

13. PART 1: CLIMATE CHANGE MITIGATION

Introduction

- 13.1 This chapter of the ES assesses the likely significant effects of the Development on the environment in respect of climate change.
- 13.2 The chapter has been prepared by Barton Willmore, now Stantec, Institute of Environmental Management and Assessment (IEMA) EIA Quality Mark registrants. A statement of expertise is included at Appendix 1.2.
- 13.3 This chapter should be read in conjunction with the following appendices and figures, which have been used to inform the assessment:
- Appendix 13.1 Relevant Policies, Legislation and Guidance; and
 - Appendix 13.2 Traffic Flow Data.
- 13.4 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).

Policy Context

- 13.5 Further policies, legislation, and guidance relevant to the chapter is included in Appendix 13.1.

National Legislation

- 13.6 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.¹"

¹ S.I. 2017 No. 571: Part 1; 4(2)(C)

*"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"*².

Climate Change Act 2008ⁱ

- 13.7 Further to the Climate Change and Sustainable Energy Act (2006), the Climate Change Act (2008) sets a legally binding target for reducing GHG emissions, in particular carbon dioxide (CO₂), by at least 80% (on 1990 levels) by the year 2050 in the United Kingdom (UK), and a requirement that domestic emissions are reduced by no less than 3% each year.
- 13.8 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. In May 2019, the CCC recommend a new emissions target for the UK: a 100% reduction ('net zero') in greenhouse gases by 2050. This change in legislation mandating a 100% reduction in CO₂ emissions by 2050 was approved by the House of Commons on 24th June 2019 and the House of Lords on 26th June 2019.
- 13.9 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 2029ⁱⁱ.

National Planning Policy Framework and Planning Practice Guidance

- 13.10 The National Planning Policy Framework (NPPF)ⁱⁱⁱ, 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 153 of the NPPF states:

"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."

² S.I. 2017 No. 571: Schedule 4; 5(f)

- 13.11 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.
- 13.12 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.
- 13.13 National Planning Practice Guidance (PPG)^{iv} was published in June 2014 and 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.
- 13.14 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.

Local Planning Policy

13.15 The Rochdale Core Strategy^v was adopted in October 2016 and sets out a vision for the Borough until 2028. The following policies within the Core Strategy are deemed relevant to climate change mitigation.

Policy G1 - Tackling and adapting to climate change

13.16 We will address climate change and ensure growth does not increase CO2 emissions by:

- *Locating growth in areas which are likely to minimise the need for travel and which are well served by public transport, services and infrastructure;*
- *Expecting all development and regeneration schemes to be well connected to surrounding areas and facilities by sustainable means of transport (Policy T2);*
- *Encouraging and promoting renewable energy developments, including standalone and community developments, that do not, by virtue of their scale, siting, construction or operation, cause harm to the local area, its character and environmental assets and adjoining uses, which cannot be satisfactorily mitigated (Policy G3);*
- *Promoting the efficient re-use of buildings, especially those of heritage value, and the recycling of construction waste;*
- *Making the best use of open space to contribute to climate change mitigation and adaptation; and*
- *Securing planning obligations for energy infrastructure and climate change adaptation measures.*

New developments will be expected to:

- a. Be zero carbon in line with national targets and definitions;*
- b. Adhere to the 'energy hierarchy' as outlined in policy G2, being designed in such a way that ensures that buildings require the minimum amount of energy to function over their lifetime;*
- c. Reduce CO2 emissions through the use of renewable and low carbon decentralised energy technologies and networks. This will be through both on-site provision in new developments and through connection to local networks;*
- d. Address the impacts of climate change by incorporating comprehensive adaptation measures, including:*
 - i. suitable measures, such as urban greening, for tackling the 'urban heat island' effect;*
 - ii. where possible, the opening up of covered and culverted sections of waterways and provision of new water features, to help cooling and provide biodiversity, landscape and flood prevention benefits;*
 - iii. the incorporation of appropriate water conservation and management measures, such as Sustainable Drainage Systems (SuDS), including ensuring that the rate of run-off on 'greenfield' sites is not increased and on 'brownfield' sites is significantly reduced, and avoiding the use of impermeable surfaces;*

- iv. the retention of existing trees wherever possible and the taking of all appropriate opportunities to plant trees and other suitable vegetation on site; and*
- v. the incorporation of 'green roofs' wherever possible, such as with flat roofs.*

Policy G2 – Energy and new development

All new development will be expected to adhere to the following energy hierarchy to the extent that policy G2 reflects national policy, targets and requirements for that type of development:

- 1. Demand Reduction – Achieve the maximum possible reduction in demand for energy through building design (i.e. the use of passive systems). At the design stage of new developments, every effort should be made to ensure that buildings use as little energy as possible throughout their lifetimes, using siting, orientation, layout, construction and landscaping to optimise use of natural passive systems such as solar gain and natural lighting, shading, ventilation and cooling to minimise heating, cooling and lighting demands. Green roofs and green walls should be incorporated into developments wherever feasible.*
- 2. Energy efficiency and low / zero carbon technologies and networks – Design to maximize energy efficiency, and use on-site or linked low or zero carbon technologies or direct connection to a low or zero carbon heat source (not necessarily on-site).*
- 3. 'Allowable solutions' – use wider energy efficiency / CO2 reduction measures, which could include developer contributions, to compensate for 'residual emissions' not addressed by 1 or 2 above.*

Technical Guidance

Building Regulations

13.17 As of 2015, the Code for Sustainable Homes was withdrawn and merged into the Buildings Regulations. 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^{vi}. Part L addresses controls for:

- Insulation values of buildings elements;
- The allowable area of windows, doors and other openings;
- The air permeability of the structure;
- The heating efficiency of heating systems;
- Hot water storage and lighting;
- Mechanical ventilation and air conditioning systems;
- Space heating controls;
- Airtightness testing of larger buildings; and

- Requirements for Carbon Index ratings.

Future Homes Standard^{vii}

- 13.18 The Government has recently 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'.
- 13.19 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^{viii}

- 13.20 In February 2022, IEMA published this guidance as a revision of the 2017 edition (referred to hereafter to as 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.
- 13.21 The updated IEMA 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.
- 13.22 The 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 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'.

- 13.23 The 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 Greenhouse Gas Statistics

- 13.24 The Department for Business, Energy & Industrial Strategy (BEIS)^{ix} (now the Department for Energy Security and Net Zero) 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 2005-2020 for RBC.

UK Carbon Budgets

- 13.25 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 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. As the sixth carbon budget is the most recently adopted budget (enacted through the Carbon Budget Order 2021), the sixth carbon budget is utilised within this ES Chapter for operational assessments.

Assessment Methodology

General Approach

- 13.26 '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. Part 1, assessed in this section is summarised below:

- **Part 1:** The direct and indirect influence of the Development on climate change (climate change mitigation).

13.27 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)^x 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;
- In-Use Carbon: Carbon emissions from the operational use of the Development including: Operational regulated energy, use, maintenance, repair, replacement, and refurbishment.

13.28 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 (not included in the Whole Lifecycle carbon process).

13.29 As the planning application is a hybrid application, with the majority of the Development in outline, there is currently very 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-A3³ and A5⁴ from the whole lifecycle process have therefore been scoped out of this ES Chapter. Furthermore, lifecycle modules B1-B5⁵ and the end-of-life phase⁶ (C1-C4) have also been scoped out of this ES Chapters, 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.

³ 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.

⁴ 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.

⁵ B1: Use or application of the installed product; B2: Maintenance; B3: Repair; B4: Replacement; and B5: Refurbishment.

⁶ 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.

Consultation

13.30 A request for an EIA Scoping Opinion was submitted to RBC on the 31st October 2022. The EIA Scoping Report (Appendix 2.1) did not scope climate change into the ES. The EIA Scoping Opinion was adopted by RBC on 15th February 2023. The Scoping Opinion (Appendix 2.2) requested that a climate change chapter be scoped into the ES.

13.31 The EIA Scoping Opinion (Appendix 2.2) considered it would be appropriate to scope in Climate Change and GHGs as in July 2019, RBC declared a climate emergency and a responsibility to take action to reduce carbon emissions.

Scope of Assessment

13.32 This part of 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.

Temporal Scope

13.33 The assessment assumes a Development completion year of 2038, (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 Transport Assessment (TA) and ES Chapter 9 Transport. Therefore, this chapter is aligned with Chapter 9 Transport, Chapter 10 Air Quality and Chapter 11 Noise in assessing vehicular emissions from 2019 and 2033 (as set out in Chapter 9 Transport and Access, a future assessment year of 2033 has been adopted, 10 years for the year of application, in line with the National Highways guidance “The strategic road network: Planning for the future”).

Spatial Scope

13.34 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 TA and the same traffic

data has been used for the Air Quality assessments within Chapter 10 of this ES. The study area involves a detailed study area and a wider general modelling area, covering 47 road links surrounding the Site. The study area links, provided by the Transport Consultant are included in Appendix 13.2.

Determining Significance

- 13.35 There is currently no industry – wide agreed threshold of carbon emissions which, if exceeded, can be defined as significant or potentially significant. The 2022 IEMA GHG Guidance acknowledges that all emissions could lead to cumulatively significant effects.
- 13.36 The IEMA GHG Guidance (2022) 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.
- 13.37 The updated IEMA 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.

Assessing Operational Vehicle Greenhouse Gas Emissions

- 13.38 The assessment of carbon emissions and the evaluation of their significance is set out in IEMA Guidance (2022). 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.
- 13.39 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.

- 13.40 The baseline conditions of the Site were based on the trip rates and existing published data sets (Appendix 13.2). 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 Emissions Factors Toolkit (EFT V11.0)^{xi} utilised for the assessment.
- 13.41 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

- 13.42 24-hour, Average Annual Daily Traffic (AADT) flows (Appendix 13.2) were provided by the Transport consultant for the following scenarios:
- 2022 Base;
 - 'Do-minimum' (2033) (Baseline + growth + committed developments); and
 - 'Do-something' (2033) (Baseline + growth + committed developments + the Development).
- 13.43 As set out above, a future assessment year of 2033 has been adopted by the Transport consultant, which is 10 years for the year of application and in line with the National Highways guidance "The strategic road network: Planning for the future".
- 13.44 Fleet composition was provided utilising the baseline split of Heavy Duty Vehicles (HDV) and Light Duty Vehicles (LDV) for each of the 47 road links assessed as part of the Study Area for this assessment, which was informed from the data available from the TA modelling.
- 13.45 As per Appendix 13.2, 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.

- 13.46 In the absence of pre-defined distances for vehicles, the most recent UK average journey distance is defined by the National Travel Survey^{xii} provided by the Department for Transport as 10.9km (6.8 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

- 13.47 Assumptions of the inputs used in the carbon modelling are provided in Table 13.1 and details provided at Appendix 13.2. This includes the percentage of HDV vehicles per road link.

Table 13.1: Traffic Data Assumptions

Variable	2022 Base		2033 'Do-minimum'		2033 'Do-something'	
24 hour Average Annual Daily Traffic (AADT) of the Development*	Flow (vehicles/day – AADT)	687,890	(vehicles/day – AADT)	751,199	(vehicles/day – AADT)	797,243
Link Length	10.9km					
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						

- 13.48 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

- 13.49 The operational energy usage assessed within this chapter is derived from the findings of the Energy & Climate Adaptation Statement, submitted in support of the planning application. This has assessed operational energy usage for the detailed phase of the Development (Phase 1) which comprises 233 dwellings. The Energy strategy calculates the predicted regulated energy demand and associated carbon emissions for house types provided in the detailed element of the hybrid application, providing an indicative sample of the Development, as this information is not currently available for the outline element of the application.

Carbon Sequestration

- 13.50 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 breaking down habitats present on the Site, as per the Biodiversity Net Gain (BNG) report. The carbon sequestration potential for the existing habitat is provided by Natural England's Capital Accounts^{xiii} and Natural England's Carbon Storage and Sequestration by Habitat October 2021^{xiv}, which provides tonnes of CO₂ equivalent per hectare year (tCO₂eq/ha/yr) for differing types of habitats.
- 13.51 As described in Chapter 3, the Site comprises of agricultural land that is divided into a number of irregular shaped fields defined by a mature hedgerow. The Site extends to 87.52 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 sequestering no carbon has been undertaken. Other habitats provided in the BNG report have been grouped according to shared characteristics and agreed with the Project Ecologist.
- 13.52 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, deriving information from the parameter plan (Figure 3.1) and the BNG report.

Significance Criteria

- 13.53 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 (2022) 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 negligible, beneficial, or minor, moderate or major as set out in Table 13.2 below. As per the IEMA Guidelines, when evaluating significance, all new GHG emissions contribute to a significant adverse environmental effect.
- 13.54 IEMA provide examples of significance criteria, which are outlined below in Table 13.2. These examples have been utilised alongside professional judgement for assessing the impact of the Development at the national level.

- 13.55 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 13.2: Emissions Significance Criteria (National Level)

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.'

- 13.56 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 Guidance. The Committee of Climate Change (CCC)^{xv} 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.

- 13.57 Table 13.3 below shows the adopted carbon budgets up to 2037 for the UK.

Table 13.3: UK Carbon Budgets

Carbon Budget	Total Budget (MtCO ₂ e)
3 rd (2018-2022)	2,544
4 th (2023-2027)	1,950
5 th (2028-2032)	1,725
6 th (2033-2037)	965

- 13.58 The Tyndall Centre carbon budget tool^{xvi} 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.

- 13.59 Table 13.4 below presents the RBC 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 RBC for 2018 and 2019 have been based on BEIS (now the Department for Energy Security and Net Zero) provisional national emissions data for 2018 and assuming the same year on year reduction rate applied to 2019.

Table 13.4: RBC Carbon Budgets

Carbon Budget	Total Budget (MtCO₂e)
3 rd (2018-2022)	4.0
4 th (2023-2027)	2.1
5 th (2028-2032)	1.0
6 th (2033-2037)	0.5

- 13.60 As the completion year of the Development is predicted to be 2038, the 6th carbon budget has been adopted for assessment within this ES chapter, as the 7th carbon budget (when the first year of operation would fall into) is yet to be published by the UK government.
- 13.61 As outlined in the updated IEMA Guidance, the crux of significance is not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050.

Limitations and Assumptions

- 13.62 The following assumptions and limitations that apply to this assessment have been set out in this section.
- 13.63 The assessment of climate change and GHG emissions is based on available best practice information.
- 13.64 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 (2033 for transport and 2038 for operational energy) within a carbon budget.
- 13.65 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 the

Department for Energy Security and Net Zero) data. Therefore, emissions from operational transport, for example, will be compared against the entire RBC carbon budget, as opposed to an allocated transport budget based on transport emission sources.

- 13.66 The initial modelling of carbon emissions for vehicles during operation is illustrative as real – time carbon emissions associated with the Development are not available.

Baseline Conditions

Current Baseline GHG Emissions for the Region

- 13.67 The current GHG emissions at the Borough Level are provided in Table 13.5. A breakdown of total GHG emissions from the three main sources for RBC are provided over the period of 2005-2020 utilising the most recent data set.

Table 13.5: GHG Emissions within RBC 2005-2020

Year	Industry and Commercial Total (kt CO ₂)	Domestic Total (kt CO ₂)	Transport Total (kt CO ₂)	Grand Total (CO ₂)	Population ('000s, mid-year estimate)	Per Capita Emissions (t)
2005	427.6	519.2	529.5		207.2	
2006	433.5	518.1	513.3		207.8	
2007	417.4	499.1	514.5		208.4	
2008	414.0	496.1	477.8		209.7	
2009	349.1	446.0	475.8		210.2	
2010	369.8	472.0	472.1		210.8	
2011	322.9	415.0	472.6		211.9	
2012	361.2	440.7	464.2		211.9	
2013	339.1	429.8	448.8		212.1	
2014	299.0	361.6	439.4		213.0	
2015	272.5	356.8	445.2		214.3	
2016	237.2	333.1	452.0		216.4	
2017	224.9	317.5	444.9		218.5	
2018	220.2	312.0	444.6	1,046.6	220.0	4.8
2019	194.6	305.1	452.2	1,024.7	222.4	4.6
2020	175.2	294.3	388.8	924.5	223.7	4.1

- 13.68 Grand total emissions and emissions per capita could not be calculated from 2005-2017 due to changes in the BEIS calculation method. Table 13.5 above shows a downward trend of emissions across the industrial and commercial, domestic and transport sectors. Emissions from domestic sources have declined by approximately 44% between 2005 and 2020. Grand total emissions and per capita emissions have also shown a downward trend since 2018.

Future Baseline

GHG Emissions

- 13.69 In absence of the Development, GHG emissions arising from the Site 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 would continue to sequester carbon at its current rate.

Likely Significant Effects

Construction Phase

Construction Transport Emissions

- 13.70 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 CO₂ 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 2025 and 2038. 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.
- 13.71 Carbon emissions associated with construction are relatively small when compared with the total user carbon emissions over the study period. As detailed in Chapter 5 Construction Methodology & Phasing of this ES, daily construction vehicle movements are anticipated to be approximately 34 HDVs and 131 LDVs per day. Therefore, upon consideration of the baseline traffic flows for the Site (See Appendix 13.2), there is likely to be a **Negligible** overall effect on the climate from construction vehicle emissions when compared to the baseline of the Site.

Operational Phase

Operational Transport Emissions

- 13.72 The impacts of carbon emissions arising from the operational phase of the Development are identified as having a contribution to climate change.

- 13.73 As outlined in the Design and Access Statement (DAS) submitted with the planning application and Figure 3.1, the primary access road via the A664 Rochdale Road provides a 'looped' route in and out of the Development, which will be suitable for a potential future bus route. The network of Public Rights of Way (PRoW's) throughout the Site will be retained and will provide active travel routes throughout the Development and into the existing surrounding built form. There will be several pedestrian and cycle access points, as shown in Figure 3.1, including from Thornham New Road, Thornham Lane and via Carnforth Avenue. These access points will encourage sustainable forms of travel from new residents. Furthermore, as outlined in Chapter 3 of the ES, each dwelling within the detailed phase of the Development will have an electric vehicle charging point (EVCPs), equating to 233 EVCPs, providing the appropriate infrastructure for EV's for future residents. EVCP's for the outline element of the Development would be secured through suitably worded planning conditions.
- 13.74 The Development will result in an increase in vehicle movements on the local road network. As shown in Appendix 13.2 and Table 13.1, the AADT traffic flow associated with the 2022 baseline scenario is 687,890 vehicle trips per day. The 2033 Do Something scenario (Baseline Growth + Committed Developments + the Development) is 797,243 vehicle trips per day. The Development, with growth values and committed developments applied, therefore results in an uplift of 109,353 vehicle trips per day.
- 13.75 In total, the uplift in vehicular trips represents 50,839 tCO₂e/year of vehicular emissions locally. This accounts for 10.17% of RBC's 6th carbon budget.
- 13.76 Nationally, the uplift in vehicular emissions from the Development represents 0.005% of the UK's 6th carbon budget (965 MtCO₂e).
- 13.77 In line with IEMA guidance and the significance criteria displayed in Table 13.2, the uplift in vehicular movements and emissions as a result of the Development (and wider growth + cumulative schemes) would result in a **Major Adverse** and **significant** effect.

Operational Energy Use

- 13.78 The Energy & Climate Adaptation Statement submitted in support of the planning application has undertaken energy modelling for the operational energy use for the detailed phase (233 dwellings) of the Development.

- 13.79 The detailed phase of the Development will follow the 'Energy Hierarchy' which includes demand reduction, energy efficiency and low / zero carbon technologies, and allowable solutions⁷, if required.
- 13.80 A range of energy efficiency measures will be incorporated into the Development, such as: highly insulated building fabric with external walls, floors, and roofs of low U-values to reduce heat loss, efficient double-glazed windows, low air permeability, and the use of natural ventilation. Dwelling heat and hot water demand will be met by low carbon technology using Air Source Heat Pumps (ASHP).
- 13.81 Following the implementation of the energy hierarchy, the current predicted residual regulated GHG emissions associated with the operation of 233 dwellings (the detailed phase) is 149 tCO₂e/year. This represents a 53% reduction below the Part L 2021 baseline, as well as 0.03% of RBC's 6th carbon budget and 0.000015% of the UK's 6th carbon budget (965 MtCO₂e).
- 13.82 In line with IEMA Guidance outlined in Table 13.2, the likely effect from operational energy emissions is considered to be **Minor Adverse** and **not significant**.

Carbon Sequestration

- 13.83 The potential levels of carbon sequestration at the Site pre and post Development have been calculated and are provided in Tables 13.6 below.

Table 13.6: Carbon Sequestration Potential

Habitat Type	Pre-Development (ha / km)	Post-Development (ha / km)	Habitat Sequestration potential (tCO ₂ eq/ha/yr)	Total sequestered (baseline) tCO ₂ eq/yr	Total sequestered (Development) tCO ₂ eq/yr
Amenity Grassland	0	4.02	1.55	0	6.23
Semi-Natural Grassland	75.2463	88.502	1.55	116.63	137.18
Scrub	1.0223	5.5777	1.55	1.58	8.65
Allotments	0	0.3	0	0	0
Buildings/ Hardstanding	4.9821	14.04	0	0	0
Ornamental Shrubs	2.1247	0	0	0	0
Broadleaved Woodland	1.3361	16.7549	10.71	14.31	179.44
Stream	0.8716	4	3.91	3.41	15.64
Native	10.123km	8.5635km	3.67	0.04	0.03

⁷ Use wider energy efficiency / CO₂ reduction measures, which could include developer contributions, to compensate for 'residual emissions' not addressed by demand reduction, energy efficiency and low / zero carbon technologies.

Hedgerows					
Line of Trees	0.509km	0.171km	10.71	0.005	0.001
Totals				135.975	347.171

- 13.84 As shown on Figure 3.1, the parameter plan outlines areas of green infrastructure throughout the Development. The southern portion of the Development will comprise a community parkland, which will include new and retained landscape features, and ecological enhancement. There are also areas of green infrastructure to the south west of the Development, surrounding St John's church, as well as along the northern and eastern boundaries of the Development. Trees located in the north western, southern and western portions of the Development are anticipated to be retained, as shown on Figure 3.1.
- 13.85 Table 13.6 above shows that the baseline scenario for the Site sequesters approximately 135.975 tCO₂e/year. This primarily comes from the semi-natural grassland and broadleaved woodland throughout the Site.
- 13.86 The introduction of new and varied habitats on the Site, as well as the retention of existing habitats as shown in the BNG assessment will increase the potential of the Site to sequester carbon as shown in Table 13.6 above. The carbon sequestration potential for the Site is 347.171 tCO₂e/year.
- 13.87 Overall, the baseline carbon sequestration potential on the Site is approximately 135.975 tCO₂e/year. The introduction of new and varied planting, including enhanced broadleaved woodland habitat, will increase the carbon sequestration potential to approximately 347.171 tCO₂e/year. This represents an increase in carbon sequestration potential of 211.196 tCO₂e/year, which represents a **Minor Beneficial** effect, which is considered to be **not significant**.

Mitigation Measures

Construction Phase

Construction Traffic Emissions

- 13.88 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.
- 13.89 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.

Operational Phase

Operational Transport Emissions

- 13.90 A Travel Plan will be submitted as part of the planning application and includes the principal aims of encouraging the use of more sustainable modes of transport, such as walking, cycling, and using public transport, reducing the need to travel, and encouraging the use of sustainable travel by improving facilities and providing information.
- 13.91 The Travel Plan outlines 5-year targets to reduce single occupancy car use from 64% to 57.6%, whilst increasing car sharing from 8.9% to 9.5%, public transport from 11.7% to 14.7% and walking/cycling from 8.4% to 9.2%.
- 13.92 Travel Plan measures will include a welcome pack to future residents informing them of public transport links in the local area, public transport timetables, a map showing walking and cycling routes, bike repair information, information on car sharing and details on journey planning.
- 13.93 The Travel Plan will encourage cycling as a mode of travel through initiatives such as increasing the awareness of cycle parking to residents, promoting the availability of cycling information, including route maps, and useful tips and guidance and providing information to residents on local cycling proficiency courses for children.
- 13.94 The Travel Plan Coordinator (TPC) will monitor travel patterns associated with the Site on a regular basis over a five-year period, with baseline surveys commencing within 3 months of the Site reaching 100 occupancies. Following the baseline period, surveys will take place on an annual basis until the construction of the Site has been completed in its entirety, with surveys undertaken at the same time of year upon each anniversary. The TPC(s) will agree the monitoring programme with RBC to ensure that the monitoring procedures are appropriate.
- 13.95 Although the modal shift to sustainable forms of transport will result in a reduction in GHG emissions, alongside the uptake of electric vehicles, this is difficult to accurately quantify.

Operational Energy Use

- 13.96 The energy hierarchy measures which have been incorporated into the detailed phase of the Development (demand reduction and energy efficiency & low/zero carbon measures) would be incorporated into the remaining up to 1,147 dwellings. This will be secured through planning conditions.
- 13.97 The Energy & Climate Adaptation Statement submitted as part of the planning application also concluded that solar PV panels would be a suitable renewable technology for the Development. Although not required, this would be considered during the detailed design process.

Carbon Sequestration

- 13.98 Hedgerows and trees throughout the Site will be retained where possible and any trees to be removed from the Site will be replaced at a ratio of 2:1. Wildflower and woodland planting will comprise of native, species-rich planting and hedgerow planting will improve connectivity between the newly created and existing habitats.
- 13.99 As outlined in Chapter 7 (Biodiversity) of this ES, ecological mitigation and long-term management for habitats and protected species will 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.
- 13.100 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.
- 13.101 As shown in the landscape strategy within the DAS, a series of ponds and wetlands will be included throughout the Development including Newhey Green, Grange Brook, Thornham wetlands and School Pond. These ponds and wetlands will be designed to provide multiple functions: storm water attenuation (SUDs), habitat creation and enhancement, informal leisure, education and attractive features to enhance the sense of place within the Development.

13.102 Further information on the landscaping strategy is available in the DAS submitted separately as part of the application.

Residual Effects

Construction Phase

Construction Traffic Emissions

13.103 As stated previously, construction vehicle emissions are considered to be small compared to the existing baseline. The CEMP and construction routing plan will also include measures to mitigate emissions. 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 **Negligible**.

Operational Phase

Operational Transport Emissions

13.104 As outlined in the additional mitigation measures section above, the Reserved Matters stages will provide opportunities to encourage a modal shift to sustainable modes of transport. Over the lifespan of the Development, it is expected that the composition of EVs associated with the Development will increase as the trajectory to net zero moves closer to 2050. Following the implementation of additional mitigation measures, it is considered that emissions associated with operational transport will decrease over the project lifespan (although this cannot be accurately quantified), and the residual effect is therefore considered to be **Moderate Adverse** and **significant**.

Operational Energy Use

13.105 The use of net zero carbon ready technology allows the Development to achieve net zero operational carbon emissions once the grid decarbonises. Due to the net zero carbon ready design, operational energy emissions will reduce to 134 tCO₂e/year in 2025, 50 tCO₂e/year in 2030 and to zero by 2038. Therefore, the residual effect of operational energy emissions is considered to be **Negligible** and **not significant**.

Carbon Sequestration

- 13.106 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. Furthermore, there will be opportunities for the BNG to improve during the Reserved Matters stages of the Development. Therefore, it is considered that the effect from carbon sequestration potential remains **Minor Beneficial** and **not significant**.

Cumulative Effects

- 13.107 As GHG emissions are global and inherently cumulative, no specific cumulative assessment has been carried out for GHG emission sources.
- 13.108 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.

Summary

- 13.109 The assessment has been undertaken in accordance with published guidance on considering climate change in Environmental Impact Assessment and consequently reviews how climate change has been considered at all stages of the project.
- 13.110 Construction and operation 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 negligible in comparison to the baseline.
- 13.111 Indicative results based on operational vehicle projections for traffic modelling scenarios for 2033 indicate the Development, committed developments and growth will result in an uplift of 109,353 vehicle trips per day. In total, the uplift in vehicular trips represents 50,839 tCO₂e/year of vehicular emissions locally. Following the implementation of additional mitigation measures, including a Travel Plan to encourage more sustainable modes of transport, the residual effect is reduced to Moderate Adverse and significant.
- 13.112 The implementation of the energy hierarchy for the detailed element of the Development will comprise demand reduction measures such as highly insulated building fabric with external walls, floors, and roofs of low U-values to reduce heat loss, efficient double-glazed windows, low air permeability, and the use of natural ventilation. Dwelling heat and hot water demand

will be met by low carbon technology using Air Source Heat Pumps (ASHP). These measures will reduce operational energy emissions below the Part L baseline by 53% and render the detailed element net zero carbon ready. This will result in a Negligible effect, which is not significant.

13.113 The proposed landscaping will enhance the carbon sequestration potential of the Site by 211.196 tCO₂e/year, which represents a Minor Beneficial effect which not significant.

13.114 Table 13.10 contains a summary of the likely significant effects of the Development.

PART 2: CLIMATE CHANGE RESILIENCE

Introduction

13.115 This part of the Climate Change chapter assesses the vulnerability of the Development to climate change (known as climate change resilience).

13.116 This part of the Climate Change chapter is supported by the following appendices:

- Appendix 13.3: Mean Annual Temperature Anomaly;
- Appendix 13.4: Mean Annual Precipitation Anomaly;
- Appendix 13.5: Maximum Summer Temperature Anomaly;
- Appendix 13.6: Summer Precipitation Anomaly;
- Appendix 13.7: Minimum Winter Temperature Anomaly; and
- Appendix 13.8: Winter Precipitation Anomaly.

Policy Context

National Planning Policy

National Planning Policy Framework and Planning Practice Guidance

13.117 National Planning Practice Guidance (PPG)^{xvii} was published in June 2014 and 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.

13.118 Paragraph 005 of the PPG puts forwards recommendations for Local Planning Authorities to consider:

- Identifying no or low-cost responses to climate risks that also deliver other benefits, such as green infrastructure that improves adaptation, biodiversity and amenity;
- Building in flexibility to allow future adaptation if it is needed, such as setting back new development from rivers so that it does not make it harder to improve flood defences in the future; and
- The potential vulnerability of a development to climate change risk over its whole lifetime.

13.119 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 155 and 156 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."

Local Planning Policy

13.120 The RBC Core Strategy was adopted in October 2016 and sets out a vision for Development in the Borough until 2028. The following policies are deemed relevant to climate change adaptation:

Policy G1 – Tackling and adapting to climate change

We will address climate change and ensure growth does not increase CO₂ emissions by:

- Making the best use of open space to contribute to climate change mitigation and adaptation; and
- Securing planning obligations for energy infrastructure and climate change adaptation measures.

Legislative Context

Institute of Environmental Management and Assessment (IEMA): Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation^{xviii}

13.121 The Guide to Climate Change Resilience and Adaptation (June 2020) provides an updated framework for the effective consideration of climate change resilience and adaption in the

EIA process in line with the UK Town and Country Planning (EIA) Regulations (2017) (as amended). This document is a revision of the 2015 IEMA guidance on Climate Change Resilience and Adaption in EIA and reflects lessons learnt from emerging practice.

13.122 A step-by-step method presented within this guidance is set out below and has been incorporated within this Chapter:

- Step 0 – Building climate resilience into the project by considering incorporating resilience during the design stage and by identifying appropriate mitigation measures;
- Step 1 – Scoping for the EIA; e.g. identify the climate change projections for use in the assessment and identify key climatic variables relevant to the project;
- Step 2 – Defining the future (climate) baseline; define future conditions using selected climate change projections (i.e. increase in rainfall, increase in mean summer temperature and wind strength);
- Step 3 – Identifying and determining sensitivity of receptors;
- Step 4 – Reviewing and determining magnitude of the effect; consider probability and consequence to determine the magnitude of the effect;
- Step 5 – Determination of significance;
- Step 6 – Developing additional adaptation / EIA mitigation measures; and
- Step 7 (Development permitted) – Monitoring and adaptive management by implementing mitigation measures.

13.123 EIA Reports produced in line with this guidance are to be proportionate in their approach and not include superfluous assessment that does not address likely material issues.

13.124 The 2020 IEMA Guidance also introduced the concept of 'In-Combination Climate Impacts' (ICCI). An ICCI is when a projected future climate impact (e.g. increase in temperatures) interacts with an effect identified by another topic and exacerbates its impact. ICCI will be summarised within this Climate Change Chapter.

13.125 Assessments undertaken in line with this guidance are to be proportionate in their approach and not include superfluous assessment that does not address likely material issues.

IEMA Climate Change Adaptation Practitioner Guidance^{xix}

13.126 In November 2022, IEMA published guidance on adaptation from both a strategic perspective (i.e., why adaptation must be a core activity for any leading private or public sector organisation), and from a practical one – i.e., how to get started.

13.127 The guidance provides an overview of understanding climate risk and adaptation and offers practical advice to take action to adapt from various perspectives. The guidance includes a 'maturity matrix for adaptation' which sets out 29 actions across five common business functions. The function most appropriate to the Development is 'sites and operations'. This guidance can be adopted to identify the most relevant and useful tasks to form an adaptation approach, which can work in conjunction with the guidance outlined above.

Assessment Methodology

General Approach

13.128 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.

13.129 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. Part 2, assessed in this section is summarised below:

- **Part 2:** The vulnerability of the Development to climate change (climate change adaptation / resilience).

13.130 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"*.

Scope of Assessment

13.131 This part Climate Change Chapter assesses the effects of climate change on the Development by:

- Establishing the existing baseline conditions (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.

Spatial Scope

13.132 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 13.1). The UKCP18 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.

Temporal Scope

13.133 In considering future climate change scenarios, managing climate change resilience and adaption, the IEMA guidance (2020) recommends the use of the UK Climate Projections (UKCP) Website^{xx}. The latest UKCP is UKCP18 which provides updated observations and climate change projections out 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.

13.134 As the construction phase is anticipated to be 14 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.

Identification of Sensitive Receptors

13.135 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 13.7. 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/prevaling 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/prevaling 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/prevaling climatic factors (e.g. retain much of its original function and form).*

13.136 The vulnerability of a receptor can be defined using the following scale:

- *High vulnerability = receptor is directly dependent on existing/prevaling 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 13.7: Receptor Sensitivity

Receptor	Sensitivity	Reasoning
Operation		
Future users of the Site (employees)	Moderate to 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	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 United Utilities Water. The Environment Agency Water Stressed Areas Final Classification for 2021 ^{xvi} classifies the region in which the Site is located as 'Not Seriously Water Stressed'.
Ecology, Landscaping and Planting	Moderate	The Site is 87.52 ha and as outlined in Chapter 7 (Biodiversity) of the ES comprises semi improved & improved wet grassland, hard standing, buildings, semi-natural broadleaved woodland, scattered trees, introduced shrubs, waterbodies, watercourses, hedgerows of varying species richness, scrub and tall ruderal vegetation of mixed species diversity. The majority of the Site comprises semi-improved agriculture fields that are grazed by stock and managed for silage crops, due to

		the current use and agricultural management regime. There are no Tree Preservation Order (TPO) trees within the Site and the hedgerows present are used for field demarcation and stock control. There is evidence of numerous species on-site such as badgers, bats, brown hare, and breeding birds. All species are considered to be of local importance.
Flood Risk	Moderate to High	The Site is located entirely within Flood Zone 1, which is considered to be at the lowest risk (1 in 1000 or 0<0.1% chance) of fluvial flooding in any given year. Much of the Site is at low risk of flooding from all sources (reservoirs, sewage, groundwater). However, there are areas of the Site that are identified as being at low-high risk of surface water flooding, particularly from Thornfields farm buildings in the east to the central portion of the Site, running through the Site in a south westerly direction and following the topography of the Site. The southern portion of the Site, south of Thornham Lane, also has areas of low-high surface water flood risk.

Determining Significance and Significance Criteria

- 13.137 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.
- 13.138 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 Biodiversity, Chapter 9 Transport, and Chapter 10 Air Quality.
- 13.139 A comprehensive Flood Risk Assessment (FRA) (Appendix 2.3) 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.
- 13.140 Chapter 7 Biodiversity 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 13.7 above. This Biodiversity Chapter is based on a wide array of surveys as described in Chapter 7 of this ES.
- 13.141 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 13.7 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 (taking into account the future baseline) are likely to lead to a significant impact on the Development or not.

13.142 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

13.143 The current projections, 'UKCP18', released in November 2018, are the most up to date climate change projections available. The Met Office states that UKCP18 provides a valid assessment of the UK's future climate over land, but that when considering decisions that are sensitive to projected future changes in summer rainfall, additional information should also be used. 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 scenarios are used. Climate projections have been derived from the UKCP 18 50th Percentile Climate Projections at 25 km grid square 387500, 412500 (where the Site is located, as shown in Figure 13.1) using baseline 1981-2000 scenario RCP 8.5.

13.144 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.

13.145 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

13.146 The resilience of the Development to climate change impacts is qualitatively assessed, based on professional expertise and judgement, with quantitative evidence where appropriate.

13.147 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, then a precautionary approach should be employed (IEMA, 2020). Therefore, receptors have been assumed to have a moderate to high sensitivity to the changing climate, as summarised in Table 13.7 above.

Limitations and Assumptions

13.148 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^{xxii}.

"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)..."

13.149 The 21st century projections presented in this report are produced for the Representative Concentration Pathways (RCP)⁸ 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."

13.150 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.

⁸ Established by the Intergovernmental Panel on Climate Change (IPCC).

13.151 The following receptors identified in other ES topic chapters and other supporting documents, are considered potentially sensitive to climate change:

- Biodiversity;
- Transport;
- Air Quality;
- Noise and Vibration;
- Population and Human Health; and
- Flood Risk.

Baseline Conditions

Current Climate Conditions

13.152 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^{xxiii}, which is the Rochdale climate station, approximately 2km north of the Site.

13.153 Climatic averages (1991-2020) for the weather station indicate the following:

- Average annual maximum temperature was 13.13°C;
- Warmest month on average was July (mean maximum temperatures of 20.01°C);
- Coldest month on average was February (mean minimum temperature of 1.41°C);
- Average total annual rainfall was 1197.22 mm (approximately 11%) below the Regional (North West of England) average);
- Wettest month on average was December (average monthly rainfall of 138.88 mm); and
- Driest month on average was May (average monthly rainfall of 65.67 mm).

Future Baseline

Future Climate Conditions (up to 2100)

Table 13.8: 50th Percentile Climate Projections at 25 km grid square 387500, 412500 using baseline 1981-2000 scenario RCP 8.5

Date	Climate Variable at 50th Percentile					
	Mean air temperature anomaly* at 1.5 m (°C)	Annual Precipitation rate anomaly (%)	Maximum 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	0.77	0.50	0.93	-7.46	0.71	2.60
2038	1.17	0.05	1.42	-10.18	1.13	2.64
2050	1.60	0.02	2.05	-16.12	1.56	5.58
2080	3.16	0.66	4.38	-31.75	2.83	13.61
2099	4.53	2.36	6.58	-45.91	4.02	21.14

*Anomaly refers to the change compared to the baseline. The projections are not absolute values.

13.154 The full datasets can be viewed in Appendices 13.3-13.8.

13.155 The projections in Table 13.8 above show a continuous increase in annual average air temperature over the next 80 years. Annual precipitation is also projected to increase slightly over this time.

13.156 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.

13.157 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

13.158 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 of these 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) (Met Office, 2019^{xxiv}).

13.159 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^{xxv}.

Summary

13.160 The North West of England region, where the Site is located, is set to experience hotter, drier summers and milder, wetter winters. With winter precipitation and the number of heavy rain days projected to increase, flooding events may be more likely and occur on a more frequent basis. Whilst there are large uncertainties in the frequency and intensity of storms increasing under climate change, wind speeds are also expected to increase slightly.

Likely Significant Effects

Construction Phase

13.161 As stated in paragraph 13.133, it is considered that changes in the climate that may give rise to potential significant effects are not anticipated to manifest in the 14-year construction timeframe. Construction phase effects are therefore scoped out of this assessment.

Operational Phase

Climate Change Risk Assessment

13.162 Table 13.9 below outlines the likely significant effects from climate on the identified receptors within the Development.

13.163 Moderate adverse effects have been identified on future users of the Site as a result of increased frequency and intensity of heatwaves.

13.164 There is potential for Moderate Adverse effect on habitats, planting, and landscaping as a result of more intense and frequent heatwaves, droughts and increasing flood risk on the Site.

Table 13.9: Climate Change Risk Assessment

Climate Condition / Hazard	Receptor	Receptor Vulnerability	Potential Impact (with embedded mitigation)	Significance
Long Term Changes to Climate Norms	Future Users of the Site	Moderate to 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 shown in Figure 3.1, the Development incorporates green infrastructure and sustainable urban drainage systems (SuDS) which will enhance the resilience of the Development. Green infrastructure includes the community parkland to the south of the Development, there are SuDS attenuation ponds throughout the Development including within the community parkland, and to the west of the Development. The north and east of the Development will also comprise an area of green infrastructure, including new woodland. Areas of blue/green infrastructure throughout the Development will provide thermal cooling as well as flood attenuation.	Minor Adverse
	Infrastructure	Moderate	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	Climate change may have implications on flora species on the Site, including trees and hedgerows.	Moderate Adverse
	Flood Risk	Moderate to High	As shown in Table 13.8, the average annual precipitation is only anticipated to increase slightly 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	Moderate to High	As shown in Table 13.8, summer temperatures are anticipated to increase, and heatwaves will become more frequent. Therefore, placing vulnerable receptors are risk. The Development's green and blue infrastructure will provide a level of thermal cooling during heatwaves. Furthermore, as shown in the Energy and Climate Adaptation Statement all dwellings have been designed to allow for cross-ventilation to reduce the risk of overheating and help them stay cool in warmer conditions. However, overheating assessments should be undertaken at design stage to ensure compliance with Approved Document O: Overheating, this should be secured through a suitably worded planning condition. Without this assessment the effect is considered Moderate Adverse and further steps may need to be taken to reduce overheating on future users of the Site.	Moderate Adverse
	Infrastructure	Moderate	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	Minor Adverse

Climate Condition / Hazard	Receptor	Receptor Vulnerability	Potential Impact (with embedded mitigation)	Significance
			design stage, where risk assessments will be undertaken to manage risks from future climate change in accordance with nationally accepted standards and guidance.	
	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. The region in which the Development is located is served by United Utilities Water, which is within an area that the EA defines as 'Not seriously water stressed'. As shown in Table 13.8, summer rainfall could decrease significantly through the lifespan of the Development, putting pressure on the water supply for the Development. However, it is currently anticipated that the regional water supply is resilient enough to handle periods of low rainfall.	Minor Adverse
	The Natural Environment (Ecology, Landscaping and Planting)	Moderate	Periods of prolonged low rainfall and drought are projected to become more frequent, as suggested in Table 13.8 with rising summer temperatures and declining summer rainfall over the next 80 years. These conditions will put more stress on new and existing plant species throughout the Development, which without management will be more likely to fail.	Moderate Adverse
Heavy Rainfall and Flooding	Future Users of the Site	Moderate	Projections in increased rainfall on average annually, as well as during winter months will place infrastructure at risk during period of heavier rainfall. The EA climate change allowances map for peak river flow in England ^{xxvi} suggests that in the 2020's, the upper limit of changes in peak river flow in the Irwell Management Catchment is 24%, rising to 43% in the 2050's. As shown in the FRA, a climate change uplift of 45% is applied in discharge rate calculations, mitigating the Development from flood risk towards the 2050's. However, in the 2080's the upper limit of peak river flow is 75%. Therefore, towards the 2080's the Development will become more vulnerable to flooding during periods of intense rainfall. The proposed surface water drainage strategy will seek to mimic the hydrological regime of the existing Site by discharging run-off to the existing ordinary watercourses (the Dell) present on-site. Discharge from each proposed catchment within the Development will be controlled to the equivalent greenfield rate.	Minor Adverse
	Infrastructure	Moderate to High		

Climate Condition / Hazard	Receptor	Receptor Vulnerability	Potential Impact (with embedded mitigation)	Significance
			Where surface water flood routes have been identified within the Site, these will be managed through the layout and landscaping design of the Development which will be developed to ensure that exceedance flood flow paths are routed away from vulnerable development and towards landscaped areas, areas of open attenuation or surrounding green/blue infrastructure. The FRA also recommends that finished floors levels are set a minimum of 150mm above the local ground level in line with best practice to mitigate against the risk of surface water runoff.	
	The Natural Environment (Ecology, Landscaping and Planting)	Moderate to High	As shown in Figure 3.1, existing ponds throughout the Development will be retained, including two in the southern portion of the Development to be community parkland, one in the west of the Development and one north of St John's Thornham Primary School. New and existing attenuation ponds and SuDS features will also create biodiversity enhancements on-site, such as through the creation of aquatic plants and species on-site. As shown in the Biodiversity Net Gain Assessment, aquatic habitats such as lakes and wetlands are proposed to be created which will provide flood attenuation and contribute towards resilient planting during periods of heavy rainfall.	Minor Adverse
	Flood Risk	Moderate	The Development will include SuDS, designed to sustainably manage all storm events by releasing surface water runoff at a greenfield runoff rate up to and including the 1 in 100 year plus 45% climate change event, therefore providing the opportunity to enhance the long term resilience of the Development to climate change. As shown in Figure 3.1, areas of green infrastructure will be located in throughout the Development where surface water flood risk is higher, such as the community parkland located south of Thornham Lane. Furthermore, the existing watercourse located in the Phase 1 area of the Site, where surface water flood risk is higher is to be retained. This provides a level of protection from flooding to the built Development. However, as stated in the future users & infrastructure section above, towards the 2080's the Development will become more vulnerable to flooding during periods of intense rainfall. As stated in the FRA, the risk of flooding from numerous sources (fluvial, tidal, surface water, groundwater and sewers) is considered to be very low or low. The entire developable area is within Flood Zone 1, which is considered to be at the lowest risk of flooding. Areas of the Site close to the lower level western boundary may be subject to flooding, this is thought to be exacerbated by culverting of the watercourse in several locations. The FRA concludes that the Development is unlikely to be at risk of flooding. As stated above, the FRA recommends that finished floors levels are set a minimum of 150mm above the local ground level in line with best practice to mitigate against the risk of surface water runoff.	Minor Adverse

Mitigation Measures

Construction Phase

- 13.165 It is anticipated that appropriate construction risk assessments will be implemented to account for potential effects from climate conditions during the construction phase.

Operational Phase

Future Users of the Site

- 13.166 Vulnerable future users of the Site are at risk during heatwaves across the lifespan of the Development. A landscaping and SuDS strategy will ensure that green / blue infrastructure is provided and maintained on-site to provide level of thermal cooling/shading.
- 13.167 As outlined in the Energy & Climate Adaptation Statement, dwellings in the detailed phase of the Development are all designed with low emissivity⁹ coated glazing which is designed to limit unwanted solar gains in summer. Most dwellings will benefit from integrated garages, which provide a thermal mass benefit by absorbing excess heat during periods of high internal temperature. These measures should be incorporated into the outline phase of the Development and secured through suitably worded planning conditions.

Infrastructure

- 13.168 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.
- 13.169 As outlined in the Energy & Climate Adaptation Statement, submitted in support of the planning application, measures regarding domestic properties water consumption are not yet known and should be designed at the detailed design phase to be equal to or less than 90 litres/person/day.

The Natural Environment (Ecology, Landscaping and Planting)

- 13.170 As outlined in Chapter 7 (Biodiversity) of the ES, ongoing ecological monitoring will be undertaken. The ongoing monitoring for a minimum of 30 years will be outlined within the

⁹ Low-emissivity glass (or low-e glass) is a type of energy-efficient glass designed to prevent heat loss through windows by reflecting infrared energy (or heat).

LEMP for the Development, to be secured through a suitably worded planning condition at a later design stage. 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.

- 13.171 Hedgerows and trees will be retained where possible on the Site, and any trees to be removed will be replaced at a ratio of 2:1. Enhancing trees on the Site provides biodiversity benefits, as well as flood attenuation and a level of thermal cooling.

Flood Risk

- 13.172 As stated in the FRA, it is recommended that finished floors levels are set a minimum of 150mm above the local ground level in line with best practice to mitigate against the risk of surface water runoff.

- 13.173 SuDS features for the outline phase of the Development will be secured at the detailed design stage and will manage storm discharge across the Development.

Residual Effects

Operational Phase

Future Users of the Site

- 13.174 Following the implementation of appropriate flood mitigation and green and blue infrastructure the residual effect on future users of the Development from long term climatic changes and flood risk is considered to be **Minor Adverse** and **not significant**.

- 13.175 Without the implementation of an overheating assessment, which would be secured through a planning condition, the residual effects on future Site users from heatwaves remains **Moderate Adverse** and **significant**.

Infrastructure

- 13.176 It is expected that infrastructure will be safeguarded at the detailed design stage to account for climate change. The Development is also not within an area that is deemed to be water stressed, so the potable water supply should be resilient during periods of low rainfall.

Appropriate flood mitigation set out in Table 13.9 will also safeguard infrastructure and the built Development from flood risk. The residual effect from climate change on infrastructure is therefore considered to be **Minor Adverse** and **not significant**.

The Natural Environment (Ecology, Landscaping and Planting)

- 13.177 Varied habitats across the Development and long-term ecological management will increase the resilience of planting throughout the Development. The residual effect on the natural environment from climate change is therefore considered **Minor Adverse** and **not significant**.

Flood Risk

- 13.178 The Development is considered to be at very low to low risk from flooding of various sources. The Development incorporates green infrastructure and SuDS to mitigate flood risk through the lifespan of the Development. The flood risk to the Development may increase towards the 2080's, however the residual effect is considered to be **Minor Adverse** and **not significant**.

Cumulative Effects

- 13.179 As with climate change mitigation, climate change is a global issue, and the combination of cumulative schemes will not impact upon climate change resilience for the Development or cumulative schemes. A cumulative assessment of climate change resilience is therefore not considered in this ES chapter.

In-Combination Climate Effects

- 13.180 There is potential for in-combination climate change effects to exacerbate other environmental effects identified in other topic chapters without mitigation. There is a need to deliver a co-ordinated approach to the climate change mitigation measures to provide climate resilience within the Development. The proposed embedded mitigation measures have been outlined throughout this chapter and other technical documents such as the DAS, which is submitted separately with the planning application. It is considered that with the implementation of these embedded mitigation measures and careful consideration of climate change mitigation and adaptation measures at the detailed design stages, the effects identified within the topic chapters will not be exacerbated as a result of climate change. In-combination effects are therefore considered to be Minor Adverse and not significant.

Summary

- 13.181 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.
- 13.182 Without the adoption of an Overheating Assessment, the residual effect on future Site users from heatwaves remains Moderate Adverse and significant. Following embedded and additional mitigation measures, residual effects from climatic changes on infrastructure, the natural environment, and flood risk are not significant.
- 13.183 Table 13.10 contains a summary of the likely significant effects of the Development.

Table 13.10: Table of Significance – Climate Change Mitigation and Resilience

Potential Effect	Nature of Effect (Permanent/ Temporary)	Significance (Major/Moderate/Minor) (Beneficial/Adverse/Negligible)	Mitigation / Enhancement Measures	Geographical Importance*							Residual Effects (Major/Moderate/Minor) (Beneficial/Adverse/Negligible)
				I	UK	E	R	C	B	L	
Construction											
Construction Transport Emissions	Temporary	Negligible	Implementation of a CEMP, to be secured through a planning condition and appropriate construction vehicle routing.	X							Negligible
Completed Development (Climate Change Mitigation)											
Operational Transport Emissions	Permanent	Major Adverse	Implementation of a Travel Plan to be secured through a planning condition.	X							Moderate Adverse (Significant)
Operational Energy Emissions	Permanent	Minor Adverse	Implementation of the Energy Hierarchy for the outline phase of the Development, to be secured by a planning condition. Solar PV panels to be considered.	X							Negligible
Carbon Sequestration Potential	Permanent	Minor Beneficial	Implementation of a LEMP to manage landscaping over 30 years.	X							Minor Beneficial
Completed Development (Climate Change Resilience)											

Effects of climate change on future site users	Permanent	Moderate – Minor Adverse	Fabric measures in the detailed phase should be incorporated into the outline phase through planning conditions. An Overheating Assessment should be secured via a planning condition.	X								Moderate Adverse (Significant) (Heatwaves)
Effects of climate change on infrastructure	Permanent	Minor Adverse	Infrastructure will be safeguarded at detailed design stages, such as finished floors levels set a minimum of 150mm above the local ground level.	X								Minor Adverse
Effects of climate change on the natural environment	Permanent	Moderate Adverse	A Landscape and Ecological Management Plan, to be secured by a planning condition.	X								Minor Adverse
Effects of climate change on flood risk	Permanent	Minor Adverse	Detailed SuDS strategy and drainage regime.	X								Minor Adverse
Cumulative Effects												
<i>Construction</i>												
N/A												
<i>Completed Development</i>												
N/A												

*** Geographical Level of Importance**

I = International; UK = United Kingdom; E = England; R = Regional; C = County; B = Borough; L = Local

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