10.0 CLIMATE CHANGE

INTRODUCTION

10.1 This Chapter of the ES includes:

- An assessment of the likely significant impacts of climate change on the resilience of the proposed development;
- A summary of the likely significant in-combination climate impacts (ICCIs) identified within other EIA technical areas; and
- An assessment of the likely significant impacts of the proposed development on the environment with regard to climate change through the direct and indirect release of greenhouse gas (GHG) emissions.

10.2 It also describes the methods used to assess the impacts; the baseline conditions currently existing at the site and in the surrounding area; the mitigation and adaptation measures required to prevent, reduce or offset any significant adverse effects; and the likely residual impacts after these measures have been adopted.

LEGISLATION AND PLANNING POLICY CONTEXT

International

The Paris Agreement, 2016

10.3 The Paris Agreement[1] is an international agreement on climate change created as a result of the United Nations Framework Convention on Climate Change (UNFCCC) Conference of the Parties in 2015. It came into force in November 2016 and has been ratified by 190 of 197 Parties to the Convention.

10.4 The Paris Agreement introduced a number of targets with regard to climate change adaptation and mitigation:

- Mitigation: reducing emissions – a long-term goal to limit global average temperature rise to 'well below' 2°C above pre-industrial levels and a rapid reduction in global emissions in accordance with the best available science, after peaking as soon as possible;
- Transparency and global stocktake – government meetings every five years to set more ambitious targets as required by science;
- Adaptation – government agreement to strengthen society's ability to deal with the impacts of climate change; and

- Loss and damage – recognising the importance of averting, minimising and addressing loss and damage associated with the negative effects of climate change; and acknowledging the need to cooperate and enhance the understanding, action and support in areas such as early warning systems, emergency preparedness and risk insurance.

10.5 Signatory nations are required to produce Nationally Determined Contributions (NDCs) that set out their targets to meet the Paris Agreement through national level policy. Many businesses are also taking action to meet the long-term goal, for example by setting their own carbon targets and developing sustainability strategies. Some have done this formally through the Science Based Targets initiative that helps businesses set targets to reduce greenhouse gas emissions in line with the level of decarbonisation required to meet the 2°C temperature rise.

National

The Climate Change Act, 2008

10.6 The Climate Change Act[2] sets a long term, legally binding target for reducing UK greenhouse gas emissions by a minimum of 80% by 2050 from a 1990 baseline, with a mid-term target of a 34% reduction by 2020. It also provides for a Committee on Climate Change (CCC), which sets out binding carbon budgets on the Government for five-year periods.

10.7 The system of carbon budgeting constrains the total amount of emissions in a given time period and sets out a procedure for assessing the risks of the impact of climate change for the UK, stimulating a requirement for the Government to develop an adaptation programme.

10.8 The most recent sixth carbon budget requires annual emissions by 2035 to be limited to an average of 78% below 1990 levels.

10.9 The Climate Change Act was amended in 2019[3] by introducing a new target for reducing UK greenhouse gas emissions by a minimum of 100% by 2050 from a 1990 baseline. This is otherwise known as a net zero target because some emissions can remain if they are offset by removal from the atmosphere and/ or by trading in carbon units.

10.10 The Climate Change Act introduced new powers and duties on climate change adaptation and mitigation, these included:

- A UK-wide Climate Change Risk Assessment that must occur every five years;
- A National Adaptation Programme that must be put in place and reviewed every five years to address the most pressing climate change risks;

- Government power to require 'bodies with functions of a public nature' and 'statutory undertakers' – e.g. water and energy utilities - to report on what they are doing to adapt to climate change. This is known as the 'Adaptation Reporting Power'; and
- Adaptation Sub-Committee of the independent CCC in order to oversee progress on the national programme and advise on the risk assessment.

National Planning Policy Framework, 2021

10.11 The National Planning Policy Framework (NPPF)[4] was published in July 2021, replacing the previous NPPF that was adopted in February 2019. The NPPF sets out the Government's planning policies for England and how they are expected to be applied. It sets out a framework that aims to achieve sustainable development throughout the planning system with three overarching objectives – economic, social and environmental.

10.12 At the heart of the NPPF is a *'presumption in favour of sustainable development'*, which requires Local Authorities as part of any plan-making or decision-making, to provide clear guidance on how the presumption should be applied locally.

10.13 The NPPF sets out how to deliver sustainable development. Chapter 14 of the NPPF outlines how development plans should be planning for climate change and taking a proactive approach to mitigating and adapting to climate change. Paragraph 154 of the NPPF states that:

'New development should be planned for in ways that: a) avoid increased vulnerability to the range of impacts arising from climate change... and b) can help reduce greenhouse gas emissions, such as through location, orientation and design.'

UK Climate Change Risk Assessment, 2022

10.14 The Government published the UK Climate Change Risk Assessment (CCRA) Government Report[5] on 17th January 2022, the second in a five-yearly cycle. The methodology enables the comparison of 61 risks and opportunities, from a number of disparate sectors, based on the magnitude of the impact and confidence in the evidence base. The UK CCRA prioritises the following risk areas for action in the next 2 years:

- risks to the viability and diversity of terrestrial and freshwater habitats and species from multiple hazards
- risks to soil health from increased flooding and drought
- risks to natural carbon stores and sequestration from multiple hazards
- risks to crops, livestock and commercial trees from multiple climate hazards

- risks to supply of food, goods and vital services due to climate-related collapse of supply chains and distribution networks
- risks to people and the economy from climate-related failure of the power system
- risks to human health, wellbeing and productivity from increased exposure to heat in homes and other buildings
- multiple risks to the UK from climate change impacts overseas

10.15 The CCRA analysis indicates that buildings and infrastructure will be affected by both extreme weather events and long-term gradual change in the climate. The challenges arise from higher temperatures and changing rainfall patterns.

National Adaptation Programme

10.16 The National Adaptation Programme (NAP) sets out how the UK Government intends to increase the resilience of the UK to future climate. It runs over five year periods with the current NAP running until 2023. It is also the Government's response to the CCRA and acts as a response to the risks identified in that process. The current NAP addresses six priority areas:

- Flooding and costal change risk to communities and infrastructure;
- Risks to health, wellbeing and productivity in high temperatures;
- Risks in shortages of public water supply agriculture, energy generation and industry;
- Risks to natural capital;
- Risks to domestic and international food production; and
- New and emerging pests and diseases and invasive non-native species affecting people, plants and animals.

Regional

London Plan, 2021

10.17 The London Plan 2021[6] was formally adopted in March 2021, forming the Spatial Development Plan for London and part of the statutory Development Plan for Greater London.

10.18 The New London Plan 2021 will run from 2019 to 2041, providing a longer- term view of London's development to inform decision making. This plan replaces the old London Plan 2016 and is therefore a key material consideration in planning decisions and has therefore been referenced in this assessment.

10.19 The following policies within the London Plan are of particular relevance to this assessment:

- Policy SI2 Minimising greenhouse gas emissions – This policy states that major development should be net zero-carbon by employing measures in the energy hierarchy and that a minimum on-site reduction of at least 35 per cent beyond Building Regulations is required for major development. The policy also states that *'development proposals referable to the Mayor should calculate whole life- cycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.'*
- Policy SI4 Managing Heat Risk – this policy states that development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials and the incorporation of green infrastructure. This includes reducing internal overheating and reliance on air conditioning in accordance with the cooling hierarchy;
- Policy SI5 Water infrastructure – this policy requires development proposals to minimise the use of mains water, water supplies and resources and residential developments to achieve a mains water consumption of 105 litres or less per head per day (excluding allowance of up to five litres for external water consumption);
- Policy SI7 Reducing waste and supporting circular economy – this policy sets out requirements for minimising waste through the life-cycle of a development based on a Circular Economy approach. Paragraph B requires that referable proposals submit a Circular Economy Statement;
- Policy SI12 Flood Risk management – this policy states that development proposals should ensure that flood risk is minimised and mitigated, and that residual risk is addressed. This policy also recommends the use of natural flood management methods;
- Policy T4 Assessing and mitigating transport impacts – Requires Transport Assessments/ Statements to be submitted with development proposals, the design of developments to promote sustainable transport through mitigation where appropriate and the provision of Travel Plans, Parking Design and Management Plans, Construction Logistics Plans and Delivery and Servicing Plans; and
- Policy T5 Cycling – this policy states that developments should support the delivery of new cycle routes, improved cycle infrastructure and sets out specific requirements for cycle parking within new developments based on the London Cycling Design Standards.

Local

LBRuT Local Plan, 2018

10.20 The LBRuT Local Plan was adopted in July 2018[7] and sets out policies and guidance for the development of the Borough to 2033. The Local Plan forms part of the overall development plan for the Borough and it identifies where the main developments will take place, and how places within the Borough will change, or be protected from change, over that period.

10.21 The Local Plan identifies that one of the Council's strategic objectives is to deliver a sustainable future, stating that the Council will:

'1. Minimise and mitigate the effects of climate change by requiring high levels of sustainable design and construction including reductions in carbon dioxide emissions by minimising energy consumption, promoting decentralised energy and the use of renewable energy as well as requiring high standards of water efficiency.

2. Promote and encourage development to be fully resilient to the future impacts of climate change in order to minimise vulnerability of people and property; this includes by risk of flooding, water shortages, subsidence and the effects of overheating'

10.22 The following policies are relevant to this assessment:

10.23 Policy LP 20 Climate Change Adaptation states that:

'A. The Council will promote and encourage development to be fully resilient to the future impacts of climate change in order to minimise vulnerability of people and property.

B. New development, in their layout, design, construction, materials, landscaping and operation, should minimise the effects of overheating as well as minimise energy consumption in accordance with the following cooling hierarchy:

1. minimise internal heat generation through energy efficient design

2. reduce the amount of heat entering a building in summer through shading, reducing solar reflectance, fenestration, insulation and green roofs and walls

3. manage the heat within the building through exposed internal thermal mass and high ceilings

4. passive ventilation

5. mechanical ventilation

6. active cooling systems (ensuring they are the lowest carbon options).

C. Opportunities to adapt existing buildings, places and spaces to the likely effects of climate change should be maximised and will be supported'

10.24 Policy LP 21 Flood Risk and Drainage identifies that developments should avoid or minimise contributing to all sources of flooding taking into account climate change.

10.25 Policy LP 22 Sustainable Design and Construction requires developments to meet a number of criteria including:

- Completing the Sustainable Construction Checklist SPD;
- Minimising water consumption to a maximum of 110 litres per person per day (including an allowance of 5 litres or less per person per day for external water consumption);
- Non-residential buildings to meet BREEAM 'Excellent' Standard;
- Major residential developments to achieve zero carbon standards in line with London Plan policy; and
- Contribute towards the use or provision of decentralised energy.

Draft LBRuT Local Plan, 2021

10.26 The LBRuT Local Plan draft for public consultation[8] will set out policies and guidance for the development of the borough over the next 15 years, from the date of its adoption.

10.27 The draft Local Plan is currently out for consultation and carries limited weight. It is nonetheless a material consideration.

10.28 The following strategic draft policy is relevant to this assessment:

10.29 Policy 3 Tackling the climate emergency (Strategic Policy): this policy states that all developments will be required to:

'1. reduce greenhouse gas emissions in accordance with the London Plan's Energy Hierarchy and support the transition to a low carbon society by maximising energy efficiency, zero and low carbon heat and local renewable energy generation;

2. follow the principles of the circular economy and support effective resources use to ensure that they are kept in use for as long as possible and thereby minimise waste;

3. reuse and refurbishment in preference to demolition and new construction;

4. demonstrate that they are well designed, fully adaptable and resilient to the impacts of a changing climate;

5. adapt to the changing climate by minimising the effects of overheating, mitigating the urban heat island effect, managing flooding, and minimising energy consumption in accordance with the London Plan's Cooling Hierarchy;

6. enhance and improve the borough's green and blue infrastructure to ensure it delivers multi-functional benefits, such as enhancing micro-climates and natural carbon sinks as well as improving air quality;

7. adopt an integrated approach to water management which considers flood risk, sustainable drainage, water efficiency, water quality and biodiversity;

8. reduce water demand and meet best practice water efficiency targets;

9. adopt a circular economy approach and minimise embodied carbon;

10. ensure that the principles of active and sustainable modes of travel are adopted;

11. promote retrofitting of existing buildings, through low-carbon measures;

12. promote healthy, sustainable and low carbon lifestyles in line with the Council's Climate Emergency Strategy.'

ASSESSMENT METHODOLOGY

Scope of Assessment

10.30 The EIA Directive 2014[9] sets out the rationale for incorporating climate change into the EIA process. It states:

'Climate change will continue to cause damage to the environment and compromise economic development. In this regard, it is appropriate to assess the impact of projects on climate (for example greenhouse gas emissions) and their vulnerability to climate change.'

10.31 The requirements of the EIA Directive 2014 have been adopted within UK EIA Regulations 2017[10] and require that the assessment provides:

'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'.

10.32 The Institute of Environmental Management and Assessment (IEMA) *'Environmental Impact Assessment Guide to: Climate Change Resilience & Adaptation'* also clearly states that in combination climate impacts of a development should be assessed which are the impacts of climate change on receptors identified in other technical areas.

10.33 Therefore, this ES Chapter covers:

- An assessment of the likely significant impacts of climate change on the resilience of the proposed development;
- An assessment of the likely significant in-combination climate impacts (ICCIs) identified within other EIA technical areas; and
- An assessment of the likely significant impacts of the proposed development on the environment with regard to climate change through the direct and indirect release of GHG emissions.

10.34 The assessment has followed guidance within the IEMA 'Environmental Impact Assessment Guide to: Climate Change Resilience & Adaptation'[11] and IEMA guidance on 'Assessing Greenhouse Gas Emissions and Evaluating their Significance'[12].

Climate Change Resilience Assessment

Study Area

10.35 For the purpose of the climate change resilience assessment the study area is the site.

Data Sources

10.36 Baseline data for the climate change risks posed to the proposed development has been gathered using the United Kingdom Climate Projections[13] (UKCP) to establish the climatic data surrounding current seasonal temperatures and precipitation. This stage of the assessment was used to analyse the current climate and compare these findings, in relation to the proposed development, to the climate change projections identified in the UK Climate Change Projections 2018 (UKCP18).

10.37 The UKCP18 aim to assist decision makers in assessing the climate change risks associated with projects. The projections form part of the Met Office Hadley Centre Climate Programme, which is supported by the Department of Business, Energy and Industrial Strategy (BEIS) and the Department for Environment, Food and Rural Affairs (DEFRA). The UKCP18 provides the most up-to-date assessment of how the climate in the UK may change over the 21st century.

10.38 The UKCP18 use a range of future emission trajectories to assess different climate change scenarios. These emission trajectories include where global emissions of greenhouse gases (GHG) rapidly peak and decline towards the climate targets in the Paris Agreement, to where fossil fuel use increases to even higher GHG emissions. The UKCP18 use representative concentration pathways (RCPs) that represent different levels of GHG concentrations in the future. For this assessment, the high (RCP8.5) emission scenario has been used for a set of key climate change parameters. This scenario was selected in accordance with IEMA Guidance on assessing climate change resilience[11] as the most conservative scenario to ensure all potential risks are addressed.

10.39 In addition, the UK Climate Change Risk Assessment: Government Report (CCRA)[14] has been used to form the basis of this resilience assessment.

Assessment Overview

10.40 The climate change resilience assessment applied to the proposed development covers the following stages:

- Defining the future climate baseline;

- Identifying and determining the sensitivity of receptors;
- Reviewing and determining the magnitude of effect;
- Determination of significance; and
- Developing additional adaptation including adaptive management for significant risks.

10.41 Once the sensitivity receptors to climate change within the proposed development have been identified, the impact of these climate variables will be evaluated based on the magnitude of effect and the tolerable thresholds will be determined. Following this, the significance will be determined.

10.42 This will be achieved by undertaking a climate change resilience assessment to identify and evaluate the impact on the resilience of the proposed development over its assumed life cycle of 60 years.

Significance Criteria

10.43 For the purposes of the climate resilience assessment, the usual EIA significance ratings (as described in Chapter 3.0: EIA methodology) do not apply but the climate change resilience of the proposed development must still be fully estimated and evaluated. Therefore, specific project criteria have been used to determine the significance of effect in line with the IEMA Climate Change Resilience Guidance.

10.44 Each impact identified has been assessed against three variables as shown in Table 10.1 - Receptor sensitivity (R_s); Probability (P); and Consequence (C) of the risk.

10.45 Using this methodology, each risk is assigned a score (Total Risk Score = R_s x P x C) between 1 (no or very low risk) and 27 (very high risk) for three separate time periods:

- 2030s;
- 2060s; and
- 2090s.

10.46 Scoring risks against two different timescales provides an indication of when action may need to be taken to adapt and increase resilience so the asset in question is able to perform effectively for its intended useful design life. For some risks, action should be taken early to avoid significant disruption and economic impact. Other risks only need to be addressed either shortly before or as they occur. For example, the risk of severe and widespread flooding may need to be addressed early through planning and design activities (such as installing higher drainage capacity and flood protection). In contrast, when considering the resilience of road surfaces to extreme weather events, adaptive management is a more suitable approach as this allows resilience to be built into a project when necessary, during ongoing maintenance or replacement.

10.47 The scores for Receptor sensitivity (R_s), Probability (P) and Consequence (C) are established through the understanding of the specific risk and the level of resilience or exposure of the proposed development to climate change and through a review of relevant literature and climate change data. These are shown in Table 10.1 – Receptor sensitivity, Probability and Consequence Factors below.

10.48 Total Risk Scores (R_s x P x C) are categorised as follows:

- Total Risk Score of 18-27 – Very High Risk for the specified time period (Major Negative Effect);
- Total Risk Score of 12-17 – High Risk for the specified time period (Moderate Negative Effect);
- Total Risk Score of 8-11 – Medium risk for the specified time period (Minor Negative Effect); and
- Total Risk Score of <8 – Low Risk for the specified time period (Negligible Effect).

10.49 Therefore, a risk score of 8 or more means that climate change resilience impacts are considered likely significant prior to mitigation.

Table 10.1 Receptor sensitivity, Probability and Consequence Factors

Factor	Commentary
Receptor sensitivity (R_s) – the sensitivity of the receptor/receiving environment is the degree of response of a receiver to a change and a function of its capacity to accommodate and recover from a change if it is affected. This considers the susceptibility of the receptor and the vulnerability of the receptor to potential climate effects. Susceptibility is the receptor's ability to withstand/ be substantially altered by the projected changes to the existing/ prevailing climatic factors (e.g. lose much of its original function and form). Vulnerability is the receptor's dependence on existing/prevailing climatic factors and reliance on these specific existing climate conditions continuing in future. Sensitivity is determined using quantifiable data, where available, the consideration of existing designations, relevant legislation, national and local policy and international, national, regional and local standards.	1 = Low susceptibility and/ or vulnerability 2 = Moderate susceptibility and/ or vulnerability 3 = High susceptibility and/ or high vulnerability
Probability (P) – likelihood of the impact occurring over the specified time period.	1 = Unknown occurrence or relatively low probability of the impact occurring in project lifetime e.g. no occurrence or may occur once 2 = Medium likelihood that the impact will occur in the lifetime of the project e.g. once or more 3 = There is a high likelihood that the impact will occur multiple times in the project lifetime e.g. every 15 years or more
Consequence (C) - This reflects the geographical extent of the effect, or the number of receptors affected (e.g. scale), the complexity of the effect, degree of harm to those affected and the duration, frequency and reversibility of effect.	1 = No or minimal consequence e.g. effect is small in scale relative to the project, results in no harm, has a short duration (e.g. 1 day) and is reversible. 2 = Moderate consequence, must meet one of the following thresholds: • Results in some level of harm; or • Medium scale effect that has some potential for cascading effects on other aspects of the proposed development. 3 = High consequence, must meet one of the following thresholds: • Irreversible or longer duration (e.g. 1 week) effect on any aspect of the project;

Factor	Commentary
	• Results in unacceptable harm; or • Large scale effect that has cascading effects on the wider function of the proposed development.

10.50 Those significant effects with a score of 8 or above have been assessed further to identify potential adaptation responses that could be implemented to reduce the receptor sensitivity, likelihood and/ or consequence(s) of the impact.

GHG Assessment

10.51 For the GHG assessment, a summary of the scope of GHG impacts and the sources of emission data where these have been quantified is provided in Table 10.2 below.

Table 10.2 GHG Data Sources

Development Phase	Baseline	Proposed development	Methods and data sources
Construction	Baseline is zero as no existing construction is taking place	A1-A5 construction stage embodied carbon emissions (from product, transport and construction operations stage) taken from the Whole Life-Cycle Carbon Assessment	Whole Life-Cycle Carbon Assessment is based on the GLA Whole Life-Cycle Carbon Assessments Guidance[15]
Operational transport	Existing transport trips provided from the Transport consultant based on traffic surveys	Net increase in opening year transport GHG emissions compared to the existing site	• Daily Trips generated in Transport Assessment; • Average trip length data from national transport survey (2019); and • GHG factors.
Operational energy use	Estimated based on: • CIBSE Benchmarks[16] (kWh/ m^2/ year) for typical gas heated flats, community centre and	Energy strategy of the proposed development and Whole Life-Cycle Carbon Assessment (B6) under the decarbonisation scenario	CO_2 from Energy Strategy for the proposed development and CO_{2e} for Whole Life-Cycle Carbon Assessment

	naturally ventilated office • Existing GIAs; and • SAP10 emission factors		

Operational Transport

10.52 For the purposes of this assessment, the annual proposed development trip lengths have been estimated based on national averages on trip length from the National Transport Survey (2019)[17].

10.53 GHG emission factors for different modes of transport have been sourced from the Department of Business, Energy and Industrial Strategy (BEIS) publication on GHG Conversion Factors for Company Reporting (2021)[18] with the ratio of cars of different fuel types for the proposed development opening year (2030) sourced from the DfT TAG Data book 2020[19]. Table 10.3 provides a summary of the BEIS factors.

Table 10.3 GHG emission factors for transport

Transport type	Unit	2021 BEIS factor (kg CO_{2e})
Pedestrians	Km	0
Cyclists	Km	0
Bus	Passenger. Km	0.07718
Underground	Passenger. Km	0.02781
Rail	Passenger. Km	0.03549
Car (Petrol)	Km	0.17431
Car (Diesel)	Km	0.16843
Car (Electric)	Km	0.08814

Significance Criteria

10.54 To assess the impact of the emissions from the proposed development in accordance with the IEMA Guidance[12], the criteria set out in Table 10.4 have been used to determine significance.

Table 10.4 GHG significance

Significance	Examples
Major Negative (significant)	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 Negative effects is locking in emissions and does not make a meaningful contribution to the UK's trajectory towards net zero following a 1.5◦C based Science Based target.
Moderate Negative (significant)	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 Negative effects falls short of fully contributing to the UK's trajectory towards net zero following a 1.5◦C Science Based target.
Minor Negative (not significant)	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 negative effects is fully in line with measures necessary to achieve the UK's trajectory towards net zero following a 1.5◦C Science Based target.
Negligible (not significant)	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.
Positive(significant)	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.

10.55 To contextualise the proposed development's emissions, CO2e emissions have been compared to the LBRuT current emissions from 2019[20], the relevant UK carbon budgets and the recommended Greater London Energy Carbon Budgets set out by the Tyndall Centre[21]. The UK carbon budgets are in place to restrict the amount of GHG emissions the UK can legally emit in a five-year period.

10.56 The appropriate UK national carbon budget during the anticipated construction programme of the proposed development is the 4th carbon budget for 2023-2027.

10.57 The anticipated operational phase of the proposed development will be compared to all of the available carbon budgets within the design life of the proposed development. These include the 5th carbon budget for 2028-2033 and the 6th carbon budget for 2033-2037.

10.58 Table 10.5 shows the future UK and regional carbon budgets up to 2033, which highlights a decline in the amount of GHG emissions that the UK can legally emit going into the future. This means that any source of emissions contributing to the UK's carbon inventory is going to have an increased impact on the UK carbon budgets in the future.

Table 10.5 UK and London Energy Carbon Budgets

Carbon Budget	Total UK Carbon budget (Mt CO_{2e})	Recommended London Energy Carbon Budget (Mt CO_2)
4th (2023 – 2027)	1,950	65.9
5th (2028 – 2033)	1,725	34.3
6th (2033 – 2037)	1,000	17.9

Note: Recommended London Energy Carbon Budgets as set out by the Tyndall Centre

ASSUMPTIONS AND LIMITATIONS

Climate Change Resilience

10.59 This assessment uses the UKCP18 projections of the future climate which are based on Met Office climate models which represent the current understanding of the climate system. The Met Office's UKCP18 Caveats and limitations report identifies that:

- Climate projections are dependent on future greenhouse gases assumptions;
- Estimated ranges for future climate are conditional; and
- UKCP18 does not capture all possible future outcomes.

10.60 The models used for UKCP18, as with all climate modelling is inherently based on statistical, and dataset choice assumptions with expert judgement playing a role in the various methodological and data choices. The data scenarios, therefore, should be interpreted as climate projections that will have some variance as models and observed impacts are recorded.

GHG Assessment

10.61 The construction assessment for the proposed development is based on the Whole-Life Cycle Carbon Assessment which is based on information available at planning submission stage provided by the Applicant and design team including the quantum and type of proposed materials. The quantum of embodied carbon emissions will be reconfirmed in

the Whole Life-Cycle Carbon Assessment upon completion of the proposed development, based on any updates to the development design in accordance with GLA requirements.

10.62 The emission factors used in the Whole Life-Cycle Carbon Assessment and used in this Chapter to compare energy emissions to future carbon budgets is based on the decarbonisation scenario based on National Grid's Future Energy Scenario 2020 'Steady Progression'. This is therefore considered a realistic worst-case scenario although the GHG emissions from the proposed development would be lower if decarbonisation occurs more quickly. Given that the CO_2 emissions from gas are not predicted to change significantly up to 2037, the current BEIS (2021) CO_2 factor for gas has been considered to be the most appropriate when comparing baseline consumption to future carbon budgets.

10.63 It is acknowledged that during the proposed development's lifetime there will likely be a decrease in operational transport emissions due to improved fuel efficiencies and an increase in electric vehicle usage. However, the carbon factors represent the current industry position and emissions during the first year of operation and therefore a worst-case scenario of the position throughout the building lifetime.

BASELINE CONDITIONS

Climate Variables

10.64 The proposed development is located in the Met Office district of England South East and Central South. Average baseline climate conditions based on data from the years 1971-2000 for this region are shown in Table 10.6 below.

Table 10.6 Baseline climate conditions for England South East and Central South

Month	Average baseline climate conditions 1971-2000		
	Average Maximum Temperature	Average Minimum Temperature	Average Rainfall (mm)
January	7.2 °C	1.5 °C	81
April	12.5 °C	3.9 °C	52.6
July	21.7 °C	11.9 °C	45.2
October	14.5 °C	7.0 °C	83.8
Annual	14.0 °C	6.1 °C	776.8

Source: Met Office (2020)[22]

10.65 Future climate projections under UKCP18 for emission scenario RCP8.5 (high emissions) for the 25 km Grid Cell within which the site is located (512500, 162500) are shown in Table 10.7[23] for the 2030s (2020-2039), 2060s (2050-2069) and 2090s (2080-2099). The projections within Table 10.7 indicate the changes in temperature and precipitation for the projected years.

Table 10.7 Future Climate Change Projections under RCP8.5

Climate Variable	Predicted Change from Baseline Period 1981-2000 under RCP8.5					
	2030s (2020-2039)		2060s (2050-2069)		2090s (2080-2099)	
	50th Percentile	5th to 95th Percentile	50th Percentile	5th to 95th Percentile	50th Percentile	5th to 95th Percentile
Mean Air Temperature Anomaly at 1.5m (°C)						
Annual Average	+1.0 °C	0.1 – +2.0 °C	+2.4 °C	0.8 – +4.1 °C	+4.3 °C	1.7 – +7.1 °C
Winter	+0.9 °C	-0.3 – +2.2 °C	+2.1 °C	0.2 – +4.1 °C	+3.5 °C	0.8 – +6.5 °C
Spring	+0.7 °C	-0.3 – +1.7 °C	+1.7 °C	0.3 – +3.3 °C	+3.1 °C	0.8 – +5.5 °C
Summer	+1.3 °C	0.1 – +2.6 °C	+3.1 °C	0.6 – +5.8 °C	+5.7 °C	1.8 – +10.0 °C
Autumn	+1.1 °C	-0.4 – +2.6 °C	+2.4 °C	0.5 – +4.7 °C	+4.4 °C	1.4 – +7.8 °C
Maximum Air Temperature Anomaly at 1.5m (°C)						
Annual Average	+1.1 °C	0.2 – +2.2 °C	+2.6 °C	0.7 – +4.5 °C	+4.6 °C	1.6 – +7.8 °C
Winter	+0.9 °C	-0.3 – +2.2 °C	+2.0 °C	0.3 – +3.8 °C	+3.4 °C	0.8 – +6.2 °C
Spring	+0.9 °C	-0.4 – +2.3 °C	+1.9 °C	0.2 – +3.8 °C	+3.6 °C	0.6 – +6.6 °C
Summer	+1.5 °C	-0.1 – +3.2 °C	+3.6 °C	0.4 – +7.0 °C	+6.5 °C	1.4 – +12.1 °C
Autumn	+1.3 °C	-0.2 – +2.9 °C	+2.7 °C	0.1 – +5.5 °C	+4.7 °C	0.7 – +9.1 °C
Minimum Air Temperature Anomaly at 1.5m (°C)						
Annual Average	+0.9 °C	-0.1 – +2.1 °C	+2.3 °C	0.6 – +4.2 °C	+4.1 °C	1.3 – +7.3 °C

Climate Variable	Predicted Change from Baseline Period 1981-2000 under RCP8.5					
	2030s (2020-2039)		2060s (2050-2069)		2090s (2080-2099)	
	50th Percentile	5th to 95th Percentile	50th Percentile	5th to 95th Percentile	50th Percentile	5th to 95th Percentile
Mean Air Temperature Anomaly at 1.5m (°C)						
Winter	+0.9 °C	-0.3 – +2.2 °C	+2.1 °C	0.1 – +4.4 °C	+3.5 °C	0.6 – +7.1 °C
Spring	+0.8 °C	-0.7 – +2.2 °C	+1.8 °C	0.1 – +3.5 °C	+3.2 °C	0.5 – +6.2 °C
Summer	+1.2 °C	0.2 – +2.3 °C	+2.8 °C	0.9 – +5.2 °C	+5.2 °C	1.9 – +9.1 °C
Autumn	+1.0 °C	-0.6 – +2.6 °C	+2.4 °C	0.2 – +4.9 °C	+4.4 °C	0.9 – +8.4 °C
Precipitation rate anomaly (%)						
Annual Average	+1%	-6 – +8%	-2%	-11 – +8%	-2%	-11 – +8%
Winter	+7%	-9 – +25%	+13%	-11 – +41%	+23%	-7 – +58%
Spring	-2%	-10– +7%	-4%	-18 – +10%	-8%	-26 – +12%
Summer	-8%	-38 – +23%	-24%	-61 – +14%	-39%	-78 – +8%
Autumn	+4%	-7 – +16%	+1%	-13 – +15%	+7%	-7 – +22%

Source: UKCP18 Climate Projections, www.ukclimateprojections-ui.metoffice.gov.uk

10.66 Table 10.7 above shows that the following changes in climate are predicted under the high GHG emissions scenario (RCP8.5) for the 2030s, 2060s and 2090s:

- Increased air temperatures across all seasons;
- Higher increases in summer air temperature (associated with an increased frequency of heatwaves);
- Increased variability in precipitation (associated with an increased frequency of heavy rainfall events and droughts);
- An average reduction in summer precipitation (associated with an increased frequency of summer droughts); and
- An average increase in winter precipitation (associated with an increased frequency of winter storms, heavy rainfall and flood events).

10.67 The magnitude and variability of these changes in climate variables increases over time with the biggest changes in the 2090s. The magnitude of these changes is likely to be lower if less global GHGs are emitted than in the RCP8.5 scenario.

GHG Emissions

10.68 The estimated baseline energy CO_2 emissions for the site are set out in Table 10.8 below. This has been estimated based on:

- Chartered Institute of Building Services Engineers (CIBSE) Benchmarks (kWh/ m^2/ year) for typical practice gas heated flats, a typical practice community centre and a typical practice naturally ventilated office;
- Existing GIAs; and
- SAP10 emission factors.

10.69 The existing site estimated energy emissions are 0.065% of 2019 LBRuT emissions.

Table 10.8 GHG emissions from existing energy

Unit Type	GIA (sqm)	Electricity (kwh/year /m^2)	Fossil Fuel (kwh/year /m^2)	Electricity (kwh/year)	Tonnes CO_2 emissions from electricity	Fossil Fuel (kwh/year)	Tonnes CO_2 emissions from fossil fuels	Total CO_2 emissions (tonnes CO_2)
Flats (gas heated)	9,859	37	138	364,785	84.99	1,360,549	285.72	370.71
Community centre	576	47	139	27,072	6.31	80,064	16.81	23.12
Maker labs (assumed to be naturally ventilated office)	57	85	151	4,845	1.13	8,607	1.81	2.94
Total	**10,492**	**169**	**428**	**396,702**	**92**	**1,449,220**	**304**	**397**

10.70 The baseline transport emissions for the site are set out in Table 10.9 below. This has been estimated based on the existing trips from the Transport Assessment and average trip lengths from the National Transport Survey (2019). These distances have then been multiplied by the 2021 GHG emission factors set out in Table 10.3.

Table 10.9 GHG emissions from existing transport

Transport type	Emission factor (kg CO_{2e} per km)	Average trip length (km)	Existing Trips (Daily) per annum	CO_2 emissions per annum (Kg)
Pedestrians	0	1.1	77380	0
Cyclists	0	5.3	5840	0
Bus	0.07718	6.0	43800	20,283
Underground	0.02781	14.2	26645	10,522
Rail	0.03549	50.9	32485	58,682
Car*	0.169882	16.4	107675	29,989
Total				**389,477**

*Emission factor based on blended average of petrol/ diesel/ electric cars in 2021

POTENTIAL IMPACTS

During Construction

In-Combination Climate Impacts

10.71 Following a review of the sensitivity of receptors to future climate change by the relevant Technical Consultants, a qualitative assessment of the in-combination climate impacts is set out in the table below.

Table 10.10 In-combination Climate Impacts during Construction

Assessment	In-Combination Climate Impact
Heritage, Townscape and Visual	During construction, the Heritage, Townscape and Visual impacts will be temporary and reversible, and it is considered that these are unlike to change as a result of climate change.
Archaeology	Climate change means that some archaeology which was relatively safely preserved under the ground is now at risk of damage due to extremes in temperature and cycles of wetting and drying. However, if any archaeological remains are present a suitable mitigation strategy will be developed and agreed with Richmond and their archaeological advisors. Therefore, no in combination climate change effects are predicted.

Assessment	In-Combination Climate Impact
Air Quality	Increased ambient temperatures and alterations in precipitation patterns have the potential to alter the concentration $PM_{2.5}$ and PM_{10} during construction and operation. Summer droughts may exacerbate pollutant concentrations. During construction, the magnitude of these climate effects will be not significant and best practice measures will be implemented to minimise dust through the implementation of the CEMP.
Noise and Vibration	Noise and vibration effects are not considered to have potential for in-combination climate change effects.
Ground Conditions and Contamination	Ground conditions and contamination impacts are not considered to have potential for significant in-combination climate change effects considering that best practice measures to reduce contamination will be incorporated into the CEMP and any Remediation Strategy.
Ecology	With respect to Ecology, changes in climate and more extreme weather conditions have the potential to cause: changes in the distribution of habitats, which has the potential to be positive (i.e. expansion of valuable habitat types) or negative (i.e. loss or degradation of valuable habitat types); changes in the distribution of protected and notable species, which has the potential to be positive (i.e. expansion of species range) or negative (i.e. reduction in species range, loss or fragmentation of species populations); greater spread of invasive non-native species, likely to result in the loss of less competitive species and negative effects on ecosystems; and, increase in species susceptibility to diseases, leading to negative effects on species populations. However, the impact of climate change on ecology receptors is unlikely to be significant during the construction period given the low magnitude of any changes and the ecology mitigation embedded into the CEMP.
Socio-economic	The increased frequency of extreme weather events and heatwaves has potential to cause some minimal short-term disruption and delays to construction work. However, climate change is not predicted to result in any impacts during construction that will reduce the provision of secure employment opportunities or alter the proposed phasing and housing provision.

GHG Emissions

10.72 The Whole Life-Cycle Carbon Assessment has identified that the proposed development is predicted to create 27,636 tonnes of CO_{2e} through construction and upstream processes including A1-A3 Product Stage, A4 Transportation to site and A5 Site Operations.

10.73 This is equivalent to approximately 3,948 tonnes of CO_{2e} per annum during the 7 year construction period and is 0.6% of current annual LBRuT emissions.

10.74 For 2023-2027, this is equivalent to 1.0×10^{-3}% of emissions from the Fourth UK Carbon Budget.

10.75 Given that the proposed development meets all existing and emerging policy for minimising GHG emissions, will significantly reduce emissions compared to a Business

As Usual scenario and represents a 1.0 x 10^{-3}% of the Fourth UK Carbon budget, it is considered to be in line with the UK trajectory to net zero.

10.76 The proposed development is therefore considered to have a **Minor Negative (not significant)** effect from construction and upstream processes.

During Operation

Climate Change Resilience

10.77 As described in Flood Risk Assessment and Drainage Strategy, the proposed development will result in a positive impact on surface water drainage based on the proposed drainage strategy through the provision of SuDS measures including green roofs, rain gardens and permeable paving. Overall, the drainage network will be designed to accommodate, without flooding, a 1 in 100-year storm with an additional 40% allowance for climate change. Therefore, this has not been assessed further in this ES Chapter.

10.78 Considering the nature of the proposed development and the climate change variables identified using the UKCP18 data, a set of risks for the proposed development have been identified as below:

- Overheating of residential units and associated health implications;
- Soft landscaping failure and associated loss of services; and
- Water shortages for public use and for landscaping.

10.79 To develop risks, the high emissions scenario (RCP8.5) data in Table 10.7 was used to estimate the risk based on the receptor sensitivity, probability and consequence. 'Adaptation' measures for the risks are identified in the mitigation and adaptation section of this Chapter.

10.80 Each of these risks has been estimated using the scoring methodology set out in Table 10.1 and evaluated using the R_s x P x C calculation to produce an associated level of risk.

10.81 The results of the risk estimation and evaluation are displayed in Table 10.11.

Table 10.11 Total Risk Score of the Proposed Development

Risk	Timescale	Receptor Sensitivity (R_S)	Probability (P)	Consequence (C)	Total Risk Score (R_S x P x C)	Significance level
Overheating in homes and associated health implications	2030s	3	2	2	12	Moderate Negative
	2060s	3	3	3	27	Major Negative
	2090s	3	3	3	27	Major Negative
Soft landscaping failure and associated loss of services	2030s	2	1	2	4	Negligible
	2060s	2	1	2	4	Negligible
	2090s	3	2	2	12	Moderate Negative
Water shortages for public use and landscaping	2030s	3	1	2	6	Negligible
	2060s	3	2	2	12	Moderate Negative
	2090s	3	2	2	12	Moderate Negative

10.82 Using the calculated risk scores in Table 10.11, impacts associated with climate change risks on the built environment at the site of the proposed development will result in long term, significant impacts on the following areas:

- Overheating in homes – **Moderate Negative** risk for 2030s and **Major Negative** risk for 2060s and 2090s – the proposed development consists of residential and commercial buildings. With increased ambient and peak summer temperatures, this will increase the likelihood and severity of the overheating risk. This will also affect local people and could have negative effects on their health;
- Soft landscaping failure – **Moderate Negative** risk for 2090s – increased extreme weather events, such as heatwaves, droughts and storms, will cause damage to landscaping features if they have not been designed to withstand a reduced water balance and the effect of higher ambient temperatures on soil structure; and
- Increased water shortages – **Moderate Negative** risk for 2060s and 2090s – the proposed development will be affected by the increased likelihood of water shortages as a result of reduced total rainfall and increased severe rainfall. This will result in more surface water runoff and fewer opportunities for natural infiltration.

In-Combination Climate Impacts

10.83 Following a review of the sensitivity of receptors to future climate change by the relevant Technical Consultants, a qualitative assessment of the in-combination climate impacts is set out in the table below.

Table 10.12 In-Combination Climate Impacts during Operation

Assessment	In-Combination Climate Impact
Built Heritage, Townscape and Visual	Changes expected from climate change, such as increased rainfall levels and temperatures, are unlikely to impact on the appearance of the operational proposed development in townscape views, the overall character of the townscape, or its relationship with heritage assets.
Air Quality	During operation, NOx concentrations are unlikely to be directly affected directly by increased ambient temperatures and future climate change. However, hot dry summers could exacerbate PM2.5 and PM10 concentrations although this will not alter the Negligible operational impact of the proposed development. Therefore, no in-combination climate change effects are predicted.
Noise and Vibration	Noise and vibration effects are not considered to have potential for in-combination climate change effects.
Ground Conditions and Contamination	Ground conditions and contamination impacts are not considered to have potential for significant in-combination climate change effects considering that best practice measures to reduce contamination will be incorporated into the CEMP and any Remediation Strategy.
Ecology	With respect to Ecology, changes in climate and more extreme weather conditions have the potential to cause: changes in the distribution of habitats, which has the potential to be positive (i.e. expansion of valuable habitat types) or negative (i.e. loss or degradation of valuable habitat types); changes in the distribution of protected and notable species, which has the potential to be positive (i.e. expansion of species range) or negative (i.e. reduction in species range, loss or fragmentation of species populations); greater spread of invasive non-native species, likely to result in the loss of less competitive species and negative effects on ecosystems; and, increase in species susceptibility to diseases, leading to negative effects on species populations. The retention and enhancement of existing ecological habitats within the application site will provide ecological resilience to the effects of climate change by delivering a greater extent and quality of valuable habitats and strengthening ecological connectivity.
Socio-economic	It is not considered that climate change will alter the provision of secure employment opportunities and local spending during operation. The impact on climate change on the provision of public services including healthcare and education is uncertain given the lack of robust data on climate change adaptation of public services.

GHG emissions

Transport

10.84 The assessment of the net additional transport GHG emissions from the proposed development during operation is shown in Table 10.13.

10.85 As stated previously, this has approximated the proposed development distance travelled per annum (km) based on data from the Transport Assessment and average trip lengths from the National Transport Survey (2019)[17]. These distances have then been multiplied by the GHG emission factors set out in Table 10.3.

Table 10.13 GHG emissions from operational transport

Transport type	Emission factor (kg CO_{2e} per km)	Average trip length (km)	Total Daily Trips per Annum	CO_{2e} tonnes pr annum (kg CO_{2e})
Pedestrians	0	1.1	210605	0.0
Cyclists	0	5.3	2920	0.0
Bus	0.07718	6.0	29930	13.9
Underground	0.02781	14.2	11315	4.5
Rail	0.03549	50.9	19345	34.9
Car	0.15982*	16.4	350035	917.5
Total				**970.7**

Source: Transport Assessment (Velocity Transport Planning Ltd), National Transport Survey (2019), BEIS (2021).
*Estimated based on proportion of electric, diesel and petrol cars for the proposed development opening year in 2030.

10.86 Overall, the proposed development will generate a net additional 970.7 CO_{2e} tonnes per annum from operational transport during the opening year (2030) which is 0.16% of current LBRuT GHG emissions.

10.87 This equates to 2,912 tonnes of CO_{2e} for the first three years of operation which is 1.7 x 10^{-4}% of the Fifth UK Carbon Budget. This equates to, based on the proportion of electric, diesel and petrol cars for the proposed development opening year in 2030, 4.9 x 10^{-4}% of the Sixth UK Carbon Budget.

10.88 Prior to the implementation of mitigation set out below including the Travel Plan, the proposed development is therefore considered to have a **Moderate Negative (significant)** impact from operational transport.

Energy Consumption

10.89 The CO_2 emissions from regulated operational energy consumption of the proposed development have been sourced from the Energy Strategy prepared by Energist UK Ltd. The table below shows the regulated operational energy CO_2 emissions.

Table 10.14 Operational energy emissions from proposed development

	Total site-wide CO_2 tonnes per annum	% Reduction
Target emission rate	502.1	-
Savings from Energy demand reduction	78.0	15%
Savings from heat network/ CHP	0.0	0%
Savings from renewable energy	252.3	52%
Cumulative on-site savings	**330.3**	**68%**
Proposed development emission rate	**171.8**	**-**

Source: Energist Energy Strategy, SAP10 emission factors

10.90 The table above shows that a 68% CO_2 saving over the Building Regulations target emission rate is achieved across the proposed development as a result of the different measures employed in the energy strategy including energy efficient building fabric, air source heat pumps and photovoltaic arrays.

10.91 The operational energy regulated CO_2 emissions of the proposed development will result in an additional 171.8 tonnes of CO_2 per annum. This is 0.03% of the emissions from LBRuT. This is lower than the existing energy emissions from the baseline.

10.92 The WLC Assessment has identified that, the WLC emissions from operational energy and water usage (B6 and B7) are predicted to be 15,751 tonnes CO_{2e} under the decarbonisation scenario during the assumed 60 year operational lifetime.

10.93 A comparison of the proposed development B6 energy emissions and net additional energy emissions (compared to the baseline) with the UK Carbon budgets and recommended Greater London Energy Carbon budgets is set out in Table 10.15 below.

Table 10.15 Proposed Energy Consumption comparison to UK Carbon Budgets

Budget for Comparison	Operational Energy CO_2 emissions		
	Baseline	Proposed Development	Net Additional impact
Tonnes of CO_2 in 2030-2033	935 tonnes	214 tonnes	-721 tonnes
% of Fifth UK Carbon Budget	5.4×10^{-5} %	1.2×10^{-5} %	-4.2×10^{-5} %
% of Fifth Greater London Energy Carbon Budget	0.0027 %	6.2×10^{-4} %	-0.0021 %
Tonnes of CO_2 in 2030-2037	1,551 tonnes	327 tonnes	-1,223 tonnes
% of Sixth UK Carbon Budget	1.6×10^{-4} %	4.0×10^{-5} %	-1.2×10^{-4} %
% of Sixth Greater London Energy Carbon Budget	0.0009 %	0.0002%	-0.0007 %

Note: based on estimated baseline energy consumption, proposed energy consumption from Energist Energy Strategy, BEIS (2021) emission factor of 0.203 kg CO_2/ kWh for gas and National Grid CO_2 emission factors under steady state progression scenario for 2030-2037 for electricity.

10.94 The proposed development will meet all adopted policy requirements and will result in a significant reduction in operational energy emissions compared to the baseline given the measures that have been embedded into the Energy Strategy including Air Source Heat Pumps and photovoltaic arrays.

10.95 The proposed development is therefore considered to have a **Positive (significant)** impact from operational energy.

MITIGATION

10.96 This section provides a summary of the GHG mitigation and climate change adaptation measures incorporated into the construction procedures and design of the proposed development. When considering these measures, more detailed descriptions from the following ES Chapters and reports should also be considered:

- Transport Assessment and Framework Travel Plan;
- Framework CEMP;
- Energy Strategy;
- Sustainability Statement;
- Flood Risk Assessment and Drainage Strategy;

- Whole Life-Cycle Carbon Assessment; and
- Circular Economy Statement.

During Construction

GHG Emissions

10.97 Mitigation measures are required to reduce as far as possible the impacts the proposed development will have on climate change, i.e. the nature and magnitude of greenhouse gas emissions. Construction of the proposed development will see a number of carbon and fuel intensive activities, such as machinery use and construction traffic, which require significant energy use and will subsequently produce increased greenhouse gas emissions. Therefore, it is important to consider mitigation measures for the construction stage to reduce emissions.

10.98 The information below sets out the mitigation measures that are to be implemented. These mitigation measures cover the construction stage to reduce its impact on climate change.

10.99 There are two potentially significant effects on climate change during the construction phase of the proposed development. These are as follows:

- Greenhouse gas emissions from construction activities; and
- Greenhouse gas emissions from construction materials.

Greenhouse Gas Emissions from Construction Activities

10.100 Through the use of a CEMP (secured by planning condition), the following measures will be implemented during the construction phase to reduce GHG emissions from the construction works:

- All construction vehicles are required to switch off their engines when stationary, as well as equipment being switched off when not in use, to prevent exhaust emissions;
- Construction vehicles, including their engines and catalysts, are to be maintained to ensure they are working efficiently and minimise emissions production;
- The use of diesel or petrol powered generators will be avoided where practicable and mains electricity or battery powered equipment is recommended; and
- Construction workers will be encouraged to use public transport through the site induction as part of the construction Travel Plan.

Greenhouse Gas Emissions from Construction Materials

10.101 Embodied carbon emissions from materials and waste will be reduced based on the Whole Life-Cycle Carbon Assessment and Circular Economy Statement including:

- Reviewing opportunities to use recycled aggregates and Ground Granulated Blast-furnace Slag (GGBS) in the substructure and frame concrete. Ready-mix concrete with 40% cement replacement will be used for all foundation, slabs and frame elements.
- Bricks from the demolition of the western boundary brick wall and the existing Maker Labs shall be reclaimed and re-used elsewhere on site.
- Aluminium and timber composite windows are proposed which will contain FSC certified timber and highly recyclable aluminium. Internal framing products to be specified with a high recycled content. All timber will be FSC certified.
- For the community centre facilities, the use of timber structural components and timber internal finishes will be investigated where feasible. The proposed window systems will potentially be a composite system incorporating aluminium and timber finishes. Proposing large format architectural masonry blocks with a recycled content of over 30% for the external envelope – these will also require less mortar joints compared to traditional sized brickwork i.e. meaning less cement is used in the envelope make-up.
- Minimising materials - slab type, foundation type, façade construction has been considered within the Whole Life-Cycle Carbon Assessment to reduce embodied carbon and total building weight. This reduces the quantity of materials used in the construction process. Floor plates will be rationalised as much as possible to maximise material efficiency whilst achieving a balance between form factor and dual aspect provision.
- Repetitive design has been utilised throughout the masterplan to minimise quantities of materials without impacting architectural character. Seven pairs of blocks share the same design principles and unit types have been rationalised and replicated throughout the scheme. Building form factor will be optimised where possible to increase efficiency and thus reduce the comparative thickness of insulation and overall area of facade required.
- Pre-fabrication – Standard bathroom and en-suite types across scheme minimises variation. Stair master, balconies, utility cupboards, bathroom pods etc. shall be considered from a prefabrication perspective.

During Operation

Climate Change Resilience

10.102 Adaptation measures to address the significant negative risks from climate change hazards identified in Table 10.11 must be developed. These measures have been assessed to understand their suitability for implementation and potential ability to reduce the level of risk severity and to increase the operational and economic resilience of the proposed development in accordance with NPPF Paragraph 154.

10.103 Adaptation measures have been incorporated into the design for the following significant risks:

- Overheating risk;
- Risk to soft landscaping features; and
- Water shortage.

Overheating risk

10.104 The impact of overheating has been investigated, with a focus on passive design solutions. Overheating has been analysed for the proposed residential areas using the Chartered Institute of Building Services Engineers (CIBSE) TM59 methodology. The proposed approach incorporates the passive and active design measures to address and successfully mitigate for the risk of overheating, including improved building fabric, natural ventilation through fully openable windows, mechanical ventilation with heat recovery in all habitable rooms, and balconies and overhangs which can create shading.

Risk to soft landscaping features

10.105 The landscape strategy will include richly planted swales, biodiverse roofs, vertical climbers on the proposed houses and native planting, which will maximise surface water storage and biodiversity as well as increasing climate change resilience.

10.106 Extensive areas of new tree planting are proposed to mitigate for the loss of existing trees. This is designed to increase long-term canopy cover on the site and correspond with proposed green corridors, thereby maximising habitat connectivity and benefits for wildlife.

10.107 The proposed tree strategy uses a range of predominantly Native species most of which are growing on the site currently, and are present in the local area.

Water shortage

10.108 All new dwellings included in the application proposals will be designed to meet a maximum water consumption rate of 105 litres per person per day, in line with the latest GLA guidelines. Furthermore, the BREEAM minimum standards in the water section for a minimum 'Excellent' rating will be met, by way of a minimum 40% water use reduction. Assisting in the reduction of water usage and the effectiveness of the installed water systems, the applicant will be investigating the installation of green and blue roofs wherever possible across the proposed development.

In-combination Climate Impacts

10.109 Given that no significant in-combination climate impacts were identified and no material changes to other ES Chapters necessary, no additional mitigation is required for in-combination climate impacts when considering the mitigation set out in other ES Chapters.

Greenhouse Gas Emissions

Energy

10.110 The submitted Energy Strategy has set out a number of measures that are embedded into the design of the proposed development to reduce emissions and therefore the proposed development's effect on climate change. Key mitigation measures that have been selected include the following:

- Passive design measures including energy-efficient building fabric; insulation to all heat loss floors, walls and roofs; double-glazed windows; low-energy lighting; and efficient heating and ventilation systems;
- Provision of an Air Source Heat Pump communal network, capable of connecting to any future District Heat Network should one become available. The communal network shall be an all-electric ASHP led system serving the heating and hot water demands for each of the apartment blocks;
- Houses and non-domestic spaces are proposed to be supplied by individual heat pumps, with a carbon and fuel cost assessment provided for the houses; and
- The renewables contribution will be maximised by the inclusion of solar photovoltaics (PV) to suitable roof spaces.

10.111 The proposed development will achieve the London Plan zero-carbon target through a carbon-offset payment which offsets the shortfall in regulated CO_2-emissions.

Transport emissions

10.112 The operational proposed development has been designed to minimise GHG emissions from transport by encouraging the use of more sustainable forms of transport. Key transport mitigation measures that will reduce GHG emissions include:

- Provision of a Travel Plan to promote sustainable transport modes for all future occupants including residents, employees and visitors;
- Reviewing incorporation of a car club scheme on the site to promote car sharing and reduce reliance on car ownership;
- Prioritisation of walking and cycling in the streets hierarchy across the proposed development;
- Provision of 800 secure long stay cycle spaces 13 short stay cycle spaces in line with the London Plan; and
- All parking spaces will provide active / passive Electric Vehicle Charging Point provision in accordance with the London Plan.

RESIDUAL IMPACTS

During Construction

GHG Emissions

10.113 Following the mitigation embedded into the construction processes and design, the residual GHG impact is considered to remain **Minor Negative (not significant).**

During Operation

Climate Change Resilience

10.114 Following the climate change resilience measures embedded into the design, the residual impacts are predicted to be:

- Overheating – **Negligible** for 2030s, **Negligible** to **Minor Negative (not significant)** for 2060s and 2090s;
- Soft landscaping failure – **Negligible** for 2030s and 2060s, **Negligible** to **Minor Negative (not significant)** for 2090s; and
- Water Resources – **Negligible (not significant)** for 2030s, 2060s and 2090s.

GHG Emissions

10.115 Following the mitigation embedded into the construction processes and design, the residual GHG impacts are considered to be **Minor Negative (not significant)** for transport and **Positive (significant)** for operational energy.

Summary

Table 10.16 Summary of Chapter Impacts and Mitigation

Description of Impact/Receptor	Significance of Impact/Receptor	Mitigation Measure	Residual Impact
During Construction			
Greenhouse gas emissions from construction (materials and activities)	Minor Negative (not significant)	CEMP, Travel Plan, selection of sustainable materials including low embodied carbon, designing out waste.	Minor Negative (not significant)
During Operation			
Climate Change Resilience			
Overheating in homes	Moderate Negative in 2030s, Major Negative in 2060s and 2090s	Shading, passive ventilation, mechanical ventilation.	Negligible for 2030s, Negligible to Minor Negative for 2060s and 2090s (not significant)
Soft landscaping failure and associated loss of services	Negligible in 2030s and 2060s, Moderate Negative in 2090s	Resilient and biodiverse planting.	Negligible for 2030s and 2060s, Negligible to Minor Negative for 2090s (not significant)
Water shortages for public use and landscaping	Negligible in 2030s, Moderate Negative in 2060s and 2090s	Water efficient sanitaryware	Negligible for 2030s, 2060s and 2090s (not significant)
GHG Assessment			
Operational Energy Emissions	Positive (significant)	Fabric first approach, passive design measures, use of Air Source Heat Pumps and Photovoltaics	Positive (significant)
Operational Transport Emissions	Moderate Negative (significant)	Travel Plan, Secure Cycle Storage	Minor Negative (not significant)

CUMULATIVE IMPACTS

10.116 This assessment of the impacts of the proposed development on, and as a result of climate change considers the cumulative developments as listed within Chapter 11.0: Cumulative Impacts. It is not possible to provide a detailed assessment accounting for all proposed developments in the area that may have a cumulative effect with the proposed development due to the global nature of climate change and the fact that the effects will not occur within a defined boundary. The emissions that each scheme makes will have some effect on climate change, but it will be a proportionally very small amount. However, the impact on climate change from the proposed development in combination with other developments is considered to have been minimised as far as possible as each of the cumulative schemes will have produced Flood Risk Assessments, Transport Assessments and Energy Strategies that help them individually adapt to and mitigate against climate change.

SUMMARY AND CONCLUSION

10.117 The climatic conditions over the next 50+ years will change as a result of increased anthropogenic CO_2 levels resulting in higher temperatures, increased droughts, increased heavy rainfall and more frequent extreme weather events.

10.118 Using UKCP18 scenarios, the most significant risks for the proposed development were identified as overheating, impacts to soft landscaping and water shortages. Adaptation measures have been included within the design for all of these risks.

10.119 The impact of the proposed development's greenhouse gas emissions on climate change was also assessed quantitatively with measures set out to minimise those that can be prevented throughout construction and operation.

10.120 Overall, the climate change and greenhouse gas assessment has followed a review and design process to identify potential impacts from changing climatic conditions. The proposed development will release additional GHG emissions from construction and operational transport but these have been minimised in line with the UK trajectory to net zero resulting in a not significant residual effect. While some of the overall residual impacts still remain significant for climate change resilience given that a worst-case climate change scenario has been assessed, a range of measures to adapt for these future scenarios have been incorporated into the design, construction and management processes for the proposed development. The adaptation and mitigation measures are deemed appropriate in accordance with the NPPF, regional and local planning policies.

REFERENCES

1 The Paris Agreement, (2016). www.unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement.
2 The Climate Change Act, (2008). www.legislation.gov.uk/ukpga/2008/27/contents
3 Climate Change Act 2008 (2050 Target Amendment), (2019). https://www.legislation.gov.uk/ukdsi/2019/9780111187654/pdfs/ukdsi_9780111187654_en.pdf
4 Ministry of Housing, Communities and Local Government, (2021); National Planning Policy Framework.
5 HM Government, (2022); UK Climate Change Risk Assessment 2022.
6 GLA (2021); The London Plan.
7 LBRuT (2018); Local Plan.
8 LBRuT (2021); Richmond Local Plan 'The best for our borough'
Draft for consultation.
9 HMSO Town and Country Planning (Environmental Impact Assessment) Regulations 2014
10 HMSO Town and Country Planning (Environmental Impact Assessment) Regulations 2017
11 IEMA (2020); Environmental Impact Assessment Guide to: Climate Change Resilience & Adaptation.
12 IEMA (2022); Assessing Greenhouse Gas Emissions and Evaluating their Significance, Second Edition.
13 Met Office, (2018); UK Climate Change Projections.
14 Department for Environment, Food and Rural Affairs, (2017); UK Climate Change Risk Assessment: Government Report.
15 Greater London Authority (2022); Whole Life-Cycle Carbon Assessment Guidance.
16 CIBSE (2022); Energy Benchmarking Tool Dashboard. https://www.cibse.org/Knowledge/Benchmarking
17 Department for Transport, (2019); National Transport Survey.
18 BEIS (2021); GHG Conversion Factors for Company Reporting.
19 Department for Transport (2020); TAG Data Book, TAG Table A 1.3.9 Proportions of vehicle kilometres by fuel types.

20 BEIS (2021); UK local authority and regional carbon dioxide emissions national statistics: 2005 to 2019, https://www.gov.uk/government/statistics/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics-2005-to-2019
21 Tyndall Centre (2022); Setting Climate Commitments for London. https://carbonbudget.manchester.ac.uk/reports/LN/
22 Met Office (2020) UK Climate Averages, 1971-2000. https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/
23 UK Climate Projections User Interface, (2018); Plume of time series anomalies for probabilistic projections (25km) over UK, 1961-2100. https://ukclimateprojections-ui.metoffice.gov.uk/ui/home [Accessed: 22/11/21].