orientation and internal space standards is a matter for subsequent stages for the development process.	☐ Positive ☐ Negative ☐ Neutral ☒ Uncertain	Good design principles and any local design, layout and space policy requirements should be applied as part of the reserved matters stages. Incorporate interior spaces and level surfaces that allow freedom of movement in all areas and rooms.
Does the proposal promote development that will reduce energy requirements and living costs and ensure that homes are	☒ Yes ☐ Partial ☐ No	Details of individual property and building types is a matter for subsequent stages of the development process.	☐ Positive ☐ Negative ☐ Neutral ☒ Uncertain	Where possible take forward and incorporate the 'future proofing development' recommendations.

Assessment criteria	Relevant?	Details/evidence	Potential health impact?	Recommended amendments or enhancement actions to the proposal under consideration
warm and dry in winter and cool in summer?				
Access to healthcare services and other social infrastructure				
Does the proposal retain or re-provide existing social infrastructure?	☒ Yes ☐ Partial ☐ No	The wider strategic allocation includes proposals to provide a new community hub (including new retail and commercial facilities, a library and healthcare facilities) and two new primary schools. The Proposed Development is expected to make financial contributions towards the above.	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	No further measures identified.
Does the proposal address the proposed growth / assess the impact on healthcare services?	☒ Yes ☐ Partial ☐ No	Analysis has been undertaken to assess the impact of the Proposed Development on local health and social care services. This analysis of local health services suggests that GP surgeries are currently overwhelmed, and the Proposed Development is likely to put this under further strain. The provision of medical/health services as part of the wider strategic allocation can help to alleviate pressures on the local healthcare system. The Proposed Development is	☐ Positive ☐ Negative ☒ Neutral ☐ Uncertain	No further measures identified.

Assessment criteria	Relevant?	Details/evidence	Potential health impact	Recommended amendments or enhancement actions to the proposal under consideration
		expected to make financial contributions to this.		
Does the proposal include the provision, or replacement of a healthcare facility and does the facility meet NHS requirements?	☒ Yes ☐ Partial ☐ No	The wider strategic allocation includes a new community hub which will provide medical/health facilities. The Proposed Development is expected to make financial contributions to this.	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	No further measures identified.
Does the proposal assess the capacity, location and accessibility of other social infrastructure, e.g. schools and community facilities?	☒ Yes ☐ Partial ☐ No	Proximity analysis has been undertaken to identify the location and accessibility of social infrastructure within the Immediate Zone of Influence. The Site is located in close proximity to two primary schools and Ormiston Six Villages Academy, all of which have existing capacity. However, it is unlikely that this capacity will be able to accommodate new demand from the Proposed Development and the wider strategic allocation. The Proposed Development is expected to make financial contributions to new early years, primary and secondary facilities, as	☐ Positive ☐ Negative ☒ Neutral ☐ Uncertain	No further measures identified.

Assessment criteria	Relevant?	Details/evidence	Potential health impact?	Recommended amendments or enhancement actions to the proposal under consideration
		part of the wider strategic allocation.		
Does the proposal explore/allow for opportunities for shared community use and co-location of services?	☒ Yes ☐ Partial ☐ No	The wider strategic allocation will provide a new community hub and indoor sports facilities which will allow opportunities for a variety of shared community uses. The Proposed Development is expected to make financial contributions towards the above.	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	No additional recommendations are made at this stage.
Access to open space and nature				
Does the proposal seek to retain and enhance existing and provide new open and natural spaces to support healthy living and physical activity?	☒ Yes ☐ Partial ☐ No	The Site already has public access via PROWs. The Proposed Development has been developed with open space at its core. The Proposed Development has large areas of communal green open space, along with areas designated for biodiversity. The areas of green space and landscape open space will benefit people of all ages and create biodiversity habitats. Children's play places are also included within the Proposed Development.	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	It is considered that the Proposed Development where possible retains and enhances existing open space and natural spaces and therefore no further recommendations are made at this stage.
Does the proposal promote links	☒ Yes ☐ Partial ☐ No	A network of green spaces will thread their way through the new	☒ Positive ☐ Negative ☐ Neutral	It is considered that the Proposed Development

Assessment criteria	Relevant?	Details/evidence	Potential health impact	Recommended amendments or enhancement actions to the proposal under consideration
between open and natural spaces and areas of residence, employment and commerce?		neighbourhood and provide the opportunity for circular walks which also link to the open countryside.	☐ Uncertain	provides links between open and natural spaces and public realm and therefore no further recommendations are made at this stage.
Does the proposal seek to ensure that open and natural spaces are welcoming, safe and accessible to all?	☒ Yes ☐ Partial ☐ No	The areas of open and natural space within the Proposed Development will benefit people of all ages and disabilities and create habitats for wildlife.	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	It is considered that the Proposed Development entails open and natural spaces that are welcoming, safe and accessible by all. No further recommendations are therefore made at this stage.
Does the proposal seek to provide a range of play spaces for children and young people (e.g. play pitches, play areas etc.) including provision for those that are disabled?	☒ Yes ☐ Partial ☐ No	The Proposed Development provides formal play spaces, alongside other informal areas of play space for children of all ages.	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	It is considered that the Proposed Development provides an appropriate level and range of play spaces for children and young people.
Does the proposal set out how new open space will be managed	☒ Yes ☐ Partial ☐ No	The Proposed Development is at the outline planning application stage. Details of how new open space will be managed and maintained will be a matter for	☐ Positive ☐ Negative ☐ Neutral ☒ Uncertain	This should be agreed prior to the development taking place.

Assessment criteria	Relevant?	Details/evidence	Potential health impact?	Recommended amendments or enhancement actions to the proposal under consideration
and maintained?		subsequent stages for the development process.		
Air quality, noise and neighbourhood amenity				
Does the proposal seek to minimise construction impacts such as dust, noise, vibration and odours?	☒ Yes ☐ Partial ☐ No	Construction impacts will be minimised through the effective implementation of a Construction Environmental Management Plan.	☐ Positive ☐ Negative ☒ Neutral ☐ Uncertain	Monitor CEMP measures to ensure that they are effective in mitigating impacts. Put in place effective community liaison and response measures to deal quickly with any non-compliances or adverse impacts.
Does the proposal seek to minimise air pollution caused by traffic and employment/ commercial facilities?	☒ Yes ☐ Partial ☐ No	There are no AQMAs within the Immediate Zone. The Proposed Development minimises the impacts of air pollution caused by traffic by promoting walking and cycling over car use. There is a network of footpaths and cycleways throughout the neighbourhood which are also connected to the wider network of footpath and cycleways.	☐ Positive ☐ Negative ☒ Neutral ☐ Uncertain	Implement a Construction Transport Management Plan during construction phase. Implement a Residential Travel Plan during occupancy phase to encourage sustainable modes of travel.
Accessibility and active transport				
Does the proposal prioritise and encourage walking (such as through shared spaces)	☒ Yes ☐ Partial ☐ No	The provision of footpaths throughout the Proposed Development will provide a comprehensive route network of both on and off-road paths.	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	It is considered that the Proposed Development encourages walking and therefore no further

Assessment criteria	Relevant?	Details/evidence	Potential health impact?	Recommended amendments or enhancement actions to the proposal under consideration
connecting to local walking networks?		Public Rights of Ways will be retained within the Site, and linked to new footpaths.		recommendations are made at this stage.
Does the proposal prioritise and encourage cycling (for example by providing secure cycle parking, showers and cycle lanes) connecting to local and strategic cycle networks?	☒ Yes ☐ Partial ☐ No	The Proposed Development provides cycle routes on-site which connect to existing networks.	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	At detailed design stage, consider the inclusion of cycle parking facilities.
Does the proposal connect public realm and internal routes to local and strategic cycle and walking networks?	☒ Yes ☐ Partial ☐ No	Internal pedestrian and cycle paths connect to local and strategic networks.	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	Appropriate signage should be provided to nearby local and strategic cycle / walking networks.
Does the proposal support traffic management and calming measures to help reduce and minimise road injuries?	☒ Yes ☐ Partial ☐ No	Primary, secondary and tertiary streets have all been designed to facilitate traffic movement and with pedestrians in mind.	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	It is considered that the Proposed Development includes appropriate traffic management and calming measures to help reduce and minimise road injuries. No further recommendations are

Assessment criteria	Relevant?	Details/evidence	Potential health impact?	Recommended amendments or enhancement actions to the proposal under consideration
				therefore made at this stage.
Is the proposal well connected to public transport, local services and facilities?	☒ Yes ☐ Partial ☐ No	The Site is located in very close proximity to local education facilities. Bus stops to the immediate west of the Site provide services to Eastergate, Barnham and Bognor Regis. Barnham train station is also located just over 2km from the Site, allowing easy access on foot or by cycling.	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	It is considered that the Proposed Development is well connected to public transport facilities, local services and facilities.
Does the proposal promote accessible buildings and places to enable access to people with mobility problems or a disability?	☒ Yes ☐ Partial ☐ No	The Proposed Development is at the outline planning application stage. Detailed design will be a matter for subsequent stages in the development process.	☐ Positive ☐ Negative ☐ Neutral ☒ Uncertain	At the detailed design stage, consider the application of good practice guidelines set out within 'Disability and Inclusive Access to the Built Environment' (2010).
Crime reduction and community safety				
Does the proposal create environments & buildings that make people feel safe, secure and free from crime?	☒ Yes ☐ Partial ☐ No	The principles of Secure by Design have been incorporated into the Proposed Development.	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	No further measures identified.
Does the proposal	☒ Yes ☐ Partial	The Proposed Development includes open space and	☒ Positive ☐ Negative	No further measures identified.

Assessment criteria	Relevant?	Details/evidence	Potential health impact	Recommended amendments or enhancement actions to the proposal under consideration
include attractive, multi-use public spaces and buildings?	☐ No	play spaces which are accessible to all and have multi-uses for residents. The wider strategic allocation also includes a community centre to be used by the public.	☐ Neutral ☐ Uncertain	
Access to healthy food				
Does the proposal support the retention and creation of food growing areas, allotments and community gardens in order to support a healthy diet and physical activity?	☒ Yes ☐ Partial ☐ No	Although the Proposed Development does not directly provide new community gardens, the Site does border an allotment site at Ivy Lane.	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	No further measures identified.
Is there a range of retail uses, including food stores and smaller affordable shops for social enterprises?	☒ Yes ☐ Partial ☐ No	Retail uses are not included as part of the Proposed Development. However, the wider strategic allocation will provide a community hub with new retail and commercial facilities.	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	The community hub should allow space for food stores and small enterprises.
Does the proposal avoid contributing towards an over-concentration of hot food	☒ Yes ☐ Partial ☐ No	The Proposed Development does not comprise a hot food takeaway (Class A5) use.	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	No further measures identified.

Assessment criteria	Relevant?	Details/evidence	Potential health impact	Recommended amendments or enhancement actions to the proposal under consideration
takeaways in the local area?				
Access to work and training				
Does the proposal seek to provide new employment opportunities and encourage local employment and training?	☒ Yes ☐ Partial ☐ No	The Proposed Development will provide 84 FTE direct jobs during the construction phase. The Proposed Development does not include any employment space. However, residential spend in the local area is likely to generate 26 new employment opportunities.	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	Consider opportunities to source local employment during the construction phase and operation through the promotion of jobs in local job centres and school/colleges. Consider apprentice and volunteering schemes where appropriate.
Does the proposal provide childcare facilities?	☒ Yes ☐ Partial ☐ No	No childcare facilities are included within the Proposed Development, although the wider strategic allocation is expected to provide a community centre and new primary school, both of which may allow opportunities for childcare.	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	No further measures identified.
Does the proposal include managed and affordable workspace for local businesses?	☒ Yes ☐ Partial ☐ No	Workspaces are not included within the Proposed Development. However, the wider strategic allocation is expected to provide new employment floorspace.	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	Consider the inclusion of flexible and affordable workspaces for small businesses as part of the new employment floorspace provided.
Does the proposal include	☒ Yes ☐ Partial ☐ No	During the construction period, the level of construction employment is	☒ Positive ☐ Negative ☐ Neutral	Local employment and the use of local suppliers during the

Assessment criteria	Relevant?	Details/evidence	Potential health impact?	Recommended amendments or enhancement actions to the proposal under consideration
opportunities for work for local people via local procurement arrangements?		expected to be significant (approximately 84 FTE jobs per annum over a six-year build period). These jobs would provide potential local employment opportunities as well as indirect beneficial impacts on the local economy, for example by boosting trade in local shops.	☐ Uncertain	construction phase and operation should be promoted.
Social cohesion and lifetime neighbourhoods				
Does the proposal connect with existing communities where the layout and movement avoids physical barriers and severance and encourages social interaction?	☒ Yes ☐ Partial ☐ No	The amenity and open space within the Site encourages social interaction. In addition to on-site open space, the proposal promotes access to the public realm which will encourage wider social urban and open space interaction.	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	It is considered that the Proposed Development connects existing communities. No further recommendations are made at this stage.
Does the proposal include a mix of uses and a range of community facilities?	☒ Yes ☐ Partial ☐ No	Accessible open spaces offered by the Proposed Development will provide opportunities for a range of uses. The wider strategic allocation will also provide a community centre and other facilities which can be used by the local community.	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	No further recommendations are made at this stage.

Assessment criteria	Relevant?	Details/evidence	Potential health impact	Recommended amendments or enhancement actions to the proposal under consideration
Does the proposal provide opportunities for the voluntary and community sectors?	☒ Yes ☐ Partial ☐ No	The community hub provided within the wider strategic allocation will provide a variety of community uses.	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	No further recommendations are made at this stage.
Does the proposal take into account issues and principles of inclusive and age-friendly design?	☒ Yes ☐ Partial ☐ No	The Proposed Development is at the outline planning application stage. Detailed design will be a matter for subsequent stages in the development process.	☐ Positive ☐ Negative ☐ Neutral ☒ Uncertain	At the detailed design stage, consider the application of good practice guidelines set out within 'Disability and Inclusive Access to the Built Environment' (2010).
Minimising the use of resources				
Does the proposal make best use of existing land?	☒ Yes ☐ Partial ☐ No	The Proposed Development will use the existing land, tress and hedgerows to create a high-quality new neighbourhood.	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	It is considered that the Proposed Development will make the best use of existing land. No further recommendations are therefore made at this stage.
Does the proposal encourage recycling, including building materials?	☒ Yes ☐ Partial ☐ No	The Proposed Development is at the outline planning application stage. Detailed design will be a matter for subsequent stages in the development process.	☐ Positive ☐ Negative ☐ Neutral ☒ Uncertain	Where possible during the construction phase, construction waste could be separated into key waste groups for recycling. The detailed design should incorporate

Assessment criteria	Relevant?	Details of evidence	Potential health impact?	Recommended amendments or enhancement actions to the proposal under consideration
				measures to encourage recycling, including building materials.
Does the proposal seek to incorporate sustainable design and construction techniques?	☒ Yes ☐ Partial ☐ No	Details of sustainable design and construction techniques will be set out within the Design and Access Statement. Specific measures can also be secured by planning conditions.	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	No further measures identified.
Climate change				
Does the proposal incorporate renewable energy and ensure that buildings and public spaces are designed to respond to winter and summer temperatures, i.e. ventilation, shading and landscaping?	☒ Yes ☐ Partial ☐ No	Details of energy efficiency and climate change proofing, including measures to conserve and recycle water will be set out within the Design and Access Statement, and the Sustainability Statement.	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	Residential buildings should be built with the 'fabric first' approach, meeting the requisite Fabric Energy Efficiency Standards under Building Regulations part L1A.
Does the proposal maintain or enhance biodiversity?	☒ Yes ☐ Partial ☐ No	The Proposed Development has large areas of communal green open space, along with areas designated for biodiversity. The areas of green space and landscaped attractive open spaces will create	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	No further measures identified.

Assessment criteria	Relevant?	Details of evidence	Potential health impact?	Recommended amendments or enhancement actions to the proposal under consideration
		habitats for wildlife and widen the biodiversity value of the Site.		
Does the proposal incorporate sustainable urban drainage techniques?	☒ Yes ☐ Partial ☐ No	A drainage strategy incorporating SUDS will be implemented as part of the Proposed Development.	☒ Positive ☐ Negative ☐ Neutral ☐ Uncertain	No further measures identified.
Any other comments?				
The Proposed Development is currently at outline planning application stage and therefore its impact on several receptors is uncertain at this point. Several measures have been identified which can help the Proposed Development to improve health outcomes. At the reserved matters stage, therefore, these measures should be considered and implemented where possible. In receptors where we can be certain about their impact, the Proposed Development is identified to have either a positive or neutral impact. No negative health impact outcomes have been identified that would necessitate further detailed analysis.				
Name of assessor and organisation	Nexus Analytics and Research			
Date of assessment	21/08/23			

16.9 References

16.9.1 Below is a list of relevant references for the Health Impact Assessment Chapter:

- 2022 Air Quality Annual Status Report, Arun District Council (2022)
- Adopted Arun Local Plan 2011-2031, Arun District Council (2018)
- Arun District Council Open Space Assessment Report, Knight, Kavanagh & Page (2016)
- Arun Housing Delivery Test Result 2021, Arun District Council (2022)
- Census 2021, Office for National Statistics (2021)
- crashmap.co.uk (2023)
- Creating healthy and sustainable places, West Sussex County Council (2020)
- Crime in England and Wales year ending March 2023, Office for National Statistics (2023)
- Health Impact Assessment in spatial planning, Public Health England (2020)

- Healthy and safe communities PPG, Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government (2022)
- House price to workplace-based earning ratio, Office for National Statistics (2023)
- HUDU Planning Contribution Model Guidance Notes, NHS London Healthy Urban Development Unit (2019)
- Index of Multiple Deprivation, Ministry of Housing, Communities & Local Government (2019)
- Life expectancy at birth and age 65 by sex, Office for National Statistics (2019)
- National Planning Policy Framework, Ministry of Housing, Communities & Local Government (2021)
- Patients registered at a GP practice (July 2023), National Health Service (2023)
- Planning School Places 2023, West Sussex County Council (2023)
- Rapid Health Impact Assessment Tool (Fourth Edition), London Healthy Urban Development Unit (2019)
- UK House Price Index Dataset, HM Land Registry (2023)
- West Sussex Joint Strategic Needs Assessment Summary 2021/2022, West Sussex County Council (2022)

17. Conclusion

17.1 Summary
17.2 The Mitigation Strategy
17.3 Cumulative Effects
17.4 Conclusions

17 Conclusions

17.1 Summary

17.1.1 A comprehensive Environmental Statement has been prepared to assess the environmental impacts of the short term (construction) and longer term (occupation) phases of the development of land east of Westergate to accompany a hybrid planning application that has been submitted to Arun District Council, which is seeking full permission for the site access off Westergate Street and through Pine Close; east-west link road, including a bridge over the Lidsey Rife and associated works and outline permission with all matters reserved (except for access) for up to 400 residential dwellings and associated works.

17.1.2 The planning application is accompanied by a comprehensive range of supporting plans and documents (which together comprise the environmental information).

17.1.3 This Environmental Statement has been prepared in accordance with the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 and explains, examines and assesses the need and alternatives that have been considered, the proposals, the existing environment, the impacts of the developments on the environment before and after mitigation and any residual impacts.

17.1.4 The site forms part of the wider Barnham/ Eastergate/ Westergate strategic housing site (SD5) set out at Policy H SP1 of the adopted Arun Local Plan 2011-2031. The requirements for this strategic allocation are set out at Policy H SP2c, which includes that *"this allocation is located around the small settlements of Barnham Eastergate and Westergate. This Strategic Allocation will provide at least 2,300 dwellings over the plan period, and up to 3,000 in total (a further 700 beyond 2031)".*

17.1.5 The development has been designed to maximise the use of the land to meet the aspirations of the site allocation and providing a link to the wider strategic site, whilst at the same time responding to the site's characteristics and needs of future residents to minimise environmental impacts. The strategy for the design process was to prevent, reduce, remedy or offset any significant adverse effects on the environment that may result from the short-term construction phase and longer term occupation phase.

17.1.6 From the outset the objective has been to design the scheme to minimise adverse environmental impacts as far as possible, this chapter however provides an overview of the proposed mitigation strategy to address any significant impacts. The processes of assessment, proposal design and consultation was carried out in parallel, this has meant that any potential for significant impact was identified at an early stage. As the EIA progressed and the significance of potential impacts became clearer, time was spent amending and refining the proposal to address impacts wherever possible to avoid the need for additional mitigation.

17.1.7 Consultation with Officers at Arun District Council, the public and other key stakeholders have played an important role in the evolution of this scheme and wherever possible local aspirations and concerns have been addressed.

17.2 The Mitigation Strategy

17.2.1 The mitigation strategy adopted a sequential approach, including:

- Impact prevention
- Reduction, and
- Mitigation

17.2.2 Wherever practicable prevention has been applied during development of the mitigation strategy. At the strategic level, the site has been allocated for the development in the adopted Local Plan and at the design stage, opportunities for preventing or designing-in mitigation of impacts was taken, to avoid the need for additional mitigation wherever possible.

17.2.3 Key Aspects of the Mitigation Strategy

17.2.3.1 The detailed mitigation measures for each element of the scheme are set out in the individual chapters. This section however describes the most important of the measures which have been designed into the development.

17.2.3.2 Transport, Accessibility & Movement

17.2.3.2.1 Construction Phase

- Construction Traffic Management Plan to reduce the impact of construction traffic on the highway network, which will include traffic routing, timing of vehicle movements and other controls (such as use of banksman) to ensure the safe movement of construction traffic to and from the site.

17.2.3.2.2 Operational Phase

- Upgrading existing PRoW and permissive paths through the site to provide attractive and accessible walking and cycling routes to use as an alternative to the A29
- Travel Plan to encourage and facilitate walking, cycling and use of public transport in preference of private car trips
- Delivery of east-west link road to the wider BEW strategic site

- Until the full A29 realignment is complete, this bridge over the Lindsey Rife will act as a pedestrian, cycling and bus only link into wider strategic site, thereby prioritising trips by non-car modes
- Pedestrian/cycle routes along the east-west link road
- All dwellings to be provided with secure cycle parking
- Pedestrian and cycle crossing facilities
- The development will be making a financial contribution to transport infrastructure in the vicinity of the site

17.2.3.3 Landscape and Visual

- The mature tree and hedgerow structure of the site is largely retained, where possible
- Native hedgerows with specimen trees and areas of woodland are proposed along the boundaries of the site including the southern edge
- Replacement and compensatory tree planting
- The use of a consistent palette of street trees and hedgerows within the development
- Sympathetic use of locally appropriate building materials and colours
- Carefully designed lighting restricted to the minimum
- Integrated internal tree planting and soft landscaping

17.2.3.4 Ecology

17.2.3.4.1 Construction Phase

- Vegetation removal will take place outside of the bird nesting season (March-August), or following a check by an ecologist
- Tree protective fencing will be installed to protect retained trees and shrubs from direct impact and from severance or asphyxiation of the roots
- A pre-commencement precautionary badger survey will be undertaken and best practice measures will be put in place to avoid impacts
- Mitigation strategies for protected species recorded on site will be put in place during construction periods to ensure that retained populations are not adversely affected. Works affecting biodiversity will be overseen by an ecologist and the site will be the subject of an ecological management plan
- Any floodlighting will be located away from important features and directed away

17.2.3.4.2 Operational Phase

- Measures to be designed into the dwellings to encourage biodiversity, including swift bricks and sparrow terraces
- Bat and bird boxes will be installed on retained tress

- Sensitive lighting strategy to minimise impacts on habitats and species of importance
- Measures will be incorporated to benefit hedgehogs

17.2.3.5 Air Quality

17.2.3.5.1 Construction processes will be controlled by the Construction Environment Management Plan to include 'Best Practicable Means' of working and controls to address the development's construction air quality impacts, including:

17.2.3.5.2 Construction Phase

General Communication

- A stakeholder communications plan
- Name and contact details of person(s) accountable for air quality and dust issues should be displayed on the site boundary
- Dust Management Plan (DMP), which may include measures to control other emissions

Site Management

- All dust and air quality complaints should be recorded and causes identified. Appropriate remedial action should be taken in a timely manner with a record kept of actions taken including of any additional measures put in place to avoid reoccurrence
- Any exceptional incidents that cause dust and/or air emissions, either on or offsite should be recorded, and then the action taken to resolve the situation recorded in the log book

Monitoring

- Daily on-site and off-site inspections should be undertaken, where receptors (including roads) are nearby to monitor dust
- The frequency of site inspections should be increased when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions

Preparing and maintaining the site

- Plan the site layout so that machinery and dust causing activities are located away from receptors, as far as is practicable
- Where practicable, erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site

- Where practicable, fully enclose the site or specific operations where there is a high potential for dust production and the site is active for an extensive period
- Avoid uncontrolled site run-off 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 where they should be appropriately covered
- Where practicable, cover, seed or fence stockpiles to prevent wind whipping

Operating vehicle/machinery and sustainable travel

- Ensure all vehicle operators 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
- A maximum-speed-limit of 15mph on surfaced and 10mph on unsurfaced haul roads
- A Construction Logistics Plan should be produced to manage the sustainable delivery of goods and materials
- A Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing)

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 and particulate matter suppression or 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 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
- Avoid bonfires and burning of waste materials.

Measures Specific to Earthworks

- Re-vegetate earthworks and exposed areas and soil stockpiles to stabilise surfaces as soon as practicable
- Stockpile surface areas should be minimised (subject to health and safety and visual constraints regarding slope gradients and visual intrusion) to reduce area of surfaces exposed to wind whipping

- Where practicable, windbreak netting/screening should be positioned around material stockpiles and vehicle loading/unloading areas, as well as exposed excavation and material handling operations, to provide a physical barrier between the Application Site and the surroundings
- Where practicable, stockpiles of soils and materials should be located as far as possible from sensitive properties, taking account of the prevailing wind direction
- During dry or windy weather, material stockpiles and exposed surfaces should be dampened down using a water spray to minimise the potential for wind whipping
- Only remove the cover in small areas during work and not all at once

Measures Specific to 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
- For smaller supplies of fine powder materials, ensure bags are sealed after use and stored appropriately to prevent dust
- All construction plant and equipment should be maintained in good working order and not left running when not in use

Measures Specific to Trackout

- 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 in frequent use
- Avoid dry sweeping of large areas
- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport
- Inspect onsite 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 log-book
- Where practicable, hard surfaced haul routes should be installed, 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 10m from receptors where possible

17.2.3.5.3 Operational Phase

- All gas-fired boilers (where used) to meet a minimum standard of <40mg/NOx/kWh
- Consideration should be given to renewable sources of energy (e.g. air source heat pumps) and the requirements for electric vehicle charging.
- Implementation of travel plan to encourage sustainable modes of travel and reduce vehicle emissions

17.2.3.6 Noise & Vibration

17.2.3.6.1 Construction Phase

17.2.3.6.2 Construction processes will be controlled by the Construction Environment Management Plan to include 'Best Practicable Means' of working and controls to address the development's construction noise impacts, including:

- Limiting hours of work
- Plant items will be properly maintained and operated according to manufacturers' recommendations in such a manner as to avoid causing excessive noise
- All plant items should be sited so that the noise effects at nearby noise-sensitive properties are minimised
- Where appropriate, plant items will be fitted with silencers or acoustic enclosures
- Hoarding will be erected around the construction works to shield residential properties from noisy activities
- Deliveries will be scheduled to arrive during daytime hours only and vehicles will be routed so as to minimise disturbance to local residents.
- Delivery vehicles will be prohibited from waiting within the site or on the public highway with their engines running
- If necessary, operating times of particularly noisy activities may be reduced;
- Good communication will be maintained with the occupants of nearby residential properties to inform them of works progress
- Construction vibration will be considered whenever the piling method for the construction works has been identified

17.2.3.6.3 Operational Phase

- A noise barrier is proposed to the southern site boundary with the railway line with a minimum surface density of 15 kg/m^3 and comprise a solid construction with no holes or gaps to reduce noise from the rail line across the development and will also mitigate railway noise levels at existing adjacent properties

17.2.3.7 Built Heritage and Archaeology

17.2.3.7.1 Construction Phase

- To reduce possible impacts, investigation works through a Written Scheme of Investigation is suggested to identify potential features by trial trenching to assess the nature, inform the knowledge base of archaeology and enable preservation of any buried archaeological deposits if appropriate

17.2.3.7.2 Operational Phase

- No mitigation measures are proposed

17.2.3.8 Water Environment

17.2.3.8.1 Best practice recommendations for the prevention of contamination will be outlined in more detail in a Construction Environmental Management Plan (CEMP). This will include measures to comply with relevant legislation and guidance, and best practice measures in line with the Considerate Contractors Scheme and Site handbook for the construction of SuDS (CIRIA C698) (tertiary mitigation). Generic measures that will be included are as follows:

- Awareness training will be provided to construction workers on the sources / risks of flooding
- Signing up to the Environment Agency's flood warning system to receive up to date flood warnings. In addition, the weather forecast should be checked daily, and works should be postponed in time of severe rainfall events to mitigate potential risk of flooding to construction workers
- No materials or site cabins should be stored / located in the areas indicated to be at risk of fluvial or surface water flooding
- Relevant safe working procedures should be applied for any operations near the existing watercourses to minimise flooding risks
- Installation of temporary drainage strategy during construction, incorporating attenuation features which may remain as part of the operational surface water drainage system (e.g., settling ponds). The temporary strategy would be defined and managed and take account of industry best practice, relevant guidance and standards, including British Standard 8582:2013
- Sub-surface flow paths will be assessed prior to construction, in accordance with British Standard 8533:2017
- Suitable dewatering techniques will be used if required, in consultation with the Environment Agency, and associated permits will be obtained
- Any additional land drainage or culverts within the site are to be mapped and the source identified to maintain the local area drainage
- Any raw effluent will be stored in sealed compartments and transferred off-site to receive the appropriate level of treatment, including sludge treatment should it be required

- Use of wheel washing
- A Pollution Control Plan will be developed prior to construction occurring, this will identify pollution pathways / watercourses and access points / pollution trapping locations so that should a pollution event occur a rapid response is possible to prevent further contamination of the water environment;
- Management of construction pollution using inspection points and plant spill kits to limit migration. Appropriate storage measures are to be provided (e.g., bunded storage of oils)
- An erosion prevention and sediment control plan will be prepared and implemented to reduce the quantity of sediment entrained in runoff and to prevent hydro-morphological changes to surface water features such as watercourses, existing ponds and existing sewers. This will include measures such as settlement lagoons and/or silt filters.

17.2.3.8.2 Operational Phase

- Mitigation measures that have been embedded the design and included as part of the operational stage are outlined below:
    - Locating the development footprint outside Flood Zone 3 and the 1 in 100 year plus climate change (with 36% increases in flows) flood extents
    - Implementation of a new drainage system prepared in accordance with latest national, regional and local standards and guidance
    - Preparation and implementation of an operational adoption and maintenance plan for the new drainage system throughout the lifetime of the development
    - Existing watercourses will be protected or carefully diverted where necessary, and / or enhanced as part of the drainage strategy. Appropriate easements / buffers will be incorporated into the design
    - Finished floor levels will be set a minimum of 150 mm above external ground levels

17.2.3.9 Socio-Economics

17.2.3.9.1 In order to avoid, prevent, reduce or offset identified adverse impacts and maximise beneficial outcomes on socioeconomic and human health receptors by phase, the following mitigation measures are proposed.

17.2.3.9.2 Construction Phase

- Setting up a Construction Partnership agreement between the local authority, local training providers, Job Centre Plus and the construction contractors to assist in ensuring local people, both unemployed or young people getting ready to leave school, are appropriately skilled and well placed to take advantage of construction opportunities.
- Many contractors have their own programmes that involve taking local young people and unemployed residents into work and training. These should be explored and co-ordinated with relevant providers at the earliest opportunity.

17.2.3.9.3 Operational Phase

- Implement a Travel Plan to encourage sustainable modes of travel.

17.2.3.10 Ground Conditions

17.2.3.10.1 Construction Phase

17.2.3.10.2 Best practice recommendations for the prevention of contamination will be outlined in more detail in a Construction Environmental Management Plan (CEMP), including:

- The storage of fuel, material and oil storage within a suitably sized storage areas located outside of flood risk areas and away from watercourses, with suitable bunding to contain any spills
- Environmental management control will be put in place to avoid the discharge of suspended solids in surface water runoff, spillages of fuels/oils/chemicals during refuelling or movement of construction equipment, use of hazardous building materials and run-off from concrete placement
- Excavation and storage of soil will be required during the construction of the development, access road, site compound, and service laying, with sub-soil and topsoil stockpiled separately
- The stockpiling area should be properly designed away from flood risk areas and managed to prevent contamination spread, ensure proper drainage, and minimise risks. Stockpiled soils might be sent to an appropriate treatment facility or landfill once the necessary permits and arrangements are in place
- Install spill prevention equipment, such as spill containment pallets, drip trays, and absorbent materials, to capture any fuel that might leak from containers and implement a rigorous maintenance and inspection schedule
- Use storage tanks and containers that are in good condition and compliant with regulations
- Install secure lids, valves, and fittings on storage tanks to prevent accidental spillage
- Regularly inspect storage areas, tanks, and containers for signs of leakage or deterioration and address any maintenance issues promptly to prevent potential spills
- Excavated material would be tested to determine any associated hazardous properties and Waste Acceptance Criteria
- During excavation, waste arisings would be carefully controlled and managed to prevent the uncontrolled release of contaminants
- Drainage should be constructed as required for temporary hard surfaces and structures, to avoid the discharge of any contaminants to the ground
- New roads will be constructed of granular material, and drainage will be constructed as appropriate, depending on the requirements of the individual accessways

17.2.3.11 Minerals

- No mitigation is necessary.

17.2.3.12 Climate Change & Resilience

17.2.3.12.1 Construction Phase

- Construction vehicles will be managed through a Construction and Environmental Management Plan (CEMP), as well as a Construction Traffic Management Plan (CTMP) which will include appropriate construction traffic routing, such as avoiding sensitive receptors including schools and driving at off-peak times

- Use of efficient vehicles, avoiding vehicle idling and limiting the time that vehicles are operating

17.2.3.12.2 Operational Phase

- An Electric Vehicle ('EV') charging point at every plot throughout the development
- Contribution to upgrade bus stops on the A29, which will contribute to increased public transport usage.
- Implementation of a Travel Plan to reduce private vehicle usage and increase public transport use
- Managing landscape and habitats to maximise biodiversity and recreational value
- Dwellings will be designed to address any overheating impacts
- Measures to minimise water usage for domestic properties
- Drainage will be designed to include SuDS features at the detailed design stage and will manage storm discharge across the development

17.3 Cumulative Impacts

17.3.1.1 This Environmental Statement has also considered the cumulative effects of the development with other proposals within the local area where there is a reasonable likelihood that these projects will be delivered e.g. a development with an extant consent, consent that is under construction or an allocation in an adopted development plan. No significant in combination effects have been identified.

17.4 Conclusion

17.4.1.1 The development of land east of Westergate forms part of an important development opportunity to help meet the Council's aspirations for growth within the District and assisting the Council help meet its housing needs.

17.4.1.2 The proposal has been designed to minimise impacts on the environment and where this was not possible a comprehensive range of mitigation measures have been applied in order to reduce any predicted impacts. In general it is not considered that the proposals will have any significant or unacceptable residual environmental impacts.



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